1999 SENATE HUMAN SERVICES

SB 2365

1999 SENATE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. SB2365

Senate Human Services Committee

❑ Conference Committee

Hearing Date JANUARY 27, 1999

Tape Number	Side A	Side B	Meter #
2	X		1,750
2/9/99 1	X	X	2,245
Committee Clerk Signature Carol Kolodychuk			

Minutes:

The hearing on SB2365 was opened.

SENATOR PETE NAADEN, sponsor, introduced the bill. The bill wants to place the point of registering an odor at the closest residence to the site; maybe about 2000 feet. SENATOR THANE expressed that he had also experienced this being a farmer raising hogs. SENATOR NAADEN went on to say the test must be administered at the closest residence. The newest method of disposing of waste is the machinery that cuts it right under the ground. All by products can be used, but there must be a consideration of disposing of by products. We can't make it tougher for businesses.

SENATOR WANZEK, sponsor, explained the bill. Cliquey: The odor to one man is smell of money to another. This bill intends to clarify the law for producers to see what is necessary in

process of odor readings. We need to minimize the smell; we need to recognize the fact that we must be good stewards and promote good health. We need a solution; this is the best we can come up with now. It just needs to be made clear. SENATOR DEMURS asked how the health department was doing it now. SENATOR WANZEK stated that the property line is reading spot. SENATOR DEMERS asked about this being micro management. SENATOR WANZEK answered that we need flexibility; the Health Department is trying to find solution. SENATOR DEMERS asked why are these not subjective? The answer was that this is the way it is read; the laws are now in effect.

SENATOR MUTCH, sponsor, explained that it was necessary to have guidelines when the Health Department started testing for odor. The bill originated in his territory.

REPRESENTATIVE BRUSEGAARD, sponsor, supports bill with written testimony.

ROBERT BERGQUIST supports the bill with written testimony. Two designs have been put up two designs to work on smell. EERC was hired to help solve problems. They are confident they are not affecting any neighbors. SENATOR THANE: Is there a size of operation below which it is affordable to table preventive measures? Mr. BERGQUIST answered that the smaller producer can't afford to do this. In spring there is little you can do when thawing makes it almost impossible to control odor.

WADE MOSER, Stockman's Assoc., supports bill. The odor problem is forefront. US has $2 million to control through diet. This is a fair bill. It seems we need to devise a better system. This is not a machine - one person's opinion. Do we really have a problem? SENATOR KILLER asked what health conditions do producers (pork/beef) have to be aware of. Mr.

MOSSIER replied - ground water, environment, waste disposal are some. All of the regulations are going to be costly and they are loosing money in business now.

BRYAN KARMA, ND Farm Bureau, supports bill. There are times when odors will permeate. They are stronger at certain times of the year. People need to call for testing at their doorstep.

FRANCIS SCHWINN, ND Health Dept., written testimony, supports bill. SENATOR THANE asked if they took into consideration the dew point or relative humidity. Mr. SCHWINN replied that centimeter readings don't take that into consideration immediately; when reader can detect the reading at 2:00. SENATOR DEMERS: Have you tried to come up with language to fix this? Mr. SCHWINN stated that they had amendments. SENATOR DEMERS: Do you see a problem with how you take readings? Mr. SCHWINN stated No, it was reasonable approached. There is a meter that measures hydro-sulfide but the human nose is about the best. SENATOR LEE asked about #6 of the amendment. Mr. SCHWINN replied that they need to get specific with feedlot rules; over 200 head needs a license; over 1000 animals you need to inject instead of top layer manure.

Opposition to the bill.

JIM GRIFFIN, citizen living about a mile and a half away from EnviroPork, opposes the bill in written testimony.

KEITH PETERSON, citizen lives adjacent to EnviroPork, opposes bill in written testimony.

SENATOR DEMERS asked Mr. SCHWINN if there are regulations for hydrogen sulfide: are you measuring it in air. The reply was that our measurements are effective; Minnesota measuring gas emissions not as effective as odor. SENATOR THANE asked if ammonia was the principle carrier of odors? Mr. SCHWINN: Probably not; just the mixture of all coming off.

The committee was called back to order in the afternoon.

Extensive discussion was held. A hoghouse amendment was proposed.

SENATOR FISCHER moved to adopt the amendments of the Health Department. SENATOR LEE seconded it. Roll call vote carried 6-0.

SENATOR LEE moved DO PASS AS AMENDED. SENATOR KILZER seconded. Discussion pursued. Roll call vote carried 6-0. SENATOR FISCHER will carry the bill.

2/1/99 SB2365 was recalled to the committee on a unanimous voice vote for further work.

Discussion resumed on SB2365 on 2/9/99. SENATOR FISCHER asked the bill be held until SENATOR WANZEK could see the amendments. He then got the parties together and I heard that Roger Johnson had not been included in those talks. Everyone agreed to these amendments. SENATOR DEMERS said the Mr. Johnson did not like the amendments. SENATOR LEE asked how these differ from the ones we adopted earlier. SENATOR FISCHER: They changed odor level and distances. A drawing on the board showed us that it depends on a situation. They wouldn't take measurements in the property line if there is a residence within 100 feet; but ½ mile from the source is there's no building. Ammonia and hydrogen sulfide can be tested scientifically; the only way to determine smell is noses. The Health Department was called. FRANCIS SCHWINDT came down from the Health Department. We met with several parties. It moved the compliance issue from just being the property line and those have been in our rules since 1971 or 72 to a variable distance. Areas of city compliance is at property line. Variable distance in rural areas ½ mile. 100 feet would be at that building. After more discussion SENATOR DEMERS moved to remove the original amendments. SENATOR LEE seconded it.

Roll call vote carried 6-0-0. SENATOR DEMERS moved a DO NOT PASS on SB2365. More discussion followed. Roll call vote carried 4-2-0. SENATOR DEMERS will carry the bill.

FISCAL NOTE

(Return original and 10 copies)

Bill/Resolution No.: SB 2365 Amendment to: _____

Requested by Legislative Council Date of Request: 1-20-99

1. Please estimate the fiscal impact (in dollar amounts) of the above measure for state general or special funds, counties, cities, and school districts.

   Narrative:

   This bill changes the location from the property line to the nearest residence, church, school, business or public building when the department monitors odor emissions.

   There is no fiscal impact with this bill.

2. **State** fiscal effect in dollar amounts:

	1997-99 Biennium		1999-2001 Biennium		2001-03 Biennium	
	General Fund	Special Funds	General Fund	Special Funds	General Fund	Special Funds
Revenues:	-0-	-0-	-0-	-0-	-0-	-0-
Expenditures:	-0-	-0-	-0-	-0-	-0-	-0-

3. What, if any, is the effect of this measure on the appropriation for your agency or department:
   a. For rest of 1997-99 biennium: -0-
   b. For the 1999-2001 biennium: -0-
   c. For the 2001-03 biennium: -0-

4. **County, City, and School District** fiscal effect in dollar amounts:

1997-99 Biennium			1999-2001 Biennium			2001-03 Biennium		
Counties	Cities	School Districts	Counties	Cities	School Districts	Counties	Cities	School Districts
	-0-			-0-			-0-	

If additional space is needed, attach a supplemental sheet.

Signed _____

Typed Name Robert A. Barnett

Date Prepared: 1-25-99

Department State Department of Health

Phone Number 328-2392

Adopted by the Human Services Committee
January 27, 1999

1/28/99

PROPOSED AMENDMENTS TO SENATE BILL NO. 2365

Senate Amendments to SB2365 Human Services 1/28/99

Page 1, line 2, after "to" insert "the regulation of odors by the" and remove "odor readings"

Page 1, replace lines 6 through 8 with:

"**Regulation of odors.**

1. Except as otherwise provided in this section, a person may not discharge into the ambient air an objectionable odorous air contaminant that measures seven odor concentration units or higher outside the property boundary where the discharge is occurring.

2. Odor measurements may be taken only on a properly maintained scentometer or other instrumental method approved by the department, and only by a department-certified inspector who has successfully completed a department-sponsored odor certification course and demonstrated the ability to distinguish various odor samples and concentrations.

3. In areas located outside a city or the area over which a city exercises extraterritorial zoning, odor measurements must be taken at least two-tenths of a mile [.32 kilometers] from the source discharging the objectionable odorous air contaminant, or at the property boundary, whichever is greater.

4. Except for a chronic violator, the department may send a certified inspector to take odor measurements for the purpose of determining compliance with this section only after receiving a complaint from the public. For a chronic violator, the department may take or require odor measurements until the chronic violator has no more than two odor measurements of seven odor concentration units or higher within a three hundred sixty-five-day period and no odor measurements of thirty-one odor concentration units or higher within that period.

5. A chronic violator is a person who:

   a. On separate days, has no fewer than three measurements of seven odor concentration units or higher, or two measurements of fifteen odor units or higher, within a thirty day period; or

   b. On separate days, has no fewer than seven measurements of seven odor concentration units or higher, or four measurements of fifteen odor units or higher, within a ninety day period.

6. A person is exempt from this section while applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved by the department. A farmer is exempt from this section while applying animal manure or other recycled agricultural material to land owned or leased by the farmer in accordance with rules adopted by the department."

Renumber accordingly

Date: 1/27/99
Roll Call Vote #: 1

1999 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. SB 2365

Senate HUMAN SERVICES COMMITTEE Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Do Pass on amendment

Motion Made By Sen Fischer Seconded By Sen Lee

Senators	Yes	No	Senators	Yes	No
Senator Thane	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Lee	✓				
Senator DeMers	✓				
Senator Mutzenberger	✓				

Total 6 (yes) 0 (no)

Absent 0

Floor Assignment _____

If the vote is on an amendment, briefly indicate intent:

Health Dept. amendments

Date: 1/27/99
Roll Call Vote #: 2

1999 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. SB2365

Senate HUMAN SERVICES COMMITTEE Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Do Pass as Amended

Motion Made By Sen Lee Seconded By Sen Kilzer

Senators	Yes	No	Senators	Yes	No
Senator Thane	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Lee	✓				
Senator DeMers	✓				
Senator Mutzenberger	✓				

Total 6 (yes) 0 (no)

Absent 0

Floor Assignment Sen Fischer

If the vote is on an amendment, briefly indicate intent:

Date: 2/9/99
Roll Call Vote #: 1

1999 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 2365

Senate HUMAN SERVICES COMMITTEE Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Remove original amendments.

Motion Made By Sen DeMers Seconded By Sen Lee

Senators	Yes	No	Senators	Yes	No
Senator Thane	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Lee	✓				
Senator DeMers	✓				
Senator Mutzenberger	✓				

Total _____(yes) _____(no)

Absent _____

Floor Assignment _____

If the vote is on an amendment, briefly indicate intent:

Date: 2/9/99
Roll Call Vote #: 2

1999 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 2365

Senate HUMAN SERVICES COMMITTEE Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Do Not Pass

Motion Made By Sen DeMers Seconded By Sen Mutzenberger

Senators	Yes	No	Senators	Yes	No
Senator Thane		✓			
Senator Kilzer	✓				
Senator Fischer		✓			
Senator Lee	✓				
Senator DeMers	✓				
Senator Mutzenberger	✓				

Total 4 (yes) 2 (no)

Absent 0

Floor Assignment Sen DeMers

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

SB 2365: Human Services Committee (Sen. Thane, Chairman) recommends **DO NOT PASS** (4 YEAS, 2 NAYS, 0 ABSENT AND NOT VOTING). SB 2365 was placed on the Eleventh order on the calendar.

1999 HOUSE AGRICULTURE

SB 2365

1999 HOUSE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. 2365

House Agriculture Committee

❑ Conference Committee

Hearing Date 3-11-99

Tape Number	Side A	Side B	Meter #
One SB 2365		x	18.0 to 55.0
Committee Clerk Signature Arlis Hanson			

Minutes:

Summary of bill: Relating to State Dept of Health and odor readings.

Sen Naaden:

Sen Wanzek: Dist 29. Stutesman county 4th generation family farmer. All this bill is a good faith effort to address every interest and trying to allow the State of North Dakota to move ahead in the 20th century. How can we be good responsible stewards of the land and still live in a complex society. This is not a cooperate Farming bill. There was a small town in SD with a cooperative that took the lead by building a feed mill and supporting the growth of livestock operations. If a rural area wants to have a viable economy in the next decade adding valu to livestock is the first rung on the ladder. This comes down to community leadership and initiative. Agriculture production unfortunately does generate some unpleasant odors, hogs , cattle , sugar beets, etc. Odor particles will not change any.

Rep Herbel: Will this make it any different then it is now?

Sen Wanzek: If a feed lot first then house built right across from it feed lot has preference. Like wise if house if there first it has preference.

Sen Naaden: I had a confined Hog barn, closed it because of losing money on Hogs. I know what hog smell is. This bill just gives them the opportunity to regulate it. Farmer in SD combing at night and a new resident wanted to stop him form running his combine because the noise was bothering her. Incinerator near Bismarck. Why don't they build it in Bismarck. It will stink up the area in town. Will what do they think its going to do in the country.? We can't be discouraging hogs or livestock operations by burdening them with rules and regulations that doesn't allow them to operate. Supports the bill.

Rep Brusegaard: Gilby. Comparing this bill with the original one and now the engrossed on has been a lot of compromise.

Bob Burke: ND Pork Producers Strongly endorses the bill. ½ mile zone very reasonable. Just back from a Pork Producers convention in Nashville. The state of Missouri has exempted livestock production from there odor regulations, thats how much they value their livestock industry.

Alvin Pierce: Gasgon, ND Pork Producers feel this ½ mile is reasonable.

Rep Brandenburg: Health Dept takes reading 50 feet from barn.

Tom x: Vice Chairman ND Feeders assoc. In support of bill.

Brian Kramer: ND FB Support of bill, (testimony attached)

Wade Moser: ND Stockmens assoc. In support of bill

Lance Gaebe: ND Milk Producers Relief miler at his folks dairy farm. supports the bill.

Opposition to bill:

Jim Griffin: Lives 1 mile and a half ne of Enviro Park. I oppose this bill. (Testimony attached) We have the family farm and this bill is clearly being submitted only for the benefit of large scale hog factories, such as Enviropork and is detrimental to the health and welfare of North Dakota.

Chm Nicholas: As we move forward into the new 20th Century these other states are growing using valu added process to do this. What do we do as farmers to keep going if we put road blocks in everything new.?

Jim Griffin: I'm not against feed lots as per sae, etc. We need to plan it so as not to interfere with others and their way of living. We still have to be responsible for our actions.

Rep Rennerfeldt: You seem to think size is everything. Responsibility is what counts.

Jim Griffen: How many people would we have if we had $5 wheat and $.75 fat cattle? Everyone raised their hand.

Keith Petersen: I've been in litigation with Enviropork in Grand Forks County. Own 1 quarter of land near the place. Odor laws have been broken & health Dept does nothing to improve it. ½ mile is to far. Hard to get anyone to come and check it. One lady can't hang cloths outside because the smell is so terrible.

Motion by Rep Brusegaard for a DO PASS as amended second by Rep Herbel motion prevailed

Vote totals YES 11 NO 3 ABSENT 1

Carrier Rep Brusegaard

Date: 3-12-99
Roll Call Vote #: 1

1999 HOUSE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 1365

House AGRICULTURE Committee

☐ Subcommittee on

or

☐ Conference Committee

Legislative Council Amendment Number

Action Taken Do Pass Amendments

Motion Made By Brusegaard Second By Herbel

Representatives	Yes	No	Representatives	Yes	No
Eugene Nicholas, Chaiman	✓		Bob Stefonowicz		✓
Dennis E. Johnson, Vice Chm	✓				
Thomas T. Brusegaard	✓				
Earl Rennerfeldt	✓				
Chet Pollert	✓				
Dennis J. Renner	✓				
Michael D. Brandenburg	✓				
Gil Herbel	✓				
Rick Berg	✓				
Myron Koppang	✓				
John M. Warner		✓			
Rod Froelich	✓				
Robert E. Nowatzki		✓			
Phillip Mueller					

Total (Yes) 11 No 3

Absent 1

Floor Assignment Brusegaard

REPORT OF STANDING COMMITTEE

SB 2365: Agriculture Committee (Rep. Nicholas, Chairman) recommends **AMENDMENTS AS FOLLOWS** and when so amended, recommends **DO PASS** (11 YEAS, 3 NAYS, 1 ABSENT AND NOT VOTING). SB 2365 was placed on the Sixth order on the calendar.

Page 2, line 1, replace "[30.48 meters]" with "[.80 kilometer]"

Renumber accordingly

1999 TESTIMONY

SB 2365

North Dakota Pork Producers Council Testimony SB 2365

I want to be quite clear that the North Dakota Pork Producers Council in no way condones livestock odors that cause a constant nuisance at a person's home. But we must face the reality that livestock production does smell. Livestock production is the backbone of our rural economy, the ultimate in value added production from our feed grains and pastures. It is a major source of employment in the countryside where jobs are already scarce. We must ensure that North Dakota's farmers can produce meat, eggs and milk in a competitive manner, while doing everything within reason to minimize the impact of their farming operation on the neighbors.

The current rules that the Health Department operate under, state that the scentometer readings be taken " outside the property line" of the odor source. The department recently has interpreted this to mean the readings are to be taken "at the property line", even though the report form the evaluator uses asks " would you find this odor objectionable at your home". This overly strict interpretation, combined with the fact that enforcement is on a "complaint" basis [and anyone in the state can be the complainant,] has placed the livestock producers in an untenable position. An odor encountered when driving by a farm, city lagoon or sugar beet factory can hardly be considered a serious nuisance. But if a home or business owner has a complaint , it can be acted upon by the Health Department.

The Health Department as a regulatory agency has an equal responsibility to the public and to those whom it regulates. We recognize that the department wishes to maximize it's regulatory flexibility. But the farmer and his lenders need to know the rules under which they must operate are in fact standards of enforcement. We feel that a farm, a municipal waste treatment facility, factory or any other odor source should be regulated on equal terms. Most counties have zoned set back distances for livestock farms from existing residences. This is to protect the home owner from nuisance odors. If the standard is to take the readings next to the odor source, what purpose do the set backs serve?

The proposed change directing the Department to take odor readings at an affected residence, church, school, business or public building, is fair to the farmers of North Dakota, and is a commonsense way to protect the public from nuisance odors.

Testimony on Senate Bill No. 2365
by
Francis J. Schwindt, Chief
Environmental Health Section
North Dakota Department of Health
701-328-5150

Odorous air contaminants have been regulated in North Dakota since the passage of N.D.C.C. ch. 23-25, North Dakota's Air Pollution Control law, in 1969. The Department of Health adopted rules implementing specific odor standards in 1978. For the last twenty years, the Department has been successful in resolving most odor complaints to the satisfaction of both the sources and the complainants. The Department has worked to find practical and reasonable solutions and compromises that all parties can live with.

The Department has several concerns with Senate Bill No. 2365. The Department acknowledges that there may be reasons for amending North Dakota's odor rules in rural areas for odors that have little or no impact on people or their property values. The Department is concerned that the amendments may create an unworkable program. The Department is willing to work with the Bill's sponsors to find a reasonable solution to these issues, so that we can both maintain ND's air quality while not imposing unreasonable burdens on North Dakota's industry and agriculture.

One of the purposes of the bill is to change the point of measurement of odorous air contaminants from outside the property boundary of the source to the nearest occupied building. The current rule, which was promulgated on July 1, 1978, is found in Section 33-15-16-02 of the North Dakota Air Pollution Control Rules, and reads as follows:

> **33-15-16-02 - Emissions of Odorous Substances Restricted.** No person may discharge into the ambient air any objectionable odorous air contaminant which is in excess of two odor concentration units outside the property boundary.

A companion rule states that Section 33-15-16-02 will be addressed on a complaint basis. See N.D. Admin. Code § 33-15-16-01.

When the Department receives an odor complaint and verifies that it exceeds the two odor concentration unit limit, the first step is to work with the source to achieve a reasonable, practicable solution to the problem so the complaint is resolved. The source is given a reasonable time to implement a solution to the problem. The Department also works with the person complaining to address their concerns, to explain what steps are being taken to correct the problem, and to help them understand that even if the levels are reduced, there may still be some odor that the complainant may still

smell. Two odor units does not mean odor free. Although the Department enforces the rule on a complaint basis, the bill would make it more difficult to determine compliance.

At present, the Department can investigate a complaint at any reasonable time after receiving it by going to the source and taking readings downwind. Under this bill, the wind would have to be blowing in the direction of the nearest occupied building at the time of the investigation in order for us to get a representative reading. For example, consider a residence located one-half mile upwind from a source, and a second residence located a mile down wind. Under the bill as drafted, the Department could only take odor readings at the nearest residence, even if the downwind residence is suffering from severe odor violations.

The bill should also be clarified concerning whether the Department is precluded from taking readings at locations other than occupied buildings - for example, a public park or recreation area.

The bill would remove the protection from objectionable odors on any land adjacent to or near a source of odors including public roads, bike trails, parks, recreational areas, wildlife refuges, state and national parks and other areas normally accessed by the general public, in addition to public or private land not having buildings on it. For example, it would not protect a forty acre tract a farmer had been saving for his retirement home, or which he had been intending to sell at a premium price for development.

The bill may conflict with N.D.C.C. § 23-25-01.1, Declaration of public policy and legislative intent of the North Dakota Air Pollution Control Law, which reads:

> **23-25-01.1. Declaration of public policy and legislative intent.** It is hereby declared to be the public policy of this State and the legislative intent of this chapter to achieve and maintain the best air quality possible, consistent with the best available control technology, to protect human health, welfare, and property, to prevent injury to plant and animal life, to promote the economic and social development of this State, to foster the comfort and convenience of the people, and to facilitate the enjoyment of the natural attractions of this State.

North Dakota has some of the cleanest air in the nation. We are one of only a few states in the nation to meet all federal clean air standards.

If we lower or eliminate our rules for objectionable odorous air contaminants on land outside the property boundary where there are no buildings, it may lower the value of neighboring property, thus

increasing the likelihood of more nuisance lawsuits such as the recent case in Iowa.

In conclusion, the Department is concerned about the current bill draft. The Department recognizes the need for a practical approach on odor control, and would like to work with you to find a solution that is reasonable for all regulated sources, including those located in the less populous rural areas of our State.

That concludes my testimony. I will be happy to answer any questions you might have. Assistant Attorney General Lyle Witham and other staff are also here to address any legal or technical questions you may have. Thank you.

NORTH DAKOTA DEPARTMENT OF HEALTH
Environmental Health Section

Location:
1200 Missouri Avenue
Bismarck, ND 58504-5264

Fax #:
701-328-5200

Mailing Address:
P.O. Box 5520
Bismarck, ND 58506-5520

TO: Senator Wanzek and Senator Fischer

Fax #: 328-1997
Phone:

FROM: Lyle Witham

Fax #: (701) 328-5200
Phone: (701) 328-5150

DATE: 1/29/99

Number of pages following: 2

Remarks:

There were three or four spelling and grammatical errors in the last draft of the amendments to SB 2365 that I gave to you at noon. I have corrected them in this draft. For example, "proscribe" in subsection 6 should be "prescribe".

If there are any other changes you would like, let me know.

Lyle Witham

ALTERNATIVE
PROPOSED AMENDMENTS TO SENATE BILL NO. 2365

Page 1, after line 5, replace the remainder of the bill with:

"Regulation of Odors.

1. ~~Except as otherwise provided in this section~~ In areas located within a city or the area over which a city has exercised extraterritorial zoning as defined by section 40-47-01.1, no person may discharge into the ambient air any objectionable odorous air contaminant that measures seven odor concentration units or higher outside of the property boundary where the discharge is occurring.

2. In areas located outside of a city or outside of the area over which a city has exercised extraterritorial zoning as defined by section 40-47-01.1, no person may discharge into the ambient air any objectionable odorous air contaminant that causes odors which measure seven odor concentration units or higher as measured at any of the following locations:

a. Within 100 feet of any residence, church, school, business, or public building, or within a campground or public park. Odor measurements may not be taken at the residence of the owner or operator of the source of the odor, or at any residence, church, school, business, or public building, or within a campground or public park, that is built or established within one-half mile of the source of the odor after the source has been built or established;

b. At any point located beyond a half-mile from the source of the odor, except for property owned by the source of the odor, or over which the source of the odor has purchased an odor easement.

~~2~~3. Odor measurements may be taken only ~~on~~ with a properly maintained scentometer, by an odor panel, or by another instrumental or method approved by the department, and only by department certified inspectors who ~~has~~ have successfully completed a department sponsored odor certification course and demonstrated the ability to distinguish various odor samples and concentrations.

~~3. In areas located outside of a city or the area over which a city has exercised extraterritorial zoning as defined by section 40-47-01.1, odor measurements must be taken at least two-tenths of a mile (352 yards) from the source discharging the objectionable odorous air contaminant, or at the property boundary, whichever is greater.~~

~~4. Except for a chronic violator as defined by this section, the department may send out a certified inspector to take odor measurements for purposes of determining compliance with this section only after receiving a complaint from the public. For a chronic violator, the department may take or require odor measurements until the chronic violator has no more than two odor~~

~~measurements of seven odor concentration units or higher within a 365 day period, and no odor measurements of thirty one odor concentration units or higher within that period.~~

~~5. A chronic violator is a person who:~~

~~a. On separate days, has no fewer than three measurements of seven odor concentration units or higher, or two measurements of fifteen odor units or higher, within a thirty day period of time; or~~

~~b. On separate days, has no fewer than seven measurements of seven odor concentration units or higher, or four measurements of fifteen odor units or higher, within a ninety day period of time.~~

~~6~~4. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved by the department. A farmer is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land owned or leased by the farmer in accordance with rules adopted by the department. An owner or operator of a lagoon or waste storage pond permitted by the department is, in the spring, exempt from this section from the time when the cover of the permitted lagoon or pond begins to melt until fourteen days after all the ice cover on the lagoon or pond has completely melted. Notwithstanding these exemptions, all persons have a responsibility to manage their property and systems to minimize the impact of odors on their neighbors.

5. This section does not apply to chemicals or chemical compounds that can be individually measured by instruments, other than a scentometer, that have been designed and proven to measure the individual chemical or chemical compound, such as hydrogen sulfide, to a reasonable degree of scientific certainty, and for which the department has established a specific limitation by rule.

6. For purposes of this section, a public park is a park established by the federal government, this state, or a political subdivision of this state in the manner prescribed by law. For purposes of this section, a campground is a public or private area of land used exclusively for camping and open to the public for a fee on a regular or seasonal basis.

PROPOSED AMENDMENTS TO SENATE BILL NO. 2365

Page 1, after line 5, replace the remainder of the bill with:

"Regulation of Odors.

1. Except as otherwise provided in this section, no person may discharge into the ambient air any objectionable odorous air contaminant that measures seven odor concentration units or higher outside of the property boundary where the discharge is occurring.

2. Odor measurements may be taken only on a properly maintained scentometer or other instrumental method approved by the Department, and only by a Department certified inspector who has successfully completed a department sponsored odor certification course and demonstrated the ability to distinguish various odor samples and concentrations.

3. In areas located outside of a city or the area over which a city has exercised extraterritorial zoning as defined by Section 40-47-01.1, odor measurements must be taken at least two-tenths of a mile (352 yards) from the source discharging the objectionable odorous air contaminant, or at the property boundary, whichever is greater.

4. Except for a chronic violator as defined by this section, the department may send out a certified inspector to take odor measurements for purposes of determining compliance with this section only after receiving a complaint from the public. For a chronic violator, the department may take or require odor measurements until the chronic violator has no more than two odor measurements of seven odor concentration units or higher within a 365-day period, and no odor measurements of thirty-one odor concentration units or higher within that period.

5. A chronic violator is a person who:

   a. On separate days, has no fewer than three measurements of seven odor concentration units or higher, or two measurements of fifteen odor units or higher, within a thirty day period of time; or

   b. On separate days, has no fewer than seven measurements of seven odor concentration units or higher, or four measurements of fifteen odor units or higher, within a ninety day period of time.

6. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved

by the Department. A farmer is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land owned or leased by the farmer in accordance with rules adopted by the Department.

Senate Human Services Committee
January 27, 1999

Senate Bill 2365

Testimony of Keith Peterson

My name is Keith Peterson. I own 160 acres of farmland and a homestead (house, shop and quonset) immediately adjacent to the 140 acres on which sits the EnviroPork facility. I have been in litigation with EnviroPork for the past six months due, in part, to violations of state odor law by EnviroPork. EnviroPork has been tested many times by the State Health Department, the Grand Forks County Health Department, and the EERC. I have attached a list of the twenty-nine violations that exceed 7 on the scale used by the Health Department. (A violation of 2 or greater is illegal.) You should be aware that the odors are awful even at levels less than 7. When the test results are 7, 15 or 31, the odors are nauseating and grotesque.

I grew up on a farm, raised cattle and pigs and I now work for a farm chemical company -- I'm not exagerating when I tell you that this smell is quite different from other odors I've encountered.

The odor laws have been broken and the State Health Department has been absolutely ineffective to stop them and hasn't imposed any penalties on EnviroPork even though it has been in violation since at least early May, 1998. I think the law is too weak already, and this bill would make it worse. We are tired of promises. Drop this bill and see if you folks can figure out a way to enforce the laws we have.

I have a question for this committee. I moved to Thompson for a job opportunity and for a great school system for my kids. I always intended however to move back to my homestead, which is on a very beutiful location with 10 acres of trees around my home. The Health Department however views my farm as abandoned but even if it were abandoned, why should EnviroPork be able to condemn my property from being used as a residence?

The smell of hog waste follows the wind. For example, one evening I was almost overcome with a nauseating odor. Who do I call at 8 p.m.? The Health Department that is more than 200 miles away, or the County Health Department that is 40 miles away, and all the offices are closed? When they do come, the wind will have changed. Now, they test at the EnviroPork property boundaries in the direction that the wind is blowing. Under this law, they would have to test at the "nearest residence". What if the wind isn't blowing toward the "nearest residence" when the Health Department eventually comes to test? What if my residence is in the opposite direction? It is absurd.

I believe the only accurate testing that can be done is in the direction of the wind. It is a joke to test in any other way. The

smell does not go away, but the wind is always changing. I have attached some of the affidavits that our neighbors have filed in this lawsuit. One says "I operate a cattle and grain farm 2 miles south of EnviroPork. I have lived on this farm for 53 years. We have raised cattle, hogs, sheep and chickens, and I have never smelled anything like the smell that comes out of EnviroPork. The smell comes in every time the wind blows from the North." Another says, "We live 3 miles east of EnviroPork. Any time there's a west wind its a bad smell. Couldn't have windows open at night because of the bad smell." Another says she lives three miles north and one mile east of EnviroPork and that "on numerous days the stench is to the level where you cannot comfortably have the windows in our home open, sit on our screenporch and enjoy the day, or even mow my own lawn." Another lives two miles southeast and kept a diary. She says she can no longer hang her clothes outside to dry, and cannot work outside on her garden and that her car smells even when she drives away from the odor zone. The odor is "sickening, nauseating, gagging and very repulsive". The point is that the smell goes where the wind is blowing. None of these people, incidentally, have had their air tested by the State Health Department. Does that mean that they are not affected by these reeking but not tested odors? Obviously not.

When the permit for EnviroPork was issued we were promised that odors that were in excess of the state odor regulations would not be allowed. Now this bill would gut the state odor regulations. It is unfair to property owners like me who are unfortunately near a place like EnviroPork. If facilities like EnviroPork can get away with violating the odor laws, they in essence are allowed to condemn and devalue all the property within the radius of the odor. In our case, people have filed affidavits from as far as six miles away! Remember that a two mile radius covers a grid of sixteen square miles. We need to have adequate testing to determine compliance. One facility that covers only a few acres, like EnviroPork, should not be allowed to injure many square miles of other people's property.

EnviroPork keeps on saying that they will fix the odor. They haven't. Now they just want to fix the law so they can't get caught. They promised us they would obey the law and be good neighbors. Now they are just trying to change the law to suit them and hurt their neighbors.

I oppose this bill. This bill will make it impossible for the Health Department and other agencies who are charged with enforcing the air quality law to detect and require correction of these violations.

Thank you for the opportunity to testify before you today.

Odor Violations recorded at EnvirPork hog farrowing facility located north west of Larimore, ND.

Date	Inspector	Affiliation	location	Odor Units
5/12/98	Wallace Helland	GF Health	Highway #2, South	15 & 31
5/28/98	Gary Haberstroh	NDHD	Highway #2, South	7
6/3/987	Wallace Helland	GF Health	Highway #2, south	7
6/30/98	Wallace Helland	GF Health	Highway #2, south	7
7/13/98	Wallace Helland	GF Health	Highway #2, south	7
720/98	Gary Haberstroh	NDHD	Highway #2, South	31
7/30/98	Wallace Helland	GF Health	Highway #2, south	7
8/3/98	Gary Kline	NDDH	West gravel road	7
8/4/98	Wallace Helland	GF Health	Highway #2, south	7
8/5/98	D. Lechner	EERC	West gravel road	15
8/6/98	D. Lechner	EERC	West gravel road	15
8/7/98	Tom Moe	EERC	West gravel road	7
8/10/98	Foerster & Lechner	EERC	West gravel road	7 & 15
8/12/98	D. Lechner	EERC	North Property Line	15
8/18/98	Dave Westerman	EERC	West gravel road	7
8/20/98	Gary Haberstroh	NDHD	Highway #2, south	7
9/2/98	J. Foster	EERC	West gravel road	7
10/6/98	D. Lechner	EERC	Highway #2, South	7
10/8/98	D. Lechner	EERC	West gravel road	7
10/14/98	Stepan	EERC	West gravel road	7
10/16/98	D. Lechner	EERC	Highway #2, South	7 & 15
10/20/98	D. Lechner	EERC	Highway #2, South	15
10/27/98	D. Lechner	EERC	Highway #2, South	15
11/3/98	Gary Haberstroh 3:00 PM	NDHD	Highway #2, South	7
11/3/98	D. LECHNER 2:05 PM 2:08 PM	EERC	HIGHWAY # 2 SOUTH	15 & 31
10/30/98	C. FETER	EERC	HIGHWAY # 2 SOUTH	7
12/1/98	G. HABERSTROH	NDHP	HIGHWAY #2 SOUTH	15 & 7
12/30/98	K. ROBERTS	NDHD	HIGHWAY #2 SOUTH	7
1/19/99	GARY HABERSTROH	NDHD	WEST GRAVEL ROAD	7

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN and KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, PURINA MILLS, INC., and NORTH DAKOTA DEPARTMENT OF HEALTH

Defendants.

AFFIDAVIT OF LINDA BOYAJIAN

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

LINDA BOYAJIAN, being first duly sworn on oath, deposes and states:

1. I Linda Boyajian, am a resident of Grand Forks County. I live at 1781 41st St. NE, about six miles ~~south~~ north west of Larimore and about two miles southeast of the EnviroPork facility. My husband and I live on 3 1/4 acres which we purchased in October of 1995. My husband Gary recently retired from the Air Force as a SR Master Sergeant and we plan to retire here.

2. I first noticed construction on the EnviroPork facility in the spring of

1997. At that time, I was not aware of what the facility was going to be. I first noticed the odor from the facility on April 30, 1998. The next few days in May, I could notice the smell so I wrote in to the Health Department on May 4, 1998 to inform them of the problem and address my concerns. (Exhibit 1)

3. I have been keeping a diary of the times that I notice the hog odor and sometimes how bad the hog odor can be. (Exhibit 2) The hog smell can be sickening, nauseating, gagging, and very repulsive. I drove by the facility with my family and the hog odor made you want to vomit, or "ralph" as my daughter put it. I have even noticed that the odor stays in my car. When I drive away from the odor zone, I can still smell the hog odor in my car.

4. Because of the hog odor, I can no longer hang my clothes outside to dry. The hog odor sticks to them and I have to re-wash them to get rid of the odor. I also have been unable to enjoy my gardening because of the hog odor. When the hog odor is so bad, I can not stand to be outside and work on my garden.

5. I also have concerns about how the odor can affect the health of people. My daughter will be coming to visit me later this summer and she is bringing my new grand~~daughter~~ SON who was born in February of 1998. They will be staying here for a few months and I am worried that the odor will be dangerous to my grand~~daughter.~~ SON I also worry that they will not want to come and see grandma anymore because the smell is so bad.

6. My husband and I purchased a house in the country because we

wanted to be away from the city. I have lived in cities before and always dreamed of having a place in the country, but now I can not even enjoy the benefits of my home because of the awful hog odor. We were planning on building an addition on to our house, but have put that project on hold because we are worried that our home is no longer worth much because of the hog odor. We do not want to move. We like it here, but the hog odor has taken away the pleasure of living in the country.

7. I am very concerned about this hog odor. Bob Berquist told me at one of the meetings in July of 1997 that the facility would only smell a couple times of year, in the spring when the lagoon thaws and when the hog waste is pumped from the lagoon and applied to fields. However, here it is the middle of June and I have been sickened by the smell on numerous occasions already and it does not seem like it will get any better.

Dated: June 16, 1998

Linda C Boyajian

Linda Boyajian

State of North Dakota)
)ss
County of Grand Forks)

On June 17, 1998, before me personally appeared LINDA BOYAJIAN known to me to be the same person described in and who executed the within and foregoing instrument and acknowledged to me that she executed the same.

Notary Public
State of North Dakota
My commission expires: Jan 1 2000

Exh. 1

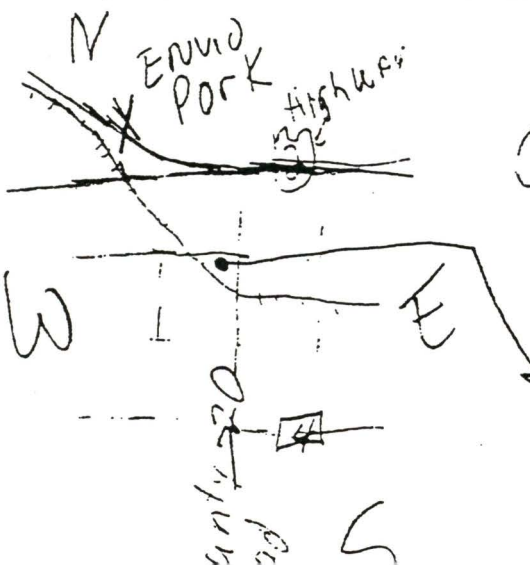
To Gary Haberstroh; May 4, 1998

I was hoping that I would never have to write this letter.. As you can see I am so that means only one thing. Today I can smell the hogs waste from Enviro Pork. It is only the 30 of April and it is above 70 and the wind is blowing from the north to the southeast. As I sit here in the second story with the window open because of the heat there is no question that the wind will carry the odor here. I first notice the odor when I was out at 5 PM to water my garden. It then has proceeded to get worse.

My only question who should I be in contact about this? How has their monitoring going?

I did appreciate the letter received with the comments from the public about Enviro Pork, and the answers. I am interested in the response that had trees being planted around the facility to help reduce the wind that can cause odors to drift. I wonder how many years it will take for those trees to be of a size to help keep the odors contained. I can tell you that my shelter belt has not kept the odors out, who knows I guess it might be worse without the trees.

All I can say is I have notice the hog odor at my home every day in May so far, It seems now to be as common as the wind.



Thanks,

Linda Boyajian

Linda Boyajian
P.O. Box 189
Larimore, ND 58251
(1781 41st NE)

[redacted]

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1 SR 5:53 am SS 9:30 pm	**2** SR 5:52 am SS 9:30 pm Hog odor 6/2 cold 40° wind NE Called Health Dept	**3** SR 5:52 am SS 9:31 pm Hog odor evening 10 stop 9 NE 6:50 pm still there Deer Gun and Muzzleloader Application Deadline	**4** SR 5:51 am SS 9:32 pm Hog odor on Highway very offensive	**5** SR 5:51 am SS 9:33 pm At 5 PM Hog odor on HW very bad and at House evening	**6** SR 5:50 am SS 9:34 pm Hog odor evenings strongest in Louis area all the way to Road Free Fishing Day
SR 5:50 am SS 9:34 pm ...y ...at Hog ...ell ...NE ...ishing Day	**8** SR 5:50 am SS 9:35 pm Hog odor Evening	**9** SR 5:49 am SS 9:36 pm Hog smelled bad of en front door Away from Hog Farm still came in House! Still at 7 AM very putrid!	**10** SR 5:49 am SS 9:36 pm	**11** SR 5:49 am SS 9:37 pm Pig smell at 12:50 still at 3:15 ... strong NE ...	**12** SR 5:49 am SS 9:38 pm Hog at 8 PM till I went in at 9:30 PM NE very light wind	**13** SR 5:48 am SS 9:38 pm
SR 5:48 am SS 9:39 pm ...dor late ...in ...window ...ag Day Handle ...	**15** SR 5:48 am SS 9:39 pm Hog odor still at 10 AM open front door and in it came	**16** SR 5:48 am SS 9:39 pm	**17** SR 5:48 am SS 9:40 pm	**18** SR 5:48 am SS 9:40 pm	**19** SR 5:49 am SS 9:41 pm	**20** SR 5:49 am SS 9:41 pm
SR 5:49 am SS 9:41 pm ...er Begins ...r's Day	**22** SR 5:49 am SS 9:41 pm	**23** SR 5:49 am SS 9:41 pm	**24** SR 5:50 am SS 9:41 pm	**25** SR 5:50 am SS 9:41 pm	**26** SR 5:50 am SS 9:41 pm	**27** SR 5:51 am SS 9:41 pm
SR 5:51 am SS 9:41 pm	**29** SR 5:52 am SS 9:41 pm	**30** SR 5:52 am SS 9:41 pm				

RAP – Report All Poachers,
call 1-800-472-2121 toll free, reward offered.

Ex. 3

RAP – Report All Poachers, call 1-800-472-2121 toll free, reward offered.

unday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				30 PIG	**1** SR 6:28 am SS 8:53 pm PIG Paddlefish Snagging Opens State Arbor Day	**2** SR 6:27 am SS 8:54 pm PIG
SR 6:25 am SS 8:56 pm PIG	**4** SR 6:24 am SS 8:57 pm PIG	**5** SR 6:22 am SS 8:58 pm PIG	**6** SR 6:21 am SS 9:00 pm PIG	**7** SR 6:19 am SS 9:01 pm PIG	**8** SR 6:18 am SS 9:02 pm	**9** SR 6:16 am SS 9:04 pm
SR 6:15 am SS 9:05 pm ...er's Day	**11** SR 6:14 am SS 9:06 pm ○	**12** SR 6:12 am SS 9:07 pm	**13** SR 6:11 am SS 9:09 pm ~~PIG~~	**14** SR 6:10 am SS 9:10 pm PIG	**15** SR 6:08 am SS 9:11 pm	**16** SR 6:07 am SS 9:12 pm
SR 6:06 am SS 9:14 pm	**18** SR 6:05 am SS 9:15 pm	**19** SR 6:04 am SS 9:16 pm	**20** SR 6:03 am SS 9:17 pm	**21** SR 6:02 am SS 9:18 pm o wind NE NO H	**22** SR 6:01 am SS 9:19 pm AM upper Floor of House PIG Smell North EW	**23** SR 6:00 am SS 9:21 pm PIG strong AM out of upper window 7AM most of day wind from NE
SR 5:59 am SS 9:22 pm **31**	**25** SR 5:58 am SS 9:23 pm ● Memorial Day	**26** SR 5:57 am SS 9:24 pm	**27** SR 5:56 am SS 9:25 pm	**28** SR 5:56 am SS 9:26 pm PIG at 7:30 pm (Bad as) NE	**29** SR 5:55 am SS 9:27 pm Night Hogsmel	**30** SR 5:54 am SS 9:28 pm Hog smell very strong about 1pm at least till 8pm smell past f.r.

STATE OF NORTH DAKOTA
COUNTY OF GRAND FORKS

IN DISTRICT COURT
NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN, KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

NORTH DAKOTA DEPARTMENT OF HEALTH, DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, and SWINE MANAGEMENT SERVICES, a subsidiary of PURINA MILLS, INC.,

Defendants.

AFFIDAVIT OF DANIEL SCHNEIDER

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

DANIEL SCHNEIDER, being first duly sworn on oath, deposes and states:

I LIVE 1/4 MI. NORTH NORTHWEST OF THE HOG FACILITY ANYTIME A SOUTHERLY MOVEMENT OF AIR HAPPENS I SMELL HOG MANURE, MANY DAYS IT WAS VERY UNPLEASANT WORKING OUTSIDE ON MY YARD

Daniel Schneider
DANIEL SCHNEIDER

On June 17, 1998 before me appeared Daniel Schneider known to me to be the person who executed the within and foregoing instrument.

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN, KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

NORTH DAKOTA DEPARTMENT OF HEALTH, DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, and SWINE MANAGEMENT SERVICES, a subsidiary of PURINA MILLS, INC.,

Defendants.

AFFIDAVIT OF GARY THORSELL

Case No. ____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

GARY THORSELL, being first duly sworn on oath, deposes and states:

I operate a cattle & Grain Farm 2 miles South of Enmisport. I have lived on this Farm For 53 years. we have raised cattle, Hog & Sheep & Chickens, and I have never Smelled anything like, ~~odor or~~ the Smell that comes out of Enmisports. The Smell comes in ~~at~~ every Time the wind blows from the North.

Gary Thorsell
SIGNATURE

Acknowledged before me this 20th day of July, 1998

Diane D. Carlson

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN, KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

NORTH DAKOTA DEPARTMENT OF HEALTH, DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, and SWINE MANAGEMENT SERVICES, a subsidiary of PURINA MILLS, INC.,

Defendants.

AFFIDAVIT OF LINNEA GRIFFIN

Case No. 98-C-00724

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

LINNEA GRIFFIN, being first duly sworn on oath, deposes and states:

I, Linnea Griffin, live one mile east and three miles north of the Enviropork operation.

On numerous days the stench is to the level where you cannot comfortably have the windows in our home open, sit on our screenporch and enjoy the day, or even mow our lawn. This morning July 17, 1998 it is particularly foul smelling.

Before this operation began we were assured this would not be a concern. Well, as the summer has progressed, so has the smell.

Like Mr. Bergquist, I went to be a good neighbor and took him at his word. Unfortunately, I'm finding that he was disingenuous in his public relations campaign to get approval for the operation.

We, his neighbors, are [illegible] air that is interfering with our quality of Life.

Linnea Griffin 7/17/1998

DUANE R. LARSON
Notary Public, State of North Dakota
My Commission Expires Oct. 30, 2003

Duane R. Larson

07/17/98 17:37 FAX 701 343 6304 GRIFFIN INS

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN, KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

NORTH DAKOTA DEPARTMENT OF HEALTH, DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, and SWINE MANAGEMENT SERVICES, a subsidiary of PURINA MILLS, INC.

Defendants.

AFFIDAVIT OF Vicky BAKKE

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

Vicky BAKKE, being first duly sworn on oath, deposes and states:

We live 3 miles ~~S~~ East of Enviro pork any time there's a west wind it's a bad smell. Couldn't have windows open at night because of the bad smell. Vicky Bakke

Acknowledge before this 20th day of July, 1998;
A notary public.
My commission expires 11-12-98 Jane L. Carlson

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN and KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, PURINA MILLS, INC., and NORTH DAKOTA DEPARTMENT OF HEALTH

Defendants.

AFFIDAVIT OF MIRANDA TOWERTON

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

MIRANDA TOWERTON, being first duly sworn on oath, deposes and states:

1. My name is Miranda Towerton and I live at 1781 41st St. NE, Larimore ND. I live with my mother Linda Boyajian. I just graduated from Larimore High School and will be going to college in Bottineau this fall.

2. I am writing to express my concerns about the hog odor that drifts from EnviroPork to our home. The hog odor can be so bad that it makes my stomach turn. The odor can be overpowering and sickly. It makes me not

stomach turn. The odor can be overpowering and sickly. It makes me not want to breathe. About a week before my prom, my mother and I were making my garter when we opened the window. The hog odor outside was nasty and sickening.

3. Some friends came to get me one day and they all commented on how bad the hog smell was. I do not even want to have friends over anymore because I do not want them to have to deal with the hog odor.

4. I enjoy taking two mile walks to enjoy nice days, but I can not do that whenever I want to anymore because the hog odor can be too horrible. We do not have air conditioning in our house and if we can not open the windows because of the hog odor, it will be too hot and we will trapped in our own home. Even though I will leaving for college this fall, I feel bad for my mom because she can not get outside and enjoy her garden like she used to because the hog odor can be too sickening.

Dated June 16, 1998

Miranda Towerton

Miranda Towerton

State of North Dakota)
)ss
County of Grand Forks)

On June 17, 1998, before me personally appeared MIRANDA TOWERTON

known to me to be the same person described in and who executed the within and foregoing instrument and acknowledged to me that she executed the same.

Notary Public
State of North Dakota (SEAL)
My commission expires: Sept 7, 2000

STATE OF NORTH DAKOTA
COUNTY OF GRAND FORKS

IN DISTRICT COURT
NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN, KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

NORTH DAKOTA DEPARTMENT OF HEALTH, DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, and SWINE MANAGEMENT SERVICES, a subsidiary of PURINA MILLS, INC.,

Defendants

AFFIDAVIT OF DAREN THORSELL

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

DAREN THORSELL, being first duly sworn on oath, deposes and states:

I LIVE 2 ½ MILES DIRECTLY SOUTH OF THE DEFENDANTS HOG FACILITY. ANY NORTHERLY WIND MOVEMENT BRINGS THE HOG SMELL INTO MY YARD. EVEN WHEN I BARBAQUE OUTSIDE IN THE EVENING I CAN SMELL HOG MANURE IT'S NOT VERY APPETITIZING.

Dave Thorsell
DAREN THORSELL

On June 17, 1998 before me appeared Daren Thorsell known to me as the person who executed the within and foregoing instrument.

Notary Public

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN and KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, PURINA MILLS, INC., and NORTH DAKOTA DEPARTMENT OF HEALTH,

Defendants.

AFFIDAVIT OF JIM GRIFFIN

Case No. _____

STATE OF NORTH DAKOTA)
) ss
COUNTY OF GRAND FORKS)

JIM GRIFFIN, being first duly sworn on oath, deposes and states:

1. I am a plaintiff in the above-entitled action. I am a resident of rural Grand Forks County and live about 3 miles west of Larimore and a quarter mile north of Highway 2. My home, in which I both live and work, is one and a quarter miles from the EnviroPork facility. My home was built in 1983 on land that I purchased from my father's brother. This land has been in my family for years.

2. I noticed construction of the facility begin in the month of June 1997.

The Health Department allowed EnviroPork to begin construction on the facility at their own risk because the Approval to Operate was not given to EnviroPork until December 23, 1997. (Exhibit 1)

3. I get my water from my private well which is supplied by the Elk Valley Aquifer so I have concerns about where the Elk Valley Aquifer boundary extends. If we have had more water in the last five years than that has occurred in the past, it makes sense to assume that the Aquifer has grown.

4. Also, the site for the EnviroPork facility is on a gravel ridge where gravel pits were located. It seems to me like a very unsuitable area for a sewage lagoon, especially considering Dr. Murphy's map of locations suited poorly for waste disposal. (Exhibit 2)

5. I have been opposed to the location of this facility since day one and sought disapproval from the Health Department. (Exhibit 3) Now that numerous odor standard violations have occurred (Exhibit 4), I am convinced that my home and business have been devalued from the odor and threat to the Elk Valley Aquifer. On Friday, June 12, 1998, I smelled the hog odor in my yard when the wind was blowing from the southwest and am concerned that it will only get worse. EnviroPork does not have the right to smell up my yard.

6. Many other people have also expressed their opposition to the facility (Exhibit 5), but the Health Department ignored our pleas. The Health Department responded to these comments by summing up the concerns and answering them

in a memorandum addressed to those who raised the concerns. (Exhibits 6 and 7)

7. I am concerned about the competence of the management of EnviroPork. A Purina Mills Inc. subsidiary was responsible for the largest hog waste disaster that has ever occurred in the history of the United States. (Exhibits 8 and 9).

8. On behalf of Keith Peterson and my self, our attorney, Sarah Vogel, has filed two separate 30 day notices pursuant to NDCC Section 32-40-07. The first notice was dated October 31, 1997 and notified the North Dakota Department of Health, Grand Forks County States Attorney, and the Attorney General of our intent to sue the Health Department (Exhibit 10). The second notice was dated May 19, 1998 and notified the North Dakota Department of Health, the Attorney General, the Grand Forks County States Attorney, Dakota Facilities LLC, North Dakota Pigs Cooperative, and Swine Management Services, Purina Mills Inc. of our intent to sue all defendants (Exhibit 11).

9. I am also concerned for other area residents and the passengers in the 3600 vehicles that pass EnviroPork on Highway 2 each day.

Dated: June 17, 1998

Jim Griffin

State of North Dakota)

County of Grand Forks)

On June 17, 1998, before me personally appeared JIM GRIFFIN known to me to be the same person described in and who executed the within and foregoing instrument and acknowledged to me that he executed the same.

Notary Public
State of North Dakota (SEAL)
My commission expires: Sept 7, 2000

STATE OF NORTH DAKOTA

COUNTY OF GRAND FORKS

IN DISTRICT COURT

NORTHEAST CENTRAL JUDICIAL DISTRICT

STATE OF NORTH DAKOTA, ex rel. JIM GRIFFIN and KEITH PETERSON and JIM GRIFFIN and KEITH PETERSON, as individuals,

Plaintiffs

vs.

DAKOTA FACILITIES, LLC, NORTH DAKOTA PIGS COOPERATIVE, PURINA MILLS, INC., and NORTH DAKOTA DEPARTMENT OF HEALTH

Defendants.

AFFIDAVIT OF KEITH PETERSON

Case No. _____

STATE OF NORTH DAKOTA)
) SS
COUNTY OF GRAND FORKS)

KEITH PETERSON, being first duly sworn on oath, deposes and states:

1. My name is Keith Peterson and I own the NE 1/4 or Section 29 which is on the same section where the EnviroPork facility is located. I am a truck driver and presently live in Thompson. I have opposed the EnviroPork facility and expressed this opposition to the Health Department early on (Exhibit 1).

2. I am very concerned about this facility endangering my land. The adjoining area of the EnviroPork facility is subject to flooding and in the spring of 1996, I rowed a rowboat across my section of land. I am worried that the lagoon could break and injure my land because the land where EnviroPork sits used to be home to gravel pits which are not suited to holding water.

3. Odor tests by both the State Department of Health and Grand Forks County health officials just outside of the boundary of the EnviroPork facility indicate that my land has been and will be affected by the odor. Numerous other tests have farther away than the property boundary have also failed thus indicating that my land has been damaged (Exhibit 2). My wife and I were hoping to build a retirement home on this section of land, but how can we when the odor emating from EnviroPork is so horrible? I do not think that anyone has the right to ruin the use of my land for any reason, especially when the profits of the facility all go to Minnesota farmers. This land has been in my family for generations and I do not think that it is right that EnviroPork can come in and devalue my land.

Dated: June 17, 1998

Keith Peterson

State of North Dakota)
) ss
County of Grand Forks)

On June 15, 1998, before me personally appeared KEITH PETERSON

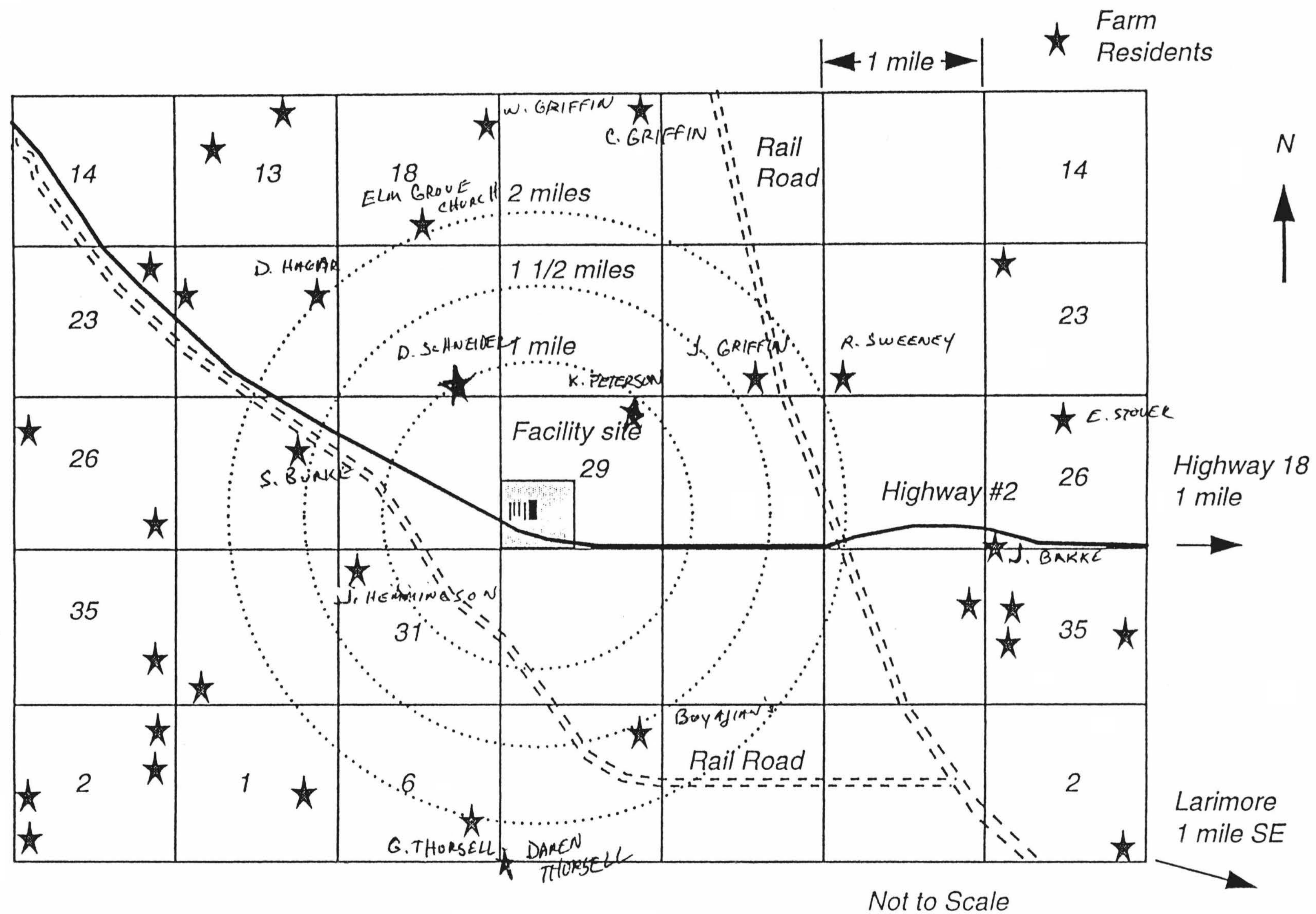
known to me to be the same person described in and who executed the within and foregoing instrument and acknowledged to me that he executed the same.

DEBBIE L. HEINTZ
Notary Public, STATE OF NORTH DAKOTA
My Commission Expires DEC. 30, 2003

Notary Public
State of North Dakota (SEAL)
My commission expires: _____

EnviroPork

Map of Area



Source: S.L. 1991, ch. 266, § 2; 1993, ch. 252, § 1.

23-06.5-03. Scope and duration of authority.

1. Subject to the provisions of this chapter and any express limitations set forth by the principal in the durable power of attorney for health care, the agent has the authority to make any and all health care decisions on the principal's behalf that the principal could make.
2. After consultation with the attending physician and other health care providers, the agent shall make health care decisions:
   a. In accordance with the agent's knowledge of the principal's wishes and religious or moral beliefs, as stated orally, or as contained in the durable power of attorney for health care or in a declaration executed pursuant to chapter 23-06.4; or
   b. If the principal's wishes are unknown, in accordance with the agent's assessment of the principal's best interests.
3. Under a durable power of attorney for health care, the agent's authority is in effect only when the principal lacks capacity to make health care decisions, as certified in writing by the principal's attending physician and filed in the principal's medical record.
4. The principal's attending physician shall make reasonable efforts to inform the principal of any proposed treatment, or of any proposal to withdraw or withhold treatment.
5. Nothing in this chapter permits an agent to consent to admission to a mental health facility or state institution for a period of more than forty-five days without a mental health proceeding or other court order, or to psychosurgery, abortion, or sterilization, unless the procedure is first approved by court order.

Source: S.L. 1991, ch. 266, § 3; 1993, ch. 252, § 2.

Constitutionality.

Plaintiff who sought to execute a living will and durable power of attorney which would have the same effect whether or not she was pregnant, and her husband, who sought to be able to serve as her agent under this act and consent to an abortion without court approval, did not have standing to claim that the pregnancy and abortion provisions of the Uniform Rights of the Terminally Ill Act and this act were unconstitutional, nor were their claims ripe, where plaintiff was neither pregnant nor incompetent, did not wish to become pregnant, and was in good health; there was no "realistic danger" that the statutes would directly injure the plaintiffs. Gabrynowicz v. Heitkamp, 904 F. Supp. 1061 (D.N.D. 1995).

23-06.5-07. Revocation.

1. A durable power of attorney for health care is revoked:
   a. By notification by the principal to the agent or a health care or long-term care services provider orally, or in writing, or by any other act evidencing a specific intent to revoke the power; or
   b. By execution by the principal of a subsequent durable power of attorney for health care.
2. A principal's health care or long-term care services provider who is informed of or provided with a revocation of a durable power of attorney for health care shall immediately record the revocation in the principal's medical record and notify the agent, the attending physician, and staff responsible for the principal's care of the revocation.
3. If the spouse is the principal's agent, the divorce of the principal and spouse revokes the appointment of the divorced spouse as the principal's agent.

URGENT

FEB. 3, 1999

ATTN: HUMAN SERVICES COMMITTEE

% JUDY DEMERS

FAX: 701-328-1997

RE: BILL 2365

ATTN: HUMAN SERVICES COMMITTEE FEB. 3, 1999

RE: BILL 2365

You have before you Bill 2365 that was submitted by the pork industry to prevent their neighbors from taking legal action against them for a smell they promised to control.

The Health Dept. stood along side the hog industry at many public meetings and assured the whole community that the tests for odor were time tested and there would be no problem with enforcement.

The citizens of Grand Forks county took the hog industry and Health Dept.'s word in good faith and allowed them to build.

They now have no intention of correcting the smell or enforcing the laws that they are legally bound to, so now intend to change them.

Do you not find it odd that the Health Dept. stood before you as a neutral party and amended the bill to let the smell be even worse. Does that show concern for the citizens who have complained.

If the odor readings are now taken at Enviropork's border and people cannot enjoy their property at these levels, what is the argument for making the tests farther away? There is none. This law would also make approximately 3 miles of Hwy. 2 a No Man's Land with no obligation to protect the passing public .

It is disheartening when large corporations refuse to keep their promises, but it is disgusting and evil when our own government refuses to do so.

If neighbors find it unbearable at times with the present testing, the new standards would make it unlivable. Is this what you do to trusting people who still remember when Mr. Bergquist said, "Let us build. All we want to do is be good neighbors." The hog industry and Health Dept. promised to uphold and enforce the law in our community, not disregard and change them.

This is also the view of the Grand Forks Herald and I believe, the community. Do not amend a bad bill to make it worse. "Kill it" and represent the citizens of North Dakota who keep their promises and expect the same from people they invite in. Remember, permission for them to build was based on existing laws, not ones watered down by their lawyers and the Health Dept.

This factory would never have been permitted to be built if the public would have known they never intended to obey existing laws. Please protect us.

Sincerely yours,

Keith A Peterson

Keith A. Peterson (537 - 3rd St., Thompson, ND 58278 Ph: 701-599-2452)

4A

Grand Forks
Herald

Michael Maidenberg Publisher
Mike Jacobs Editor
Tom Dennis Opinion Editor
Kevin Grinde Managing Editor

"It will be the people's paper, run strictly in their interests, guarding jealously their rights and maintaining boldly their cause."

George Winship, founder

EDITORIAL

2-1-99

Don't relax hog farm odor standards

EnviroPork and other hog-feeding operations are welcome in North Dakota — on two conditions: They can't pollute the water or excessively foul the air. The Legislature should take a dim view of any proposal that would let the operations do one or both.

OUR VIEW

Strict — not loose — enforcement of tough odor standards is called for.

And that's why lawmakers should reject the bill that would relax the way the Health Department takes odor readings.

The bill before the Senate Human Services Committee would require the department to take readings at the residence, church, business or public building nearest the source of the odor, Herald Staff Writer Ian Swanson reported last week ("Two sides in hog farm suit clash over odor testing bill," Jan. 28, Page 1B). Current law calls for the readings to be taken at the hog operation's property line.

EnviroPork of Larimore, N.D., favors the bill while neighbors who testified oppose it, the story reported. In this case, the neighbors know best. They know their houses sit much farther away from the pig facility than the property line does, so taking readings at the house would enable the smell to waft across the property line in much greater concentrations than it does now. The acreage between their house and the property line would be a kind of "no man's land," where the smell could be overpowering, as long as it dissipated by the time it got to the house.

That would be unfair to the neighbors, who deserve full and unfettered use of their entire property, not just their residence.

Furthermore, EnviroPork should be held to a strict rather than a loose standard where smell is concerned. North Dakota needs tough rules now to govern this young industry. Hog operators should know what they're getting into if they set up shop in North Dakota: A no-nonsense law that insists the facilities themselves pay the costs of odor control, rather than transferring that cost to neighbors and others downwind.

This time, North Dakota should snuff out odor problems in an industry's earliest stage, rather than letting them become a fact of life (as happened with some other industries).

Livestock operations always create a smell. But modern factory farms are on an entirely different scale. The number of animals can approach the number of people in a small city, and create a fair share of that city's waste, too.

Market forces probably make the farms' growth inevitable. But the smell's intensity mustn't be allowed to follow suit. Somehow, owners must find a way to keep their environmental impacts — including smell — on a small or modest scale, despite the size of their operations. If that raises the cost of production somewhat, so be it. Better for all North Dakotans to pay a bit more at the grocer, than for those unlucky enough to live downwind of a hog farm to wind up paying through the nose.

— Tom Dennis, for the Herald

ND Legislative Assembly

1/27/99

Senate Standing Committee on Human Services
Russell Thane, Chairman

Mister Chairman and members of the committee:

My name is Rep. Tom Brusegaard, I represent district 19. (rural Grand Forks County) Today I ask your support for SB2365.

SB2365 requires the state health department to take odor emission readings at the nearest place where those odors would cause a problem. Currently the readings are taken at the property line.

This places an huge burden on a farm or business for virtually no reason. SB 2365 will protect the rights of home owners and business people while encouraging responsible development of profitable enterprises

I'm sure you will here horror stories today of factory farms and environmental irresponsibility. I urge you to use your common sense and good judgment and pass SB2365.

Thank you for your consideration.

Rep. Thomas Brusegaard
District 19

RR 1 Box 4

58235

(701) 869 - 2855

Fax

rbrusega@state.nd.us

Senate Human Services Committee
January 27, 1999

Senate Bill No. 2365

Testimony of Jim Griffin

I am Jim Griffin, and I live about a mile and a half northeast of EnviroPork. I oppose this bill.

Passing this bill would be unfair to people who live near facilities like EnviroPork because we have to call the Health Departments of the County or State during business hours, not on holidays, Saturdays, Sundays, or early morning or evening (when the smell is most prevalent.) Also, when we do call, we may not even get a call back much less a test of the odor. When someone does come, it might be a week later and the wind, of course, has changed.

Let me give an example. I have attached a list of the official odor violations of 7 or higher on the official test used by the Health Department. As you can see, despite the many claims of EnviroPork that they have fixed the odor the odor last week was just as bad as it was last May. (The typed violations are those in the State's complaint against EnviroPork and the handwritten ones are violations that occurred after the complaint was finished.) I want to draw your attention to November 3. On this date, the EERC tested at about 2 p.m. and the levels were 31 and 15. Less than an hour later, the North Dakota Health Department tested and the level was seven. I have also attached a letter I wrote on November 23, 1998 about the smell and how it can change rapidly.

I don't like this bill because the problem arises at the source of the odor. When the level becomes high at the source and at the property line of the source, the test should be taken downwind at the property line so that steps can be taken to fix the odor problem before it affects businesses, homes, schools, etc.

In addition, this is a pointless bill. The "nearest residence" to EnviroPork for example is the home of Dan Schneider, who lives one and a quarter mile NNW from EnviroPork. He filed an affidavit in our case which says that "anytime a southerly movement of air happens I smell hog manure." He told me that on the 4th of July he couldn't stand to be outside. How would you like it if you had relatives over on the 4th of July and your yard stunk like hog manure? We don't.

The wording of this bill requires that all tests would have to be made from Dan Schneider's house no matter which way the wind is blowing. So if the wind is blowing from the north, the Health Department would have to go to Dan's house on the north side of EnviroPork and, surprise, it wouldn't smell! Meanwhile, Linda Boyjian who most often gets the smell from the prevailing wind couldn't get the air by her house tested. How much sense does that

make? This bill is frivolous.

We want EnviroPork to fix the smell; they seem to just want to "fix" the law.

I am not a fussy person. I used to farm. I grew up on a farm with livestock. I spent 15 years as a aerial crop sprayer. But my home is all I've worked for. I planted over 250 trees in my yard, and it is land that has been in my family for two generations. I've lived there for 24 years. Now EnviroPork moves in and destroys my quality of life, and devalues my home by sending reeking waves of odor over my home. And, most of the time, the worst smells are early in the morning and at night -- when all the beaurocrats have gone back to their homes that don't smell!

I've been doing a lot of reading on odor. It isn't just a question of offensive smell. It does affect the health of nearby residents. I have attached several studies that have come to our attention. A study from Iowa in 1997 shows:

> Evidence indicates that neighbors of the large-scale swine operation in our study reported experiencing increased rates of a number of interrelated symptoms, including headaches, respiratory problems, eye irritation, nausea, weakness, and chest tightness.

Sometimes the EnviroPork people like to portray us as "complainers" or people with a vendetta against EnviroPork. We are not. We are just people trying to defend our homes and our property rights and our health. We hope you will defeat this frivolous bill on our behalf and other persons in the same situation. It is a bad idea.

To whom it may Concern.

On Nov 22nd at 4:20 p.m. I was Jogging ½ mile west and ½ mile South of my Home. or Approximately 1 mile East of Enviro pork. I started to smell pig manure I thought I would Jog out of it But it got worse to the point of being very offensive, then it ~~tapered off again, the smell lasted for about~~ ½ mile. Jogging Back I could only smell it for About 100 yds and it wasn't nearly as offensive as the first time through. This shows that there are many times that as residents Close By Enviro pork we smell an offensive odor But there is no way we Can Have officals get there in time to Do a reading.

I Called the County Health office at 4:40 and no official was in, although a Secretary took my message.

~~Immediately~~ I called the State Health Dept. Gary Habbelstroh was not in so I left a message on his Voice Mail & also left a message with his Secretary. What I can't understand, is why our State Health Dept bends over backwards to Help out of State investors to pollute our State, But ingores protecting the citizens of North Dakota, which I thought was their job and duty.

James A. Griffin

INDUSTRIAL SCIENTIFIC CORPORATION

Preserving human life is our life's work.

Hydrogen Sulfide Data Sheet

Hydrogen Sulfide: H_2S

Hazard:
Flamable will explode; LEL 4.0%

Classification
Health: extremely toxic
OX: oxidizing agent

Synonyms:
hydrosulfuric acid, sewer gas, sour gas, rotten egg smell

Exposure limits:
(OSHA) PEL\TWA: 10 ppm
(ACGIH) STEL: 15 ppm / 15 min.
(OSHA) IDLH: 300 ppm / 30 min.

Industries:
Oil and Gas industries (complete from drilling to refining), pulp and paper, and waste water treatment

Hydrogen sulfide is a colorless gas that is known by its characteristic rotten egg like odor. It appears naturally as a byproduct of decomposition. One of the drawbacks to trusting the senses (olfactory) for protection against hydrogen sulfide is that prolonged exposure to the gas renders the sense of smell inoperative.

Hydrogen sulfide is a highly toxic gas. It reacts with the enzymes in the blood stream which inhibit cell respiration. in other words, high concentrations of hydrogen sulfide can shut off the lungs. Low concentration exposure to the gas can burn the respiratory tract and cause swelling around the eyes.

Effects of Various H_2S Levels

Hydrogen Sulfide Levels in PPM	Resulting Condition/Effects on Humans
0.13	Minimal perceptible odor
4.6r	0 Easily detected, moderate odo
10	Beginning eye irritation. Permissible Exposure Level, 8 hours (OSHA, ACGIH)
27	Strong, unpleasant odor, but not intolerable.
100	Coughing, eye irritation, loss of sense of smell after 2 to 5 minutes.
200-30	0 Marked conjunctivitis (eye inflammation) and respiratory tract irritation after one hour of exposure.
500-700	Loss of consciousness, cessation (stopping or pausing) of respiration, and death.
1000-200	Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur even if individual is removed to fresh air at once.

Source: American National Standards Institute (ANSI Standard No. Z37.2-1972 CHLORINE GAS DATA SHEET)

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Preserving human life is our life's work.

Ammonia Data Sheet

Ammonia: NH_3

Hazard:
Flam: Difficult to burn, LEL 15%

Classification:
Health: extremely toxic

Synonyms:
Anhydrous ammonia, aqua ammonia, aqueous ammonia

Exposure limits:
(OSHA) PEL\TWA: 25 ppm
(ACGIH) STEL: 35 ppm/ 15 min.
(OSHA) IDLH: 500 ppm / 30 min.

Industries:
Fertilizer plants, poultry farms, food processing, refrigeration, chemplants

Ammonia is a widely used chemical that can be found in a variety of common industrial environments. It is a colorless gas with a pungent suffocating odor. Ammonia is characterized as a flammable although it is very difficult to ignite. When exposed to heat, an ammonia solution will decompose to form ammonia gas and oxides of nitrogen, (Nox). Ammonia is an irritant and will become extremely irritating as concentrations increase.

Effects of Various NH_3 Levels

Ammonia Level in PPM	Resulting Conditions on Humans
0-25	Minor irritation of the eyes and respiratory tract.
25	Permissible Exposure Limit (OSHA)
50-100	Swelling of the eyelids, conjunctivitis, vomiting, irritation of the throat.
100-500	Concentrations are dangerously high, irritation becomes more intense. Death can result from highly concentrated, prolonged exposure.

Source: Dangerous Properties of Industrial Materials (Sixth Edition) by N. Irving Sax

Industrial Scientific
1001 Oakdale Road,
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Health & Environment

DIGEST

A publication of the Freshwater Foundation
Featuring information from its Health & Environment Network

Volume 12, No. 8 August 1998

FEATURE

Odor Problems from Large-Scale Agriculture: Nuisance or Public Health Problem?

Kendall Thu, Ph.D.
Research Scientist
Institute for Rural and Environmental Health
University of Iowa
Iowa City, IA

The spread of large-scale industrialized livestock facilities is occurring nationwide, from Pennsylvania and North Carolina in the East, through Texas and Mississippi in the South, to Colorado and Utah in the West, and back through the prairie and plains of the Midwest. Throughout these areas, farmers, rural residents, public health officials, local governments, and the scientific community have raised concerns over the environmental, social, economic, and human health consequences of such facilities (Thu, 1996).

Large-scale livestock facilities are distinguished by:

- absentee owner relationship, where ownership, management, and labor are separate. Conversely, in a family-owned facility, the same person may be an owner, a manager, and a member of the work force.
- a non-family corporate organizational structure.
- capital-intensive production technology.

Local, state, and federal policymakers and government agencies at all levels are struggling to formulate an appropriate response to the increasingly vocal concerns over these types of operations.

While concerns have been directed at a broad spectrum of large-scale livestock operations, including dairy, cattle, and poultry, the swine industry has received the most attention. The 1990s have been a period of rapid industrialization of swine production, marked by consolidation into fewer hands and the growth of larger production units. In 1974, the United States listed 750,000 hog producers (USDA-NASS). By the end of 1994 the number had declined to 250,000. And between 1994 and 1997 almost half of all remaining hog producers, mostly independent producers, left the business. Those that remain are increasingly large-scale operations, with the 1,500 largest hog producers in the country now accounting for 35 percent of all U.S. pork production.

Communities that have these large-scale operations, with their multi-acre open-air manure storage lagoons, often find themselves in an uproar. For example, Beaver County, Utah, population 5,600, is witnessing first hand the consequences of these changes as the largest swine operation in the country is well under way there. When the facility is fully operational, this county will be home to a projected 1.3 million hogs at any one time, with annual production estimated at some 2 million hogs (The News & Observer 1997). This total represents more than 3 percent of all hogs produced in the country. To provide some perspective, that means there will be more hogs in one county than in all of Alabama, California, Florida, Idaho, Louisiana, Montana, New York,

North Dakota, Texas, West Virginia, Wyoming, and Tennessee combined.

Effect on Workers

One of the concerns expressed by farmers and rural residents living near large-scale swine operations is the effect of gas emissions and related odors on their health and quality of life (Thu and Durrenberger, 1994). However, virtually all of the human health-related research on confined swine production facilities has focused on the health of workers inside the facilities (Thorne et al., 1996). Since the late 1970s, more than 25 published studies worldwide have consistently documented a number of occupational health problems among swine confinement workers. The most notable of these is a series of interrelated respiratory conditions such as chronic bronchitis and organic dust toxic syndrome, which occur in approximately 25 to 30 percent of swine confinement workers (ibid:164). Recommended limits on gas (7 ppm ammonia), dust (2.5 mg/m3 total dust; .23mg/m3 respirable dust), and endotoxin (100 EU/m3) levels have also been developed for interior swine confinement operations based on dose-response research (Donham et al., 1995; Reynolds et al., 1996). However, comparable health research and standards are lacking for the external environment.

Most research over the last 30 years on the external environment surrounding large-scale livestock operations has focused on identifying compounds that produce odors (Muckie 1995; Miner 1975; O'Neill and Phillips 1992), mechanisms for measuring odor (Barrington 1995; Hobbs 1995), and the development of control technologies (Lwo 1995; Voermans 1995). Much of this work focuses on the development of quantifiable thresholds of odor using mechanical measurements. The assumption pervading this work is that odor is primarily a nuisance issue that should be addressed because it can interfere with the quality of lives of neighbors.

A New Paradigm

However, a notable shift has occurred in the last few years as rural physicians receive an increasing number of health complaints from neighbors of large-scale swine operations. Emerging research and results from several recent scientific conferences provide evidence of a paradigm shift from one that views odors as a nuisance to one that considers odors and associated emissions a public health issue.

Only two articles have been published directly assessing the health of neighbors living in the vicinity of large-scale swine operations. In 1995, Dr. Susan Schiffman and associates at Duke University published the results of a matched control study examining the psychological effect of odors from commercial swine operations in North Carolina (Schiffman et al., 1995). They administered a standardized mood states (POMS) and total mood disturbances (TMD) scale to 44 neighbors of commercial swine operations and 44 matched controls not living near such operations. Results showed that the neighbors subjected to odors scored significantly higher on both scales, exhibiting significantly higher rates of tension, depression, anger, and fatigue than did the control group. Elsewhere, Schiffman describes a variety of mechanisms that explain how odor can have a deleterious human health effect, including a physiological pathway between the olfactory lobe and the immune system that directly implicates odor as a health risk (Schiffman et al., 1998).

In 1997 we published the results of a comparative control study built on the earlier work of Schiffman (Thu et al., 1997). We collected data on the physical and psychological health of 18 neighbors living within a two-mile radius of a 4,000 sow swine confinement production facility and compared the results with data from 18 demographically comparable rural residents who lived near minimal livestock in Iowa. Results indicated that the neighbors of the swine operation reported significantly higher rates of four clusters of symptoms that have previously been documented to represent toxic or inflammatory effects on the respiratory tract. Most notable is the fact that the configuration of respiratory symptoms fit a well-documented pattern of respiratory health problems among swine confinement workers.

However, no differences between the two groups in psychological health were apparent as reflected in the standardized anxiety and depression scales we administered. It should be noted that this finding does not contradict Schiffman's earlier work since the scales we employed measured different dimensions of mental health.

A Suspected Culprit

One of the suspected culprits in creating neighbor health problems is hydrogen sulfide. Chronic or acute occupational exposure to hydrogen sulfide concentrations near or above 500 ppm (parts per million) is known to result in Acute Respiratory Distress Syndrome (ARDS) or pulmonary edema among swine confinement workers (Thorne et al., 1996). Approximately 20 deaths in swine confinement workers have been reported from exposure to hydrogen sulfide. High-level exposures usually occur from agitation of liquid manure in a confined space.

In 1987, the World Health Organization recommended a maximum level of 107 ppb (parts per billion) in ambient air over a 24-hour period to prevent health problems and 5 ppb over 30 minutes as a threshold for odor nuisance (Roth, 1993). These

levels compare to OSHA occupational exposure limits of 10,000 ppb for an eight-hour work day (time weighted average). The Minnesota Pollution Control Agency (MPCA) recently collected data on hydrogen sulfide levels near 10 livestock operations in that state, and five of the operations exceeded the state standard of 30 ppb (Ison, 1998). Minnesota appears to be the only state actively measuring gas levels and applying standards.

It is as yet unclear to what extent hydrogen sulfide, acting alone or more likely in combination with one of the other 160 compounds generated from swine waste, contributes to neighbor health problems. Perhaps most notable in this regard is the fact that research indicates little relationship between hydrogen sulfide and odor levels (Jacobson et al., 1997).

Moreover, research on the effectiveness of leading manure additives to control odor indicates such additives do not affect hydrogen sulfide emissions (Zhu et al., 1997). This raises the concern that if there is indeed a health problem from livestock emissions, we may be mistakenly assuming that taking care of the odor issue is synonymous with addressing the public health problem.

Large-scale industrialized livestock facilities, spreading nationwide, are raising environmental and human health concerns among farmers, rural residents, public health officials, local governments, and the scientific community. Printed with permission from "Raleigh News & Observer," Raleigh, N.C.

References

Barrington S. (1995) Odor Measurement, Commercial Substrates and Biofilters. In: International Round Table on Swine Odor Control, pp. 40-45. Ames, Iowa, Iowa State University.

Donham K.J., Reynolds S.F., Wouten P., Merchant J., Burmeister L., and Popendorf W.J. (1995) Respiratory Dysfunction in Swine Production Facility Workers: Dose-Response Relationships of Environmental Exposures and Pulmonary Function. American Journal of Industrial Medicine 27:405-418.

Donaham K.J. and Thu K. (1996) Introduction. In: Thu K. (ed) Understanding the Impacts of Large-Scale Swine Production, pp. 1-9. The University of Iowa, Iowa City, Iowa.

Hobbs P. (1995) Measurement of Swine Odor Using Electronic Nose Technology. In: International Round Table on Swine Odor Control, pp.36-39. Iowa State University, Ames, Iowa.

Ison C. (1998) State air test finds high levels of toxic gas near 5 feedlots. Star Tribune, April 26, Minneapolis, Minnesota.

Jacobson L.D., Nicolai R.E., and Schmidt D.R. (1997) Odor Concerns for Animal Production Systems, University of Minnesota.

Luo J.H. (1995) Swine Odor Control Methods in Taiwan. In: International Round Table on Swine Odor Control, pp. 7-30, Iowa State University, Ames, Iowa.

Mackie R.I. (1995) Microbial Production of Odor Components. In: International Round Table on Swine Odor Control, pp. 18-19. Iowa State University, Ames, Iowa.

Miner J.R. (1975) Management of odors associated with livestock production. In: Managing livestock wastes, pp. 378-380. American Society of Agricultural Engineers, St. Joseph, Missouri.

The News and Observer Publishing Company (1997) Circle Four Farms, Raleigh, North Carolina, Aug. 3.

O'Neill D.H. and Phillips V.R. (1992) A review of the control of odor nuisance from livestock buildings: Part 3, Properties of the odorous substances which have been identified in livestock wastes or in the air around them. Journal of Agricultural Engineering Research 34:23-50.

Reynolds S.J., Donham K.J., Whitten P., Merchant J.A., Burmeister L.F., and Popendorf W.J. (1996) Longitudinal evaluation of dose-response relationships for environmental exposures and pulmonary function in swine production workers. American Journal of Industrial Medicine 29:33-40.

Roth S. (1993) Hydrogen Sulfide. In: Handbook of Hazardous Materials, pp. 367-375. Academic Press.

Schiffman S., Miller E.A.S., Suggs M.S., and Graham B.G. (1995) The Effect of Environmental Odors Emanating from Commercial Swine Operations on the Mood of Nearby Residents. Brain Research Bulletin 37(4):369-375.

Schiffman S., Miller E.A.S., Suggs M.S., and Graham B.G. (1998) Mood Changes Experienced by Persons Living Near Commercial Swine Operations. In: Thu K. and Durrenberger E.P. (eds), Pigs, Profits, and Rural Communities, pp 84-102. State University of New York Press, Albany, New York.

Thorne P.S., Donham K.J., Dosman, J.D., Jagiela P., Merchant J.A., and von Essen S. (1996) Occupational Health. In: Thu K. (ed) Understanding the Impacts of Large-Scale Swine Production, pp. 153-193. The University of Iowa, Iowa City, Iowa.

Thu K. (ed) (1996) Understanding the Impacts of Large-Scale Swine Production, The University of Iowa, Iowa City, Iowa.

Thu K., Donham K.J., Ziegenhorn R., Reynolds S., Thorne P.S., Subramanian P., Whitten P., and Stookesberry J. (1997) A Control Study of the Physical and Mental Health of Residents Living Near a Large-Scale Swine Operation. Journal of Agricultural Safety and Health 3(1):13-26.

Thu K. and Durrenberger E.P. (1994) North Carolina's Hog Industry: The Rest of the Story. Culture and Agriculture 49:20-23.

The *Health & Environment Digest*® (ISSN 0893-8242) is published at the Freshwater Foundation at Gray Freshwater Center, 2500 Shadywood Road, Excelsior, MN 55331. The *Digest* is a monthly (except bimonthly November/December) publication of the Freshwater Foundation, a public nonprofit foundation whose mission is to pursue the sustainable use of freshwater resources through education, conferences, publications, and research. The Freshwater Foundation's address is: Gray Freshwater Center, 2500 Shadywood Road, Excelsior, MN 55331; (612) 471-9773, FAX (612) 471-7555; E-mail: freshwater@freshwater.org.

The *Digest* draws on the expertise of a network of representatives in schools of public health, state health departments, private research institutions, other government agencies, state public health associations, and medical societies. Start-up funds were provided by a grant from the Bush Foundation.

Subscriptions to the *Digest*: government/public sector, $90; private sector, $115. Additional postage: $8 Canada & Mexico; $15 International. Special rates are available for orders of two or more. Back issues: $10 each for non-subscribers; $5 for subscribers. Periodical postage paid at Minneapolis, MN and additional entry. POSTMASTER: Send address changes to: *The Health & Environment Digest*, Gray Freshwater Center, 2500 Shadywood Road, Excelsior, MN 55331; (612) 471-9773.

A Control Study of the Physical and Mental Health of Residents Living Near a Large-scale Swine Operation

K. Thu, K. Donham, R. Ziegenhorn, S. Reynolds, P. S. Thorne, P. Subramanian, P. Whitten, J. Stookesberry

Abstract

This article presents the results of a study assessing the physical and mental health of residents living in the vicinity of a large-scale swine confinement operation. Physical and mental health data were collected via personal interviews from a sample (n = 18) of all neighbors living within a two-mile radius of a 4,000-sow swine production facility. Results were compared to similar data collected from a random sample of demographically comparable rural residents (n = 18) living near minimal livestock production. Results indicate that neighbors of the large-scale swine operation reported experiencing significantly higher rates of four clusters of symptoms known to represent toxic or inflammatory effects on the respiratory tract. These clusters of symptoms have been well-documented among swine confinement workers. There was no evidence to suggest that neighbors of the large-scale swine operation suffered higher rates of psychological health problems manifested as anxiety or depression. A larger population-based study is needed to test the hypothesis that neighbors of large-scale swine operations experience elevated rates of physical health symptoms comparable to interior confinement workers.

Keywords. Large-scale swine operation, Environment, Neighbor health.

The movement from pasture-based or partially enclosed to totally enclosed swine production first occurred in the United States in the early 1970s. This transformation was patterned in part after changes in the poultry industry in the 1960s (Donham et al., 1977). The last decade has witnessed a dramatic proliferation of large-scale swine confinement operations throughout the United States. Large-scale facilities often have over a thousand sows with multi-acre manure lagoons located at a single site. While there is no single quantitative definition of "large-scale" swine production, it can be characterized by several features: (1) separation of ownership, management, and labor; (2) nonlocal capital; (3) owners, management, and labor do not all live on, or in many cases, in the vicinity of the operation; (4) a nonfamily corporate or company organizational structure; and (5) family labor plays a limited role if any in the operation.

This work was supported in part by a grant from the Center for Health Effects of Environmental Contamination, The University of Iowa, Iowa City, Iowa.

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The proliferation of large-scale swine production facilities has resulted in considerable concern among neighboring farmers and other rural residents over their environmental, social, economic, and health consequences (DeLind, 1995; Thu, 1995/96; Thu and Durrenberger, 1994). Among these concerns are the potential health and quality of life consequences for neighbors exposed to gases, dusts, and odors emanating from such facilities.

Beginning in the mid 1970s and continuing to the present, research has been devoted to understanding human exposures and health consequences of working in swine confinement environments (Donham, 1990; Donham et al., 1977; Kickhaefer et al., 1995; Thorne et al., 1992). The results indicate swine confinement workers experience a number of health problems. A notable problem area is the range of respiratory conditions resulting from exposure to gases and dusts while working inside these facilities (Donham, 1993). However, very little research has been conducted on exposures to external emissions.

Research on exterior conditions has primarily targeted the reduction and elimination of odor emissions from swine operations. This research has concentrated on identifying compounds producing odors (Merkel et al., 1969; O'Neill and Phillips, 1992; Ritter, 1989), mechanisms for measuring odor (Hobbs, 1995; Longhurst, 1995; Mannebeck, 1995; Sweeten, 1988), and the development of control technologies (Fullhage, 1995; Voermans, 1995; Yokoyama, 1995). In addition, considerable research has been devoted to the uptake of ammonia from animal manure and the environmental consequences of its redeposition as rain in Europe (ApSimon and Kruse-Plass, 1991; Legg, 1990). However, little work has been devoted to understanding odor-related complaints and health problems among residents living near large livestock operations.

Emerging research (Schiffman, 1995; Schiffman et al., 1995) has investigated relationships between the psychological health of neighbors and swine-generated odors. This research indicates deleterious psychological health effects such as mood disorders result from a combination of physical agents and physiological responses to swine odor. It also suggests changing social conditions in rural neighborhoods may be a factor affecting responses. Other research (Thu and Durrenberger, 1994) supports Schiffman's suggestion that rural social issues play a role.

This study addresses a gap in research through a control approach to assessing interrelated issues of health, quality of life, and mental health of residents living in the vicinity of a large-scale swine confinement facility. The primary purpose of the study was to test a methodology for assessing neighbor health and quality of life issues, provide preliminary data to identify salient neighbor health and life quality problems, and generate hypotheses for further research.

Methodology

This study is based on a comparative control methodology. Data on physical health status, mental health, and quality of life were collected via personal interviews of neighbors of a large-scale swine production facility and from a random sample of rural residents who do not live near any livestock. Results from the two groups were compared to identify salient differences.

Survey Instrument

A questionnaire was developed to elicit data via personal interviews on physical health status, mental health, quality of life, and standard sociodemographics. An

initial section was designed to collect basic background information, including demographics, employment, residential history, and previous occupational exposures. The second section elicited symptoms indicative of health status. Health status questions were drawn from earlier health assessment studies of swine confinement workers (Donham, 1990). They consisted of an initial set of open-ended questions concerning health problems, frequency ratings of 18 symptoms, and a series of health history and current health status questions.

To assess psychological health, mental health questions were developed in consultation with Professor Susan Schiffman, a medical psychologist at Duke University. In her research (Schiffman et al., 1995), Schiffman collected data on mood states between swine operation neighbors and controls utilizing a standardized mood profile scale (McNair and Lorr, 1992). To complement her findings, we included psychological scales to collect data on depression (Zung, 1965) and anxiety (state-trait anxiety inventory from Steer et al., 1993).

A third section included open-ended questions to solicit qualitative information on neighborhood social issues. For the case sample, questions were designed to elicit information on issues such as how well and how long neighbors knew the owners and operators of the swine facility and the nature of their relationship. Both case and control participants responded to a question on the characteristics of a "good neighbor".

Sample Selection and Procedures

A large-scale swine confinement operation was selected as the study site based on its scale and because we knew certain neighbors had expressed environmental and health concerns. The selected swine operation is one of the largest in Iowa, with approximately 4,000 sows in a farrowing operation consisting of six confinement units, an office building, and a two-stage outdoor waste lagoon about five acres in size. The entire operation is situated on an estimated 35 acres of land.

The 27 neighbors living within two miles were identified from plat maps as potential participants. Each household was sent a letter of introduction, a project summary, an invitation to participate, and a stamped return postcard. Of the 27 households contacted, 18 returned the postcard indicating an interest in participating (67% participation rate). Follow-up phone calls were made to each of the 18 interested households to schedule personal health assessment interviews. Of the 18 interested households, 10 households met the selection criterion of living closer to the large-scale swine operation than other livestock operations. Nine of these with 19 participants completed all aspects of the study. Multiple dwellers within a single household were interviewed independently from each other.

A control sample of rural residents not living near any livestock operation was selected. County level data from the 1992 Agricultural Census were used to locate areas of minimal livestock production. A county different from the case sample site was selected and all rural zip code areas within the county were checked to identify areas with the lowest population of livestock. All rural residents (n = 188) within the selected zip code area who owned a telephone were selected from a telephone data base. Letters of introduction were sent to all residents, including a project summary, an invitation to participate, and a stamped return postcard. Included in the letter was an additional screening caveat that prospective participants must not live within a mile of any type of livestock operation greater than 50 head.

Of the 188 letters sent, 14 were returned undeliverable by the Post Office, 24 postcards were returned declining participation, and 11 postcards were returned indicating they met the selection criteria and were interested in participating. All interested participants were contacted by phone to schedule interviews in their

Table 1. Demographic comparison of case and control samples

	Gender		Marital Status		Age	Education		Occupation	
	Men	Women	Marr.	Single	Mean	H.S.	> H.S.	Farmer	Nonfarmer
Case sample	10	8	14	4	47	10	8	9	9
Control sample	11	7	14	4	47	9	9	8	10

homes at their convenience. We requested that as many members of the household as possible participate. A total of 21 interviews were conducted in 11 households. However, data from two households in which three interviews were conducted had to be eliminated because of a failure to meet our selection criteria. Consequently, the control sample consisted of 18 personal interviews across nine rural households. Neither the control or case sample participants were provided financial or other incentives to participate.

The principle author and a co-author were the primary interviewers. Both are trained in qualitative and quantitative data collection methods utilizing ethnographic and personal interview techniques from social anthropology and the social sciences (Weller and Romney, 1988). The interviewers have 12 years combined experience in data collection specific to agriculture.

All data from the interviews were coded and entered into a Paradox database. Quantitative analyses were performed using a SAS statistical package*. Qualitative data were analyzed based on a combination of results from the quantitative analysis and interviewer notes on the questionnaires.

Results

As evidenced in table 1, there was little difference in gender, marital status, age, or educational level between the two samples. In addition, all respondents were white and there was a comparable proportion of farmers and nonfarmers in our sample populations. It is unlikely that the findings are biased by demographic differences between the sample and control populations.

Physical Health Symptoms

Results of the frequency of physical symptoms are presented in figure 1. The study population reported higher frequencies of 14 out of the 18 symptoms than the control population. There was no connection between the frequency of reported physical symptoms and distance from the swine facility. Results indicate a pattern of four interconnected clusters of symptoms that include respiratory problems, nausea and weakness, headaches and plugged ears, and irritation of eyes, nose, and throat. This constellation of symptoms matched those reported by participants in response to an open-ended question posed earlier in the interview. Skin rash, muscle aches, and fever were reported more frequently among the control group, while hearing problems were reported at an identical frequency by both groups.

Table 2 presents the results of analyses assessing the significance in differences between the reported symptoms from neighbors of the swine facility and the control population. The constellation of 14 symptoms reported more frequently by the study group showed composite mean frequency scores of 21 for the study population and 15 for the control. The first line of table 2 labeled "All Symptoms" presents the

* SAS Institute Inc., Release 6.03., 1988, Cary, N.C.

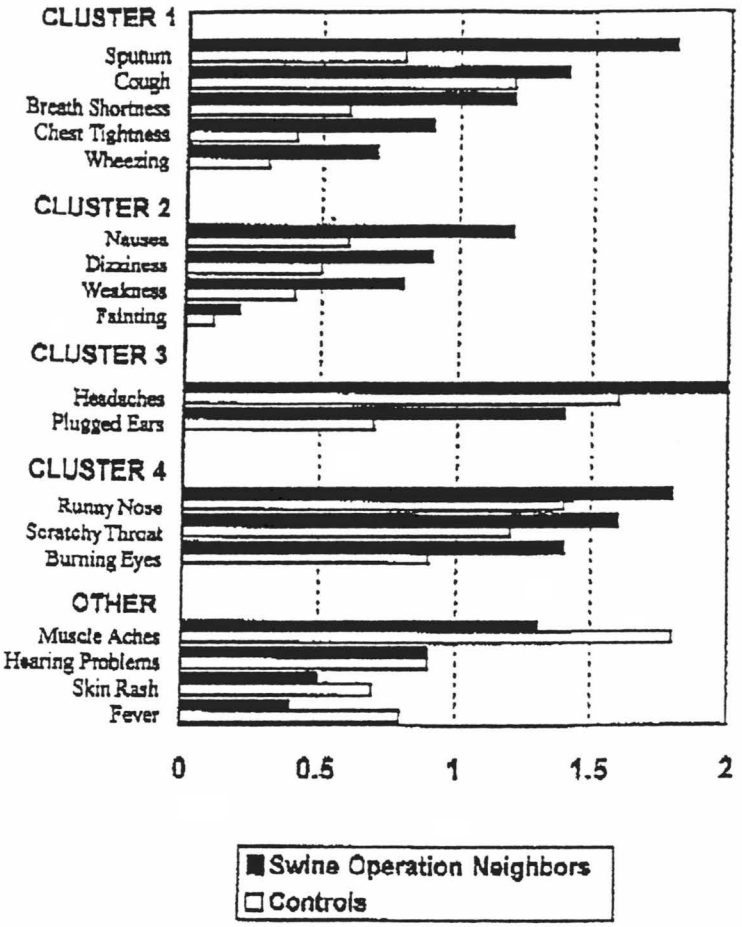

Figure 1–Frequency of physical symptoms experienced by rural resident (comparison of mean scores, 0 = Never, 4 = Very Often).

results of a Wilcoxon Test (Chi Sq = 2.3; P = 0.13) indicating this difference warrants attention but is not conclusive.

More significant is the trend among clusters of symptoms. Within the range of symptoms reported more frequently by the study sample, four clusters of related symptoms deserve particular attention. These clusters of symptoms have been recognized previously in swine facility workers (Donham, 1995). They represent toxic or inflammatory effects on different segments of the respiratory tract.

The first cluster is a combination of five symptoms indicative of inflammation of the bronchi and bronchioles, or chronic bronchitis and hyperreactive airways: sputum, cough, breath shortness, wheezing, and chest tightness. A variety of standardized survey instruments include this cluster of symptoms: the American Thoracic Society,

Table 2. Physical symptom clusters: A comparison of swine facility neighbors and rural controls

Physical Symptom Cluster	T Value	Significance Level
All symptoms combined	2.30	0.13
Cluster 1: Respiratory symptoms	2.12	0.02
Cluster 2: Nausea, weakness, dizziness and fainting	1.83	0.04
Cluster 3: Headaches and plugged ears	1.67	0.06
Cluster 4: Burning eyes, runny nose and throat	1.18	0.12

the British Medical Research Council, and the Agricultural Dust Exposure Assessment. A one-tailed t-test was conducted to determine whether the study population reported experiencing this combination of symptoms more frequently than the control sample. As presented in Cluster 1 of table 2, results indicate that residents living in the vicinity of the large-scale operation do report experiencing significantly higher rates of symptoms associated with chronic bronchitis and hyperreactive airways ($T = 2.12$; $P = 0.02$; 26.7 degrees of freedom). This type of bronchitis is almost invariably associated with environmental exposures, e.g., air pollution, chronic agricultural dust exposure, and long-term cigarette smoking.

A second cluster of related symptoms was examined that included: nausea, weakness, dizziness, and fainting. Previous research among swine workers reveal this group of symptoms is fairly common (Donham, 1993). A one-tailed t-test was again conducted to determine whether the study population reported experiencing this combination of symptoms more frequently than the control sample. As presented in Cluster 2 of table 2, results indicate that residents living in the vicinity of the large-scale operation do report experiencing significantly higher rates of nausea, weakness, dizziness, and fainting ($T = 1.83$; $P = 0.04$; 24.5 degrees of freedom). Research among swine confinement workers suggests that long-term exposure to less than acutely toxic levels of endotoxin and hydrogen sulfide merit investigation in conjunction with these symptoms (Auger et al., 1994).

A third combination of symptoms, headaches and plugged ears, is another frequently observed among swine confinement workers. Once again, a one-tailed t-test was conducted to determine whether the study population reported experiencing this combination of symptoms more frequently than the control sample. As presented in Cluster 3 of table 2, results indicate that residents living in the vicinity of the large-scale swine operation report experiencing higher rates of headaches and plugged ears, though the difference is marginally less significant than the first two clusters ($T = 1.67$; $P = 0.06$; 24.5 degrees of freedom). The physiological explanation for these symptoms among swine confinement workers is that they are often associated with chronic sinusitis. Symptoms of chronic sinusitis are seen in nearly a quarter of active swine producers (Donham, 1993).

A final cluster of symptoms was examined that included: burning eyes, runny nose, and scratchy throat. The one-tailed t-test was replicated to compare the study and control sample. As presented in Cluster 4 of table 2, results indicate that the higher rates of these reported symptoms among neighboring residents of the large-scale operation warrant notice but the difference is less clear ($T = 1.18$; $P = 0.12$; 33 degrees of freedom). Among interior swine confinement workers, these symptoms are associated with a condition called mucous membrane irritation. Irritant gases and particulates inside swine confinement buildings are thought to affect the mucous membranes of the eyes and upper airways, resulting in the symptoms reported.

Differences in reported physical health symptoms between the study and control population are present. More notable than individual symptoms or clusters of symptoms, is the overall trend of interrelated symptom clusters reported more frequently among neighbors of the swine facility than the control sample. The constellation of symptoms reported in excess by neighbors is consistent with, but less severe and frequent, compared to symptoms of workers in swine confinement facilities. A companion article to this article reveals that ammonia, dust, and endotoxin are present in the air downwind from large swine facilities. However, these levels are much lower than those previously associated with any known illness (Reynolds et al., in press). This raises the question as to whether low levels may be associated with reported symptoms.

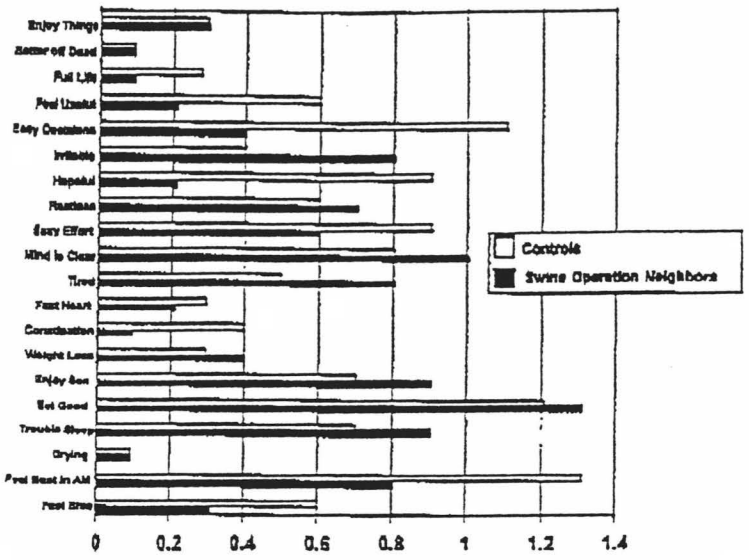

Figure 2–Frequency of depression symptoms experienced by rural residents.

Psychological Symptoms

Research in North Carolina (Schiffman et al., 1995) reported that persons living near large-scale swine operations exhibited significantly higher rates of mood disorders than did matched control participants as measured by a Profile of Mood States (POMS) scale. Neighbors living near large swine facilities experienced higher rates of tension, anger, fatigue, and confusion. Schiffman discusses how molecules responsible for odors can potentially result in physical responses linked to mood alterations. She also suggests that odor may play a role in suppressing immune system responses via physical connections between the olfactory and immune systems. The psychological scales we used measured depression and anxiety as a comparative supplement to Schiffman's research.

The depression scale is based on the work of Zung (1964) and is derived from established research utilizing factor analyses to derive the most common set of underlying characteristics that predict depression in a clinical setting. Participants in our pilot study were administered 20 questions from the Self-Rating Depression Scale (SDS) derived from this clinical work. The comparative results of mean scores of individual items are presented in figure 2.

Little difference in depressive symptoms exists between the study and control populations. Following Zung's (1964) methodology, a depression index was created by totaling the raw scores of participants and dividing them by the total possible score†. The composite mean depression index for case study participants totaled 0.37 compared with 0.40 for the controls and were not significantly different (Chi Sq = 0.35; P = 0.55). These scores compare with a mean depression index of 0.74 in Zung's clinically admitted population of depressed patients. Zung's control, or "normal" population, scored 0.33. Thus our study population is well within the range of Zung's control population, exhibiting very little depressive symptomology.

† Comparison of Mean Scores, 0 = Never or little, 3 = Most of the time. A value of one was added to each response value listed in table 2, i.e., 0 = 1, 1 = 2, 2 = 3, and 3 = 4, in order to make the index results comparable to other research.

An anxiety scale was administered based on the Beck Anxiety Inventory (BAI) developed by Beck and Steer (Steer et al., 1993). The scale is derived from analyses of in-patients exhibiting a set of symptoms distinct from other mental disorders in a clinical setting. Participants in our pilot study were administered 21 questions from the BAI derived from this clinical work. The comparative results of mean scores of individual items are presented in figure 3.

Little difference in anxiety symptoms exists between the study and control populations. Following the methodology of Steer et al. (1993), an anxiety index was created for each case by totaling the raw scores of participants and dividing it by the total possible score. The composite mean anxiety indexes for case study and control participants were virtually identical: 0.11. These scores compare with a mean anxiety score of 0.29 in Steer and coworkers' population of 250 clinically admitted patients categorized as "moderately anxious". Our study population does not appear to be suffering from anxiety related psychological symptoms. Moreover, no significant differences were found in anxiety between the study participants and the control population.

Conclusion

Evidence indicates that neighbors of the large-scale swine operation in our study reported experiencing increased rates of a number of interrelated symptoms, including headaches, respiratory problems, eye irritation, nausea, weakness, and chest tightness. The pattern of differential symptomology rates between the study and control samples suggest further study is warranted. There is little evidence to suggest that neighbors of the large-scale swine operation suffer higher rates of anxiety or depression.

Further study is needed to test the hypothesis that neighbors of large-scale swine operations experience higher rates of physical symptoms comparable to the types of symptoms experienced by interior confinement workers. A larger population-based study is needed that includes neighbors of a cross-section of various sizes and types of swine and other livestock operations. Such a study should continue to use personal interviews as the basis of health assessments. A central issue in these investigations is

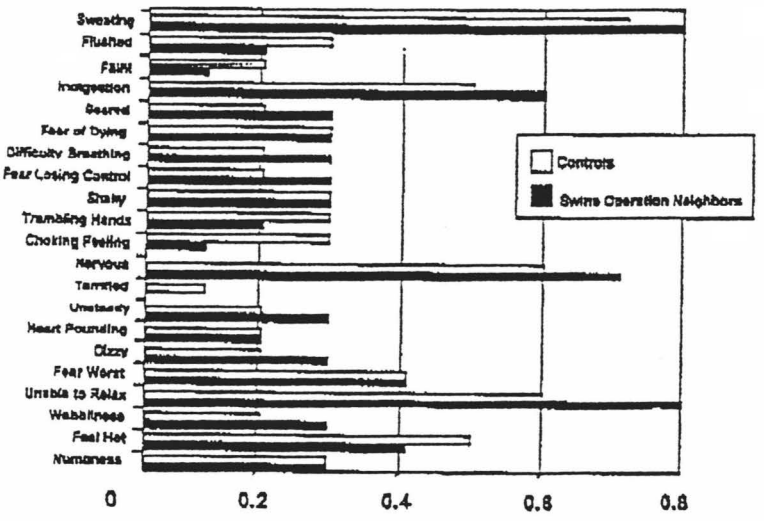

Figure 3–Frequency of anxiety symptoms experienced by rural residents.

the reliability and quality of data. Personal interviews by trained and experienced interviewers in the homes of rural residents provide a comfortable setting for participants to discuss issues in a forthright and open manner. A report based on a 1985 National Science Foundation conference on data collection points to natural settings as providing the best opportunity for collecting reliable interview data (Bernard et al., 1986). Validity of data collection is related to a host of factors, including the extent of open exchange between interviewers and persons being interviewed.

Neighbors did not appear to be concocting evidence of health or psychological problems based on any personal or political agenda. Evidence for the credibility of physical symptom reports comes from the psychological profile data. If participants wanted to concoct evidence it would have been easy for them to report high rates of depression and/or anxiety. Such reporting did not occur. Physical assessments of neighbors would provide clarification of these issues.

Permeating all the responses, regardless of whether respondents had specific health problems, was the underlying view that the owner was creating social and class divisions in the neighborhood and community. Most believed that the construction and presence of the facility violated core rural values of being a good "neighbor". For virtually all respondents, rural "neighborliness" embodies central cultural principles of egalitarian relationships, reciprocal exchange such as helping or sharing in times of need, mutual respect, and being kept informed. The facility's construction and continuing presence was viewed as eroding these cornerstones of agrarian life. Often discussed outside the strictures of the questionnaire, participants voiced concern about such issues as labor turn-over, social chasms emerging between neighbors and between children of neighbors, the influence of the facility's owner on local political and economic decision-making boards, and the ability of residents to have control over their land, homes, families, and quality of life. Clearly the issues confronting rural residents in this study reflect an intertwining of personal, environmental, economic, and social health. Further study should seek to clarify and broaden our understanding of these interrelated issues.

References

ApSimon, H. M. and M. Kruse-Plass. 1991. The role ammonia has as an atmospheric pollutant. In *Odour and Ammonia Emissions from Livestock Prod.*, 2-9, eds. V. C. Nielsen et al. London, England: Elsevier Applied Science Publishers.

Auger P., P. Gourdeau and J. Miller. 1994. Clinical experience with patients suffering from a chronic fatigue-like syndrome and repetitious upper respiratory infection in relation to airborne molds. *Am. J. Ind. Med.* 25(1):41-42.

Bernard, H. R., P. J. Pelto et al. 1986. The construction of primary data in cultural anthropology. *Current Anthropology* 27(4):382-396.

DeLind, L. 1995. The state, hog hotels and the "Right to Farm": A curious relationship. *Agric. and Human Values* 12(3):34-44.

Donham, K. J. 1995. A review — The effects of environmental conditions inside swine housing on worker and pig health. In *Manipulating Pig Production V*, 203-221, eds. D. P. Hennessy and P. D. Cranwell. Werribee, Victoria, Australia: Australasian Pig Science Assoc.

————. 1993. Respiratory disease hazards to workers in livestock and poultry confinement structures. *Seminars in Resp. Med.* 14(1):49-59.

————. 1990. Health effects from work in swine confinement buildings. *Am. J. Ind. Med.* 17(1):17-25.

Donham, K. J., M. J. Rubino et al. 1977. Potential health hazards of workers in swine confinement buildings. *J. Occ. Med.* 19(6):383-387.

Fullhage, C. 1995. Minimizing odor problems in lagoons/composting of dead animals. In *Int. Round Table on Swine Odor Control*, 72-77. Ames, Iowa: Iowa State University.

Hobbs, P. 1995. Measurement of swine odor using electronic nose technology. In *Int. Round Table on Swine Odor Control*, 36-39. Ames, Iowa: Iowa State University.

Kiekhaefer, M. S., K. J. Donham et al. 1995. Cross seasonal studies of airborne microbial populations and environment in swine buildings: Implications for worker and animal health. *Ann. Agric. Environ. Med.* 2(2):37-44.

Legg, B. J. 1990. Farm and food waste: utilization without pollution. In *Proc. of the Sixth Int. Symp. on Agricultural and Food Processing Wastes*, xi-xxi. St. Joseph, Mich.: ASAE.

Longhurst, P. 1995. Applications of electronic nose technology/community assessment of odor. In *Int. Round Table on Swine Odor Control*, 32-35. Ames, Iowa: Iowa State University.

Mannebeck, H. 1995. Olfactory measurement. In *Int. Round Table on Swine Odor Control*, 2-4. Ames, Iowa: Iowa State University.

McNair, D. M., M. Lorr. et al. 1992. Rev. *Manual: Profile of Mood States*. San Diego, Calif.: Education and Testing Service.

Merkel, J. A., T. E. Hazen et al. 1969. Identification of gases in a swine confinement building atmosphere. *Transactions of the ASAE* 12(3):310-315.

O'Neill, D. H. and V. R. Phillips. 1992. A review of the control of odor nuisance from livestock buildings: Part 3, Properties of the odorous substances which have been identified in livestock wastes or in the air around them. *J. Agric. Eng. Res.* 34:23-50.

Reynolds, S., K. J. Donham et al. Air quality assessments in the vicinity of swine production facilities. *J. of Agromedicine* (In press).

Ritter, W. F. 1989. Odour control of livestock wastes: State-of-the art in North America. *J. Agric. Eng. Res.* 42:51-62.

Schiffman, S. 1995. Psychological effects of swine odor on humans. In *Int. Round Table on Swine Odor Control*, 8-11. Ames, Iowa: Iowa State University.

Schiffman, S. S., E. A. S. Miller et al. 1995. The effect of environmental odors emanating from commercial swine operations on the mood of nearby residents. *Brain Res. Bulletin* 37(4):369-375.

Steer, R. A., D. J. Rissmiller et al. 1993. Structure of the computer-assisted Beck Anxiety Inventory with psychiatric inpatients. *J. Personality Assessment* 60(3):532-542.

Sweeten, J. M. 1988. Odor measurement and control for the swine industry – Recent developments. *J. Env. Health* 50(5):282-286.

Thorne, P. S., M. S. Kiekhaefer et al. 1992. Comparison of bioaerosol sampling methods in barns housing swine. *Appl. and Environ. Microbiology* 58(8):2543-2551.

Thu, K. 1995/96. Piggeries and politics: rural development and Iowa's multibillion dollar swine industry. *Culture and Agric.* 53:19-23.

Thu, K. and E. P. Durrenberger. 1994. North Carolina's hog industry: The rest of the story. *Culture and Agric.* 49:20-23.

Voermans, J. 1995. Reducing ammonia and odor emissions from hog barns. In *Int. Round Table on Swine Odor Control*, 87-92. Ames, Iowa: Iowa State University.

Weller, S. and A.K. Romney. 1988. *Systematic Data Collection*. Newbury Park, Calif.: Sage.

Yokoyama, M. 1995. Ozonation to reduce odors generated from swine industry waste slurry. In *Int. Round Table on Swine Odor Control*, 92-97. Ames, Iowa: Iowa State University.

Zung, W. W. K. 1965. A self-rating depression scale. *Archive Gen. Psychiatry* 12:63-70.

Appendix — Questionnaire

Date: _____

Interviewer: _____

I. Background Computer Code

1. Name _____ ID # _____
2. Address _____
   _____
   _____
3. Phone # _____
4. County _____ _____
5. Race _____ _____
6. Age _____ _____
7. Gender _____ _____
8. Marital status _____ _____
   How long? _____ _____
9. Occupation _____ _____
10. If farming, what kind? _____
11. Off-farm employment? (what and how many hours per week?)
    _____
12. Highest level of education _____
13. Annual household income (on- and off-farm income) _____
14. What proportion of your annual household income comes from farming (%)? _____
15. What proportion of your annual household income comes from hog production (%)? _____
16. How many people live at your residence? _____
17. How long have you lived at this residence? _____

18. Do any exposures or conditions specific to your neighborhood bother you, or give you health problems?

_____

_____

_____

_____

II. Symptoms

19. Please check the frequency with which you experience the following symptoms:

	1 Never	2 Rarely	3 Occasionally	4 Often	5 Very Often
Headache	☐	☐	☐	☐	☐
Plugged, popping ears	☐	☐	☐	☐	☐
Hearing problems	☐	☐	☐	☐	☐
Burning or watering eyes	☐	☐	☐	☐	☐
Runny nose	☐	☐	☐	☐	☐
Scratchy throat	☐	☐	☐	☐	☐
Sputum or phlegm	☐	☐	☐	☐	☐
Cough	☐	☐	☐	☐	☐
Fever	☐	☐	☐	☐	☐
Nausea or vomiting	☐	☐	☐	☐	☐
Weakness	☐	☐	☐	☐	☐
Dizziness	☐	☐	☐	☐	☐
Fainting or blackout	☐	☐	☐	☐	☐
Shortness of breath	☐	☐	☐	☐	☐
Wheezing	☐	☐	☐	☐	☐
Muscle aches and pains	☐	☐	☐	☐	☐
Skin rash or hives	☐	☐	☐	☐	☐
Tightness in chest	☐	☐	☐	☐	☐
*_____	☐	☐	☐	☐	☐
*_____	☐	☐	☐	☐	☐

*_____	☐	☐	☐	☐	☐

* Fill in other symptoms bothering you that are not listed.

20. Please check the following items in terms of the frequency with which they currently apply to you.

	1 Never or a Little of the Time	2 Some of the Time	3 Good Part of the Time	4 Most of the Time
I feel down-hearted and blue	☐	☐	☐	☐
Morning is when I feel the best	☐	☐	☐	☐
I have crying spells or feel like it	☐	☐	☐	☐
I have trouble sleeping at night	☐	☐	☐	☐
I eat as much as I used to	☐	☐	☐	☐
I still enjoy sex	☐	☐	☐	☐
I notice that I am losing weight	☐	☐	☐	☐
I have trouble with constipation	☐	☐	☐	☐
My heart beats faster than usual	☐	☐	☐	☐
I get tired for no reason	☐	☐	☐	☐
My mind if as clear as it used to be	☐	☐	☐	☐
I find it easy to do the things I used to	☐	☐	☐	☐
I am restless and can't keep still	☐	☐	☐	☐
I feel hopeful about the future	☐	☐	☐	☐
I am more irritable than usual	☐	☐	☐	☐
I find it easy to make decisions	☐	☐	☐	☐
I feel that I am useful and needed	☐	☐	☐	☐
My life is pretty full	☐	☐	☐	☐
I feel that others would be better off if I were dead	☐	☐	☐	☐
I still enjoy the things I used to do	☐	☐	☐	☐

21. Please check the following items in terms of the frequency with which they currently apply to you.

	0 Not at All	1 Sometimes	2 Frequently	3 Almost Constantly
Numbness	n	n	n	n
Feeling hot	n	n	n	n
Wobbliness	n	n	n	n
Unable to relax	n	n	n	n
Fear of the worst	n	n	n	n
Dizzy	n	n	n	n
Heart pounding	n	n	n	n
Unsteady	n	n	n	n
Terrified	n	n	n	n
Nervous	n	n	n	n
Feelings of choking	n	n	n	n
Hands trembling	n	n	n	n
Shaky	n	n	n	n
Fear of losing control	n	n	n	n
Difficulty breathing	n	n	n	n
Fear of dying	n	n	n	n
Scared	n	n	n	n
Indigestion	n	n	n	n
Faint	n	n	n	n
Face flushed	n	n	n	n
Sweating	n	n	n	n

Pergamon

Brain Research Bulletin, Vol. 37, No. 4, pp. 369–375, 1995

0361-9230/95 $9.50 + .00

0361-9230(95)00015-1

The Effect of Environmental Odors Emanating From Commercial Swine Operations on the Mood of Nearby Residents

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[Received 1 June 1994; Accepted 22 December 1994]

ABSTRACT: The effect of environmental odors emanating from large-scale hog operations on the mood of nearby residents was determined using the POMS (Profile of Mood States). The scores for six POMS factors and the TMD (total mood disturbance score) for 44 experimental subjects were compared to those of 44 control subjects who were matched according to gender, race, age, and years of education. The results indicated a significant difference between control and experimental subjects for all six POMS factors and the TMD. Persons living near the intensive swine operations who experienced the odors reported significantly more tension, more depression, more anger, less vigor, more fatigue, and more confusion than control subjects as measured by the POMS. Persons exposed to the odors also had more total mood disturbance than controls as determined by their ratings on the POMS. Both innate physiological responses and learned responses may play a role in the impairment of mood found here.

KEY WORDS: Odors, Mood, Pollution, Swine, Psychological effects, Brain-immune connections.

INTRODUCTION

Odors have always been associated with livestock and poultry production [24,55,72,78,79,86,88]. However, odors have recently become a major challenge for the livestock industry due to the present trend toward intensive livestock operations in which large numbers of animals are confined on small areas of land [8,19,51,69,120,122–124,127]. Environmental odors can have a considerable impact upon a population's general well-being, affecting both physiological and psychological status [93,103,128]. Miner [70] concluded that unpleasant odors can affect well-being by "eliciting unpleasant sensations, triggering possible harmful reflexes, modifying olfactory function and other physiological reactions." He also reported that annoyance and depression can result from exposure to unpleasant odors along with nausea, vomiting, headache, shallow breathing, coughing, sleep disturbances, and loss of appetite. Odorous compounds associated with livestock production that are at low concentrations but above odor thresholds are still likely to generate complaints [18,52].

Neutra et al. [77] studied people living near hazardous waste sites, and found that those complaining of odors had a higher number of symptoms than those who did not complain, regardless of proximity to the site. Shusterman [103] reviewed several studies [e.g., 4,37,47,95–97] in which there was a direct relationship between nontoxicological odors and symptomatology. In a variety of settings (municipal, agricultural, and industrial) where airborne toxicants were negligible and odors had been complained about, there was a strong relationship between reported symptoms and odor exposure.

The sources of the odors from swine operations include ventilation air released from swine buildings, waste storage and handling systems including lagoons, and land application of manure to fertilize fields [15]. The odors are produced by a mixture of fresh and decomposing feces, urine, and spilled feed. The more objectionable odors appear to result from anaerobic microbial decomposition of the feces [90]. A broad range of compounds has been identified in livestock manure including volatile organic acids, alcohols, aldehydes, amines, fixed gases, carbonyls, esters, sulfides, disulfides, mercaptans, and nitrogen heterocycles [30,70,71,73,104]. It is likely that the mixture of compounds rather than a single component contributes to the mood changes measured here.

A variety of techniques for reducing odor have been evaluated, but overall the results have been disappointing [113]. Aerobic treatment has been found to be the most effective method to date for deodorizing pig slurry [2,9,11,54,105–107,127]. Odorous compounds can be carried in a plume, and the concentration of these compounds in the plume may not be significantly reduced at distances of 750–1500 feet or more downwind from a source [36]. Dispersion models have been developed to predict the peak and mean concentrations of odors and environmental air pollutants at various distances from the source [20,36,46,80], and complaint patterns at a variety of distances from an odor source have been studied [21].

The purpose of the present study was to use a well-standardized scale to quantify objectively the moods of people living near large-scale hog operations who are exposed to odors. The Profile

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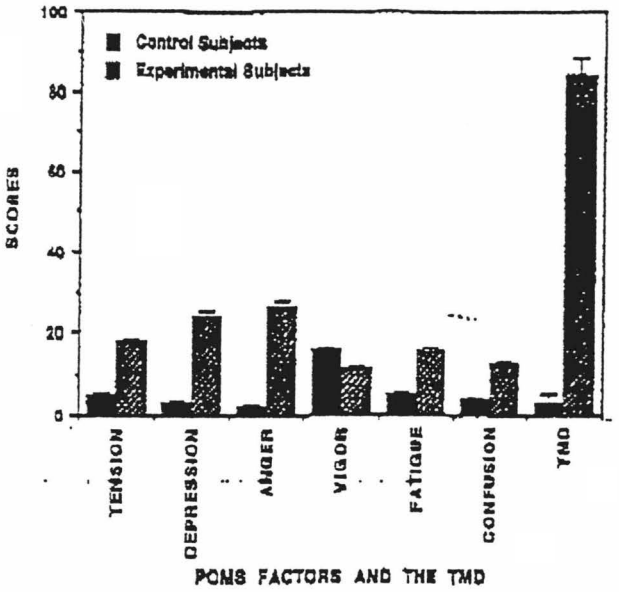

FIG. 1. Mean POMS scores of each factor and the total mood disturbance score (TMD) for experimental and control subjects.

of Mood States questionnaire [65,66] was used to assess mood in persons living near swine operations and in control subjects. This scale has been used extensively in many situations including previous studies that evaluated the effect of pleasant odors on mood [98,99]. The study of mood in persons exposed to odors is important because negative mood has been found to play a role in immunity [16,81,111,125] and can potentially affect subsequent disease.

METHOD

Subjects

Forty-four experimental (persons living near hog operations) and 44 control subjects participated in the study; all of the subjects were residents of North Carolina. The subjects in the two groups (control and experimental) were matched according to gender, race, age, and years of education. Twenty-six subjects in each group were female, and 18 subjects were male. The mean age of the experimental group was 52.0 ± 13.4 years, and the mean age of the control group was 51.7 ± 8.3 years. The experimental group had an average of 12.8 ± 3.3 years of education, and the control group had an average of 13.0 ± 3.1 years of education. The majority of subjects in both groups were employed as skilled laborers. The groups were also matched for the number of chronic illnesses that they had experienced; 14 subjects in each group suffered from allergies. The experimental group lived an average of 5.3 ± 6.5 years near hog operations, with a maximum of 27 years and a minimum of 8 months.

Materials

Subjects in both groups signed a consent form and filled out a general information questionnaire that asked demographic, medical, and dietary information. Mood ratings were obtained from all subjects by filling out Profile of Mood States questionnaires (POMS). The POMS was chosen to measure the impact of the hog odors on mood because it has been shown to be sensitive to transient mood shifts [65,66]. There are 65 adjectives/feelings on the POMS, most of which may be grouped into one of six factors: tension/anxiety, depression/dejection, anger/hostility, vigor/activity, fatigue/inertia, and confusion/bewilderment. Each feeling is rated on a scale from 0 (not at all) to 4 (extremely). The feelings for each factor were added together, according to the POMS manual, to get a total score for that factor. The totals for each factor were then added together, with the vigor/activity factor weighted negatively, to derive a total mood disturbance score (TMD).

Procedure

At the beginning of the study, all subjects filled out the consent form as well as the general information questionnaire. Experimental subjects were asked to complete one POMS questionnaire per day on 4 days when the hog odor could be smelled. The 4 days did not have to be consecutive, and subjects had as long as needed to complete all four POMS questionnaires. Control subjects were asked to complete one POMS per day for 2 days. All subjects were asked to complete the POMS based upon how they recently had been feeling, including at that particular time.

RESULTS

Figure 1 shows the means and standard errors for the experimental group vs. the control group for all POMS factors and the TMD. An analysis of variance was performed to determine if there were any main effects or interactions between group (control or experimental) and gender for each POMS factor and the TMD. Subjects were nested within group and gender. Table 1 gives the results of the analysis. There was a significant difference (at $p < 0.0001$ level) between the control group and the experimental group for all of the POMS factors as well as the TMD. The experimental group had significantly worse scores than the control group for every factor and the TMD. There was a significant main effect of gender for the anger factor, $p < 0.01$, and a significant gender × group interaction for the confusion factor, $p < 0.005$. Males had significantly higher (worse) anger scores than the females. For the confusion factor, scores for experimental males were significantly higher than those for experimental females and control males and females; scores for ex-

TABLE 1

RESULTS OF THE ANALYSIS OF VARIANCE

Effect	Tension	Depression	Anger	Vigor	Fatigue	Confusion	Total Mood Disturbance Score
Group	*	*	*	*	*	*	*
Gender			*				
Group × gender						*	
Subject (group, gender)	*	*	*	*	*	*	*

* Significant at $\alpha = 0.05$ level.

perimental females were significantly higher than those of control males and females. Only scores for control males and control females were not significantly different from each other.

DISCUSSION

The main finding of this study is that persons living near the swine operations who experienced the odors had significantly more tension, more depression, more anger, less vigor, more fatigue, and more confusion than control subjects as measured by the Profile of Mood States (POMS). In addition, persons exposed to the odors also had more total mood disturbance than controls as determined by their ratings on the POMS. These findings are consistent with previous studies in which odors of varying hedonic properties have been found to affect mood [7,32,93,98,99,103,128]. In other settings, odors have also been reported to affect cognitive performance [57,62] and physiological responses including heart rate and electroencephalographic patterns [56,58–61,64].

Possible Causes of Altered Mood

A variety of factors may play a role in the altered mood of residents who are exposed to odors from nearby swine operations. These factors include: a) the unpleasantness of the sensory quality of the odor; b) the intermittent nature of the stimulus; c) learned aversions to the odor; d) potential neural stimulation of immune responses via direct neural connections between odor centers in the brain and lymphoid tissue; e) direct physical effects from molecules in the plume including nasal and respiratory irritation; f) possible chemosensory disorders; and g) unpleasant thoughts associated with the odor.

At moderate to high odor intensities, most persons rate the quality of the odor from the swine operations as unpleasant. The odor is not only perceived while breathing outdoor air but can also be perceived within the homes of nearby residents due to air circulation through open windows and air conditioning systems. The odorant molecules can be absorbed by clothing, curtains, and building materials which act as a sink; the molecules are then released slowly over a period of time from textiles and other materials after the plume has passed the house increasing the temporal exposure to the odor. The intermittent nature of the odors may also be a factor in the mood of persons living near swine operations. Studies of noise have shown that intermittent stimuli produce more arousal and are more likely to affect performance negatively than constant noise [22]. This is due in part to feelings of lack of control over the timing of unwanted transient stimuli. Differences in responses to irregular noise and predictable noise are not only found in humans but in animals as well [27].

Learning (via conditioning) may also play a role in the psychological and physical effects from odors. Conditioned aversions to odors are well-documented in the scientific literature [31,38,44,67,75,119]. Aversive conditioning can occur if environmental odors are associated with an irritant or other toxic chemicals such as pesticides [103]. In addition, conditioned alterations in immune responses using chemosensory (smell and taste) stimuli provide strong evidence for functional relationships between chemosensory centers in the brain and the immune system [1]. Both conditioned immunosuppression and immunoenhancement have been reported using chemosensory stimuli as the conditioned stimulus [1,31,42,43,109,110].

There is a potential for unpleasant odors to influence physical health without involvement of learning or conditioning due to the direct anatomical connections between the olfactory system and the immune system. Brain structures broadly involved in smell [12,35,39,49,82–85,101,112,114–116] can modulate immune responses, especially via the integrated circuitry of the limbic cortex, limbic forebrain, hypothalamus, and brain stem [13,25,26,48,50,76,92,118]. These studies provide an anatomical basis for the possibility that sensory stimulation of the limbic forebrain, hypothalamus, and other odor projection areas of the brain can directly alter immune status. The links between the brain and the immune system are bidirectional [108] so that immune responses can also affect odor centers in the brain [10,94].

Components in the odorous plume may also have direct physical effects on the body. Some of the odorant molecules implicated in malodor from hog farms can cause nasal and respiratory irritation [15,23,29,70,103]. Nasal irritation has been shown to elevate adrenalin [3] which may contribute to feelings of anger and tension. The volatile organic compounds (VOCs) responsible for odors may also be absorbed directly by the body (into the bloodstream and fat stores) via gas exchange in the lungs. Many VOCs that are inhaled into the lungs are known to reach blood and adipose tissue [4,6,53,63,126]. Persons who have absorbed odorants through the lungs can sometimes smell the odor for hours after exposure due to slow release of the odorants from the bloodstream into expired air activating the olfactory receptors. Volatile organic compounds are well known to be eliminated in breath after exposure [89,121], and methods for measuring VOCs in breath have been described [87,89,117]. It is also theoretically possible for some compounds in the plume to be transmitted to the brain via olfactory neurons because a range of agents have been found to reach the brain through the nasal route [28,33,45,74,91,102]. Endotoxin, a component of bacteria, found in the swine house air environment [29], may also be present in the plume. Persons with olfactory dysfunction caused by factors unrelated to swine odor such as concurrent medical conditions, drugs they are taking, or pesticide exposure [100], may find the odor even more objectionable due to their abnormal smell functioning.

Finally, odors may alter mood because they are associated with unpleasant thoughts. Some persons consider the smell from hog farms a taboo odor, which they should not have to endure. For other persons, the odors generate environmental concerns, fear of loss of use and value of property, or a conviction that odors interfere with their enjoyment of life and property. Livestock odors may also be considered inappropriate in certain environments. Odor complaints have been reported to be most frequent among new, large, or recently expanded facilities that are located near existing residences or shopping areas [70,113]. Part of the motivation for odor complaints may be the increased awareness of other environmental agents, such as tobacco smoke, which is malodorous and is considered dangerous to one's health.

Lack of Legislation to Monitor Odor Levels

Odors are not regulated by the Clean Air Act because they are generally regarded as nontoxic [15]. In addition, nonfederal legislation for controlling odors from swine operations is imprecise or lacking in many states. For example, North Carolina Administrative Code Title 15A.02D.0522(c) specifies that "a person shall not cause, allow, or permit any plant to be operated without employing suitable measures for the control of odorous emissions including wet scrubbers, incinerators, or such other devices as approved by the Commission." This regulation is subjective because it gives no provision for either emission standards or ambient air standards. Under this regulation, it appears that as long as a plant has suitable control devices, it is lawful for them to emit offensive odors. In addition, it is unclear what type of operation is to be considered a plant. In contrast, Connecticut's laws on odor emissions set specific standards, as shown in Table

TABLE 2

ACCEPTANCE LIMITS FOR ODORS (FROM 17)

Chemical	ppm by Volume
Acetaldehyde	0.21
Acetic acid	1.0
Acetone	100.0
Acrolein	0.21*
Acrylonitrile	21.4*
Allyl chloride	0.47
Amine, dimethyl	0.047
Amine, monomethyl	0.021
Amine, trimethyl	0.00021
Ammonia	46.8*
Aniline	1.0
Benzene	4.68
Benzyl chloride	0.047
Benzyl sulfide	0.0021
Bromine	0.047
Butyric acid	0.001
Carbon disulfide	0.21
Carbon tetrachloride (chlorination of CS_2)	21.4*
Carbon tetrachloride (chlorination of CH_4)	100.0*
Chloral	0.047
Chlorine	0.314
Dimethylacetamide	46.8*
Dimethylformamide	100.0*
Dimethyl sulfide	0.001
Diphenyl ether	0.1
Diphenyl sulfide	0.0047
Ethanol (synthetic)	10.0
Ethyl acrylate	0.00047
Ethyl mercaptan	0.001
Formaldehyde	1.0
Hydrochloric acid gas	10.0*
Hydrogen sulfide gas	0.00047
Methanol	100.0
Methyl chloride	(above 10 ppm)
Methylene chloride	214.0*
Methyl ethyl ketone	10.0
Methyl isobutyl ketone	0.47
Methyl mercaptan	0.0021
Methyl methacrylate	0.21
Monochlorobenzene	0.21
Monomethylamine	0.021
Nitrobenzene	0.0047
Paracresol	0.001
Paraxylene	0.47
Perchloroethylene	4.68
Phenol	0.047
Phosgene	1.0*
Phosphine	0.021
Pyridine	0.021
Styrene (inhibited)	0.1
Styrene (uninhibited)	0.047
Sulfur dichloride	0.001
Sulfur dioxide	0.47
Toluene (from coke)	4.68
Toluene (from petroleum)	2.14
Toluene diisocyanate	2.14*
Trichloroethylene	21.4

* Exceeds the Threshold Limit Value adopted by the American conference of Industrial Hygienists for 1971.

2 [17]. Similarly, in the Netherlands, regulations are based on accurate records of manure production and bookkeeping, and violations are considered a criminal offense [14].

Regulations need to be established in all 50 states because animal wastes contain high levels of volatile organic compounds that can produce strong odors. The annual production of animal manure in the US in 1987 was estimated at 1.5 billion tons per year, which is enough to apply one ton per acre on each of the 1.9 billion acres of the continental US [14].

Persons exposed to high levels of odor from agricultural sources generally use nuisance laws to protect their rights. However, there are many caveats in nuisance laws that consider a) which party was there first; b) the character of the neighborhood; c) the reasonableness of the use of the land; and d) the nature and degree of the interference [40]. In addition, most states have right-to-farm statutes that supersede nuisance laws in some circumstances [40]. Strong support against nuisance suits involving agriculture is not specific to the United States but is found in the laws of many countries [5]. Suits against agricultural activities based on odor nuisance are harder to prove than those based on water pollution [68]. In addition, nuisance claims fall under state laws, while suits on water pollution are most frequently filed in federal courts.

Conclusion

Odors from swine operations have a significant negative impact on mood of nearby residents. Methods must be found to lower the concentrations of compounds responsible for the odors so that swine operations do not affect the emotional lives of residents in the local vicinities. This may involve legislation that sets standards for odor. In addition, technological solutions must be found to reduce the concentrations of the offending compounds.

REFERENCES

1. Ader, R.; Cohen, N. The influence of conditioning on immune responses. In: Ader, R.; Felten, D. L.; Cohen, N., eds. Psychoneuroimmunology. 2nd ed. San Diego: Academic Press; 1991:611–646.
2. Al-Kanani, T.; Akochi, E.; MacKenzie, A. F.; Ali, I.; Barrington, S. Waste management. Odor control in liquid hog manure by added amendments and aeration. J. Environ. Qual. 21:704–708; 1992.
3. Allison, D. J.; Powis, D. A. Early and late hind-limb vascular responses to stimulation of receptors in the nose of the rabbit. J. Physiol. (Lond.) 262(2):301–317; 1976.
4. Ames, R. G., Stratton, J. W. Acute health effects from community exposure to *n*-propyl mercaptan from a ethoprop (Mocap)-treated potato field in Siskiyou County, California. Arch. Environ. Health 46:213–217; 1991.
5. Artis, D.; Silvester, S. Odour nuisance: Legal controls. J. Planning Environ. Law (Great Britain) Aug:565–577; 1986.
6. Ashley, D. L.; Bonin, M. A.; Cardinali, F. L.; McCraw, J. M.; Wooten, J. V. Blood concentrations of volatile organic compounds in a nonoccupationally exposed US population and in groups with suspected exposure. Clin. Chem. 40:1401–1404; 1994.
7. Baron, R. A. Environmentally induced positive affect: Its impact on self-efficacy, task performance, negotiation, and conflict. J. Appl. Soc. Psychol. 20:368–384; 1990.
8. Barth, C. L.; Melvin, S. W. Odor. In: Sweeten, J. M.; Humenik, F. J., eds. Agriculture and the environment. St. Joseph, MI: American Society of Agricultural Engineers; 1984:97–106.
9. Beaudet, R.; Gagnon, C.; Bisaillon, J. G.; Ishaque, M. Microbiological aspects of aerobic thermophilic treatment of swine waste. Appl. Environ. Microbiol. 56:971–976; 1990.
10. Besedovsky, H.; Sorkin, E.; Felix, D.; Haas, H. Hypothalamic changes during the immune response. Eur. J. Immunol. 7:323–325; 1977.

11. Bourque, D.; Bisaillon, J.-G.; Beaudet, R.; Sylvestre, M.; Ishaque, M.; Morin, A. Microbiological degradation of malodorous substances of swine waste under aerobic conditions. Appl. Environ. Microbiol. 53:137–141; 1987.
12. Brodal, P. The central nervous system: Structure and function. Oxford: Oxford University Press; 1992:370–371.
13. Brooks, W. H.; Cross, R. J.; Roszman, T. L.; Markesbery, W. R. Neuroimmunomodulation: Neural anatomical basis for impairment and facilitation. Ann. Neurol. 12:56–61; 1982.
14. Brussard, W.; Grossman, M. R. Legislation to abate pollution from manure: The Dutch approach. N.C. J. Int. Law Commercial Regul. 15(1):85–114; 1990.
15. Bundy, D. S. Odor issues with wastes. In: National livestock, poultry and aquaculture waste management. Proceedings of the National Workshop. 1991. ASAE Publication 03-92: St. Joseph, MI: American Society of Agricultural Engineers; 1992:288–292.
16. Calabrese, J. R.; Kling, M. A.; Gold, P. W. Alterations in immunocompetence during stress, bereavement, and depression: Focus on neuroendocrine regulation. Am. J. Psychiatry 144:1123–1134; 1987.
17. Campbell, W. A.; Ratliff, E. E.; Boyers, A. S.; Johnston, D. R. Air pollution controls in North Carolina: A report on their legal and administrative aspects. Institute of Government. The University of North Carolina at Chapel Hill: January 1973:91–94.
18. Carney, P. G.; Dodd, V. A. The measurement of agricultural malodours. J. Agric. Eng. Res. 43:197–209; 1989.
19. Casey, J. A.; Hobbs, C. Look what the GATT dragged in. Corporate hogs and toxic waste. New York Times OP-ED. March 21, 1994.
20. Cha, S. S.; Li, Z.; Brown, K. E. A conversion scheme for the ISC model in odor modeling. Air and Waste Management Association meeting, Kansas City, MO; June, 1992.
21. Clarenburg, L. A. Odour: A mathematical approach to perception and nuisance. Dev. Toxicol. Environ. Sci. 15:75–94; 1987.
22. Cohen, S.; Weinstein, N. Nonauditory effects of noise on behavior and health. J. Soc. Issues 37:36–70; 1981.
23. Cometto–Muniz, J. E.; Cain, W. S. Influence of airborne contaminants on olfaction and the common chemical sense. In: Getchell, T. V.; Doty, R. L.; Bartoshuk, L. M.; Snow, J. B., Jr., eds. Smell and taste in health and disease. New York: Raven Press; 1991:765–785.
24. Cox, J. P. Odor control and olfaction: Handbook. Lynden, WA: Pollution Sciences Company; 1975:1–490.
25. Cross, R. J.; Brooks, W. H.; Roszman, T. L.; Markesbery, W. R. Hypothalamic-immune interactions. Effect of hypophysectomy on neuroimmunomodulation. J. Neurol. Sci. 53:557–566; 1982.
26. Cross, R. J.; Markesbery, W. R.; Brooks, W. H.; Roszman, T. L. Hypothalamic-immune interactions. I. The acute effect of anterior hypothalamic lesions on the immune response. Brain Res. 196:79–87; 1980.
27. De Boer, S. F.; Van der Gugten, J.; Slangen, J. L. Plasma catecholamine and corticosterone responses to predictable and unpredictable noise stress in rats. Physiol. Behav. 45:789–795; 1989.
28. DeLorenzo, A. J. D. The olfactory neuron and the blood–brain barrier. In: Wolstenholme, G. E. W.; Knight, J. eds. Taste and smell in vertebrates. CIBA Foundation Symposium. London: Churchill; 1970:151–176.
29. Donham, K. J. Health concerns from the air environmental in intensive swine housing: Where have we come from and where are we going? In: Making swine buildings a safer place to work. Des Moines, IA: National Pork Producers Council; 1990:9–20.
30. Du Toit, A. J. Quantification of odour problems associated with liquid and solid feedlot and poultry wastes. Water Sci. Technol. 19:31–41; 1987.
31. Dyck, D. G.; Janz, L.; Osachuk, T. A.; Falk, J.; Labinsky, J.; Greenberg, A. H. The Pavlovian conditioning of IL-1-induced glucocorticoid secretion. Brain Behav. Immun. 4:93–104; 1990.
32. Ehrlichman, H.; Bastone, L. The use of odour in the study of emotion. In: van Toller, S.; Dodd, G.H., eds. Fragrance. The psychology and biology of perfume. London: Elsevier Applied Science; 1992:143–159.
33. Esiri, M. M.; Tomlinson, A. H. Herpes simplex encephalitis: Immunohistological demonstration of spread of virus via olfactory and trigeminal pathways after infection of facial skin in mice. J. Neurol. Sci. 64:213–217; 1984.
34. Felten, D. L.; Cohen, N.; Ader, R.; Felten, S. Y.; Carlson, S. L.; Roszman, T. L. Central neural circuits involved in neural–immune interactions. In: Ader, R.; Felten, D. L.; Cohen, N., eds. Psychoneuroimmunology. 2nd ed. San Diego: Academic Press; 1991:3–25.
35. Fukuda, M.; Ono, T.; Nakamura, K. Functional relations among inferotemporal cortex, amygdala, and lateral hypothalamus in monkey operant feeding behavior. J. Neurophysiol. 57:1060–1077; 1987.
36. Gassman, P. W. Simulation of odor transport: A review. Presented at American Society of Agricultural Engineers meeting, Nashville; 1992.
37. Goldsmith, J. R. Annoyance and health reactions to odor from refineries and other industries in Carson, California, 1972. In: Goldsmith, J. R., ed. Health and annoyance impact of odor pollution. Environmental protection technology series. EPA-650/1-75-001. Washington, DC: Environmental Protection Agency; 1973:189–227.
38. Goodwin, G. A.; Heyser, C. J.; Moody, C. A.; Rajachandran, L.; Molina, V. A.; Arnold, H. M.; McKinzie, D. L.; Spear, N. E.; Spear, L. P. A fostering study of the effects of prenatal cocaine exposure: II. Offspring behavioral measures. Neurotoxicol. Teratol. 14:423–432; 1992.
39. Guevara–Guzman, R.; Garcia–Diaz, D. E.; Solano–Flores, L. P.; Wayner, M. J.; Armstrong, D. L. Role of the paraventricular nucleus in the projection from the nucleus of the solitary tract to the olfactory bulb. Brain Res. Bull. 27:447–450; 1991.
40. Hamilton, N. D.; Bolte, D. Nuisance law and livestock production in the United States: A fifty state analysis. J. Agric. Taxation Law 10(2):99–136; 1988.
41. Heinzow, B. G.; McLean, A. Critical evaluation of current concepts in exposure assessment. Clin. Chem. 40:1368–1375; 1994.
42. Hiramoto, R. N.; Ghanta, V. K.; Rogers, C. F.; Hiramoto, N. S. Conditioning the elevation of body temperature, a host defensive reflex response. Life Sci. 49:93–99; 1991.
43. Hiramoto, R. N.; Hsueh, C. M.; Rogers, C. F.; Demissie, S.; Hiramoto, N. S.; Soong, S. J.; Ghanta, V. K. Conditioning of the allogeneic cytotoxic lymphocyte response. Pharmacol. Biochem. Behav. 44:275–280; 1993.
44. Hunt, P. S.; Molina, J. C.; Rajachandran, L.; Spear, L. P.; Spear, N. E. Chronic administration of alcohol in the developing rat: Expression of functional tolerance and alcohol olfactory aversions. Behav. Neural Biol. 59:87–99; 1993.
45. Jackson, R. T.; Tigges, J.; Arnold, W. Subarachnoid space of the CNS, nasal mucosa, and lymphatic system. Arch. Otolaryngol. 105:180–184; 1979.
46. Janni, D. A. Modeling dispersion of odorous gases from agricultural sources. Trans. ASAE 25SE:1721–1723; 1982.
47. Jonsson, E.; Deane, M.; Sanders, G. Community reactions to odors from pulp mills: A pilot study in Eureka, California. Environ. Res. 10:249–270; 1975.
48. Kadlecova, O.; Masek, K.; Seifert, J.; Petrovicky, P. The involvement of some brain structures in the effects of immunomodulators. Ann. NY Acad. Sci. 496:394–398; 1987.
49. Karadi, Z.; Oomura, Y.; Nishino, H.; Aou, S. Olfactory coding in the monkey lateral hypothalamus: Behavioral and neurochemical properties of odor-responding neurons. Physiol. Behav. 45:1249–1257; 1989.
50. Katayama, M.; Kobayashi, S.; Kuramoto, N.; Yokoyama, M. M. Effects of hypothalamic lesions on lymphocyte subsets in mice. Ann. NY Acad. Sci. 496:366–376; 1987.
51. Kilman, S. Power pork. Corporations begin to turn hog business into an assembly line. The Wall Street Journal: March 28, 1994, p. A10.
52. Laing, D. G.; Eddy, A.; Best, D. J. Perceptual characteristics of binary, trinary, and quaternary odor mixtures consisting of unpleasant constituents. Physiol. Behav. 56:81–93; 1994.
53. Lam, C. W.; Galen, T. J.; Boyd, J. F.; Pierson, D. L. Mechanism of transport and distribution of organic solvents in blood. Toxicol. Appl. Pharmacol. 104:117–129; 1990.

54. Lau, A. K.; Lo, K. V.; Liao, P. H.; Yu, J. C. Aeration experiments for swine waste composting. Bioresource Technol. 41:145–152; 1992.
55. Lehrmann, E. J. Odor pollution. A bibliography with abstracts. National Technical Information Service (NTIS)-WIN-73-033/COM-73-11463. Environ. Protect. Agency 1–55; 1973.
56. Lorig, T. S. Human EEG and odor response. Prog. Neurobiol. 33:387–398; 1989.
57. Lorig, T. S. Cognitive and noncognitive effects of odour exposure: Electrophysiological and behavioral evidence. In: Van Toller, S.; Dodd, G. H., eds. The psychology and biology of perfume. London: Elsevier Applied Science; 1992:161–173.
58. Lorig, T. S.; Huffman, E.; DeMartino, A.; DeMarco, J. The effects of low concentration odors on EEG activity and behavior. J. Psychophysiol. 5:69–77; 1991.
59. Lorig, T. S.; Roberts, M. Odor and cognitive alteration of the contingent negative variation. Chem. Senses 15:537–545; 1990.
60. Lorig, T. S.; Sapp, A. C.; Campbell, J.; Cain, W. S. Event-related potentials to odor stimuli. Bull. Psychonom. Soc. 31:131–134; 1993.
61. Lorig, T. S.; Schwartz, G. E. Brain and odor—I: Alteration of human EEG by odor administration. Psychobiology 16:281–284; 1988.
62. Ludvigson, H. W.; Rottman, T. R. Effects of ambient odors of lavender and cloves on cognition, memory, affect and mood. Chem. Senses 14:525–536; 1989.
63. Mage, D. A comparison of direct and indirect methods of human exposure. Prog. Clin. Biol. Res. 372:443–454; 1991.
64. Manley, C. H. Psychophysiological effect of odor. Crit. Rev. Food Sci. Nutr. 33(1):57–62; 1993.
65. McNair, D. M.; Lorr, M.; Droppleman, L. F. Manual: Profile of mood states, Revised 1992. San Diego: Education and Industrial Testing Service; 1992.
66. McNair, D. M.; Lorr, M. An analysis of mood in neurotics. J. Abnorm. Soc. Psychol. 69:620–627; 1964.
67. Meschum, C. L.; Bernstein, I. L. Behavioral conditioned responses to contextual and odor stimuli paired with LiCl administration. Physiol. Behav. 52:895–899; 1992.
68. Means, P. Eau de hog or, it smells like money to me. Ark Lawyer 26(2):36–40; 1992.
69. Miller, M. There is something in the air. Pork August. 1994. p. 5.
70. Miner, J. R. Controlling odors from livestock production facilities: State-of-the-art. In: Livestock waste: A renewable resource. St. Joseph, MI: American Society of Agricultural Engineers; 1980:297–301.
71. Miner, J. R. Management of odors associated with livestock production. In: Managing livestock wastes. St. Joseph, MI: American Society of Agricultural Engineers; 1975:378–380.
72. Miner, J. R. Odors from confined livestock production: A state of the art. Environmental protection technology series. EPA-660/2-74-023. Washington, DC: U.S. Government Printing Office; 1974.
73. Miner, J. R.; Kelly, M. D.; Anderson, A. W. Identification and measurement of volatile compounds within a swine building and measurement of ammonia evolution rates from manure-covered surfaces. In: Managing livestock wastes. St. Joseph, MI: American Society of Agricultural Engineers; 1975:351–353.
74. Monath, T. P.; Cropp, C. B.; Harrison, A. K. Mode of entry of a neurotropic arbovirus into the central nervous system: Reinvestigation of an old controversy. Lab. Invest. 48:399–410; 1983.
75. Murua, V. S.; Molina, V. A. Desipramine and restraint stress induce odor conditioned aversion in rats: Suppression by repeated conditioning. Psychopharmacology (Berlin) 102:503–506; 1990.
76. Nance, D. M.; Rayson, D.; Carr, R. L. The effects of lesions in the lateral septal and hippocampal areas on the humoral immune response of adult female rats. Brain Behav. Immun. 1:292–305; 1987.
77. Neutra, R.; Lipscomb, J.; Satin, K.; Shusterman, D. Hypotheses to explain the higher symptom rates observed around hazardous waste sites. Environ. Health Perspect. 94:31–38; 1991.
78. Nielsen, V. C.; Voorburg, J. H.; L'Hermite, P., eds. Odour and ammonia emissions from livestock farming. London: Elsevier Applied Science; 1991:1–222.
79. Nielsen, V. C.; Voorburg, J. H.; L'Hermite, P., eds. Odour prevention and control of organic sludge and livestock farming. London: Elsevier Applied Science; 1986;1–391.
80. Nordstedt, R. A.; Taiganides, E. P. Meteorological control of malodors from land spreading of livestock wastes. In: Livestock waste management and pollution abatement. St. Joseph, MI: American Society of Agricultural Engineers; 1971;107–110.
81. O'Leary A. Stress, emotion, and human immune function. Psychol. Bull. 108:363–382; 1990.
82. Ono, T.; Luiten, P. G.; Nishijo, H.; Fukuda, M.; Nishino, H. Topographic organization of projections from the amygdala to the hypothalamus of the rat. Neurosci. Res. 2:221–238; 1985.
83. Oomura, Y. Input-output organization in the hypothalamus relating to food intake behavior. In: Morgane, P.; Panksepp, J., eds. Handbook of the hypothalamus, vol. 2. New York: Marcel Dekker; 1980:557–620.
84. Oomura, Y. Modulation of prefrontal and hypothalamic activity by chemical senses in the chronic monkey. In: Kawamura, Y.; Kare, M. R., eds. Umami: A basic taste. New York: Marcel Dekker; 1987:481–509.
85. Oomura, Y.; Ono, T.; Ooyama, H. Inhibitory action of the amygdala on the lateral hypothalamic area in rats. Nature 228:1108–1110; 1970.
86. Pain, B. F.; Clarkson, C. R.; Phillips, V. R.; Klarenbeek, J. V.; Misselbrook, T. H.; Bruins, M. Odour emission arising from application of livestock slurries on land: Measurements following spreading using a micrometeorological technique and olfactometry. J. Agric. Eng. Res. 48:101–110; 1991.
87. Phillips, M.; Greenberg, J. Ion-trap detection of volatile organic compounds in alveolar breath. Clin. Chem. 38:60–65; 1992.
88. Rains, B. A.; Deprimo, M. J.; Croseclose, L. L. Odors emitted from raw and digested sewage sludge. Environmental protection technology series. Prepared for the Office of Research and Development, Environmental Protection Agency. Washington, DC: U.S. Government Printing Office; 1973.
89. Raymer, J. H.; Pellizzari, E. D.; Thomas, K. W.; Cooper, S. D. Elimination of volatile organic compounds in breath after exposure to occupational and environmental microenvironments. J. Expo. Anal. Care Environ. Epidemiol. 1:439–451; 1991.
90. Ritter, W. F. Odour control of livestock wastes: State-of-the-art in North America. J. Agric. Eng. Res. 42:31–62; 1989.
91. Roberts, E. Alzheimer's disease may begin in the nose and may be caused by aluminosilicates. Neurobiol. Aging 7:561–567; 1986.
92. Roszman, T. L.; Cross, R. J.; Brooks, W. H.; Markesbery, W. R. Hypothalamic–immune interactions. II. The effect of hypothalamic lesions on the ability of adherent spleen cells to limit lymphocyte blastogenesis. Immunology 45:737–742; 1982.
93. Rotton, J. Affective and cognitive consequences of malodorous pollution. Basic Appl. Soc. Psychol. 4:171–191; 1983.
94. Saphier, D.; Abramsky, O.; Mor, G.; Ovadia, H. Multiunit electrical activity in conscious rats during an immune response. Brain Behav. Immun. 1:40–51; 1987.
95. Satin, K. P.; Huie, S.; Croen, L. Operating Industries Inc. health effects study. Berkeley, CA: California Department of Health Services, Epidemiological Studies Section; 1986.
96. Satin, K. P.; Windham, G.; Stratton, J.; Neutra, R. Del Amo–Montrose Health effects study. Berkeley, CA: California Department of Health Services, Epidemiological Studies Section; 1987.
97. Scarborough, M. E.; Ames, R. G.; Lipsett, M. J.; Jackson, R. J. Acute health effects of community exposure to cotton defoliants. Arch. Environ. Health 44:355–360; 1989.
98. Schiffman, S. S.; Sattely Miller, E. A.; Suggs, M. S.; Graham, B. G. The effect of pleasant odors and hormone status on mood of women at midlife. Brain Res. Bull. 36:19–29; 1994.
99. Schiffman, S. S.; Suggs, M. S.; Sattely Miller, E. A. Effect of pleasant odors on mood of males at midlife: Comparison of African-American and European-American men. Brain Res. Bull. 36:31–37; 1994.
100. Schiffman, S. S. Taste and smell in disease. N. Engl. J. Med. 308:1275–1279; 1337–1343; 1983.
101. Scott, J. W.; Pfaffmann, C. Olfactory input to the hypothalamus: Electrophysiological evidence. Science 158:1592–1594; 1967.

adopted on floor

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Prepared by the Legislative Council staff for
Senator Wanzek
February 15, 1999

2/16/99

PROPOSED AMENDMENTS TO SENATE BILL NO. 2365

Page 1, replace lines 6 through 8 with:

"**Regulation of odors - Rules.**

1. In areas located within a city or the area over which a city has exercised extraterritorial zoning as defined in section 40-47-01.1, a person may not discharge into the ambient air any objectionable odorous air contaminant that measures seven odor concentration units or higher outside the property boundary where the discharge is occurring.

2. In areas located outside a city or outside the area over which a city has exercised extraterritorial zoning as defined in section 40-47-01.1, a person may not discharge into the ambient air any objectionable odorous air contaminant that causes odors that measure seven odor concentration units or higher as measured at any of the following locations:

   a. Within one hundred feet [30.48 meters] of any residence, church, school, business, or public building, or within a campground or public park. An odor measurement may not be taken at the residence of the owner or operator of the source of the odor, or at any residence, church, school, business, or public building, or within a campground or public park, that is built or established within one-half mile [.80 kilometer] of the source of the odor after the source of the odor has been built or established; or

   b. At any point located beyond one-half mile [30.48 meters] from the source of the odor, except for property owned by the owner or operator of the source of the odor, or over which the owner or operator of the source of the odor has purchased an odor easement.

3. An odor measurement may be taken only with a properly maintained scentometer, by an odor panel, or by another instrument or method approved by the state department of health, and only by inspectors certified by the department who have successfully completed a department-sponsored odor certification course and demonstrated the ability to distinguish various odor samples and concentrations.

4. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land in accordance with a nutrient management plan approved by the state department of health. A person is exempt from this section while spreading or applying animal manure or other recycled agricultural material to land owned or leased by that person in accordance with rules adopted by the department. An owner or operator of a lagoon or waste storage pond permitted by the department is exempt from this section in the spring from the time when the cover of the permitted lagoon or pond begins to melt until fourteen days after all the ice cover on the lagoon or pond has completely melted. Notwithstanding these exemptions, all persons shall manage their property and systems to minimize the impact of odors on their neighbors.

5. This section does not apply to chemical compounds that can be individually measured by instruments, other than a scentometer, that have been

designed and proven to measure the individual chemical or chemical compound, such as hydrogen sulfide, to a reasonable degree of scientific certainty, and for which the state department of health has established a specific limitation by rule.

6. For purposes of this section, a public park is a park established by the federal government, the state, or a political subdivision of the state in the manner prescribed by law. For purposes of this section, a campground is a public or private area of land used exclusively for camping and open to the public for a fee on a regular or seasonal basis."

Renumber accordingly

PROPOSED AMENDMENTS TO SENATE BILL NO. 2365

Page 2, line 1, replace "[30.48 meters]" with "[.80 kilometers]"

Page 2, line 5, after "scentometer," insert "or"

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North Dakota Farm Bureau

NORTH DAKOTA FARM BUREAU

TESTIMONY

SENATE BILL 2365

Chairman Nicholas and members of the House Agriculture Committee, I am Brian Kramer and I am representing the North Dakota Farm Bureau in support of Engrossed Senate Bill 2365.

We believe this bill sets reasonable parameters for the regulation of odors. It provides that the entity that is established first has precedence. If a livestock operation is in place and someone builds a home near within one-half mile of that facility they cannot have odors tested at their residence. If the residence is in place first the livestock operation may be liable for objectionable odors that facility may create.

The bill establishes distances from the livestock operation at which the odor readings shall be taken and provides odor protection for public facilities.

The bill also provides an exemption from odor standards for land application of recyclable animal materials. There is also an exemption for lagoons (any lagoons) during the spring thaw when the lagoon water turns over.

If we are to encourage animal agriculture in this state, we need SB 2365. If we support adding value to our agricultural production by feeding livestock, we need SB 2365. The bill is fair and reasonable for livestock producers and their neighbors as well. We support the bill and ask that you concur.

Thank you for your kind attention.

Testimony in opposition to SB2365

Before the House Agriculture Committee
March 11, 1999

Keith Johnson, R.S., Administrator/EHP, Custer District Health Unit
For the North Dakota Environmental Health Association.

The North Dakota Environmental Health Association is an organization composed of environmental health professionals from around the state who work in both public and private organizations. Many of us are the ones who carry out the odor readings when nuisances have been reported.

We oppose two items in the bill. First and foremost is changing the point of odor reading from the property boundary to either a half mile away, or 100 ft from the nearest residence or business. The second is changing the nuisance level to 7 OCU's (odor concentration units) from the present level of "greater than 2 OCU's".

Allowing an odor to travel a half mile, or 100 ft. from a neighbor, is an unacceptable taking of the neighbor's use and enjoyment of his or her property. I've been trying to quantify an odor reading of 7 OCU's in some meaningful way. The best I can do is to use the example of driving by a dairy farm in the spring when they're applying manure on a field right by the road. We've all experienced this. It smells quite a lot. That is still not usually an odor reading of 7. Imagine sitting in your living room and smelling that level of odor for hours on end. This bill would allow that because it changes the point of odor reading to 100 ft from a neighbor's house or business. In the case of open space, a half mile of park or golf course could be enveloped in an awful stink - legally. For this reason, we oppose what we see as a taking of a neighbor's right to enjoyment of property. The property boundary is the appropriate place to take readings.

I have brought a scentometer today to show you the instrument used to take odor readings. As you can see, with this instrument, the language "greater than 2 OCU's" is the same as "7 OCU's". However, the difference in odor concentration between 2 and 7 OCU's is significant. If the technology changes, the law should allow for finer differentiation than the present crude standard. For that reason, we advocate that the nuisance level odor reading remain at "greater than 2 OCU's".

I will answer any questions the committee may have. Thank you.

Testimony of Roger Johnson
Commissioner of Agriculture
North Dakota Department of Agriculture
Senate Bill 2365
March 11, 1999
House Agriculture Committee
Peace Garden Room

Chairman Nicholas and Committee members, for the record, my name is Roger Johnson, and I serve as the Commissioner of Agriculture.

The North Dakota Department of Agriculture and the North Dakota Department of Health held a forum on June 1, 1998, to discuss issues concerning Concentrated Animal Feeding Operations. Forty-four people, including representatives from the Legislature, invited interest groups, agency staff members, members of the general public, and press representatives attended the forum. The major emphasis of the forum was to review the *United States Department of Agriculture and United States Environmental Protection Agency Draft Unified National Strategy for Animal Feeding Operations* and discuss the potential impact on North Dakota.

The forum was held because the new federal strategy brought potential uncertainty to North Dakota's livestock industry. On the national front, the discussion of concentrated animal feeding operations has been heightened because of the increased concentration of livestock feeding operations, high profile lagoon spills or failures, and the potential environmental impact these facilities create on the environment. On the local front, discussion has centered on the district court case involving private landowners, Enviropork, and the North Dakota Department of Health.

The following issues were raised and generally agreed upon by the participants at the forum:

1) **Federal government's role in regulating animal feeding operations.**
   Questions were raised about EPA's involvement in the regulation of animal feeding operations. Support for a state-regulated program instead of an EPA-regulated program was shown. Many were concerned that EPA's national standards will not fit North Dakota.

2) **Need for additional regulation.**
   Forum attendees questioned the need for an additional federal regulatory program. They generally felt that the North Dakota Department of Health had enough authority to properly regulate animal feeding operations.

3) **Changing financial conditions of North Dakota agriculture.**
   Agriculture producers face the challenge of being profitable and yet protecting the

environment. Economies of scale are forcing ranchers to increase herd sizes to maximize profits; however, local financing is not always readily available to allow for expansion. A concern was raised that the current state regulations in North Dakota were written for family farms; they may not apply to larger farms or very large animal feeding operations.

4) **Bonding.**
The issue of bonding was raised, but no consensus was reached on this issue. Bonding was raised as a possible requirement for larger animal feeding operations. Bonding would provide a method to ensure funds would be available for cleanup if pollution occurs and the responsible party is no longer solvent.

5) **200 animal head limit.**
Questions were raised about the number of animal units held at one time to meet the need for approval to operate from the Department of Health. Some recommended that this number be raised from the present 200-head limit to a 380-head limit, which is also a breakpoint use by EPA.

SB 2365 relates to the Health Department's authority on taking odor readings. The impact of odors from livestock facilities is a growing concern. There is a need to protect existing livestock enterprises from the encroachment of the expanding urban population in North Dakota. However, livestock facility owners and operators also need to be sympathetic to neighbors surrounding the facility.

I recommend the following changes to the bill:

Page 1, line 15, replace "seven" with "two"

Page 1, line 22, replace "one-half" with ". 2"

I also believe that where permitted animal feeding operations pre-exist, other persons should be prevented from building within one mile of such facilities.

These above-mentioned recommendations weigh in on a stricter standard compared to the proposed language in the bill. I feel it is a better approach to start with a stricter standard and make adjustments downward in the event that further investigation shows that the proposed level might be too stringent.

As the issue of concentrated animal feeding operations continues to be a main discussion point in the agriculture and environmental communities, I hope that the issue of odor concerns can be dealt with in a fair manner for all who are impacted.

If there are any questions, I would be glad to answer them.

HOUSE AGRICULTURE COMMITTEE

SENATE BILL No. 2365

MY NAME IS Jim GRIFFIN, I LIVE A MILE AND A HALF NORTHEAST OF ENVIROPORK. I oppose THIS BILL.

THIS BILL IS CLEARLY BEING SUBMITTED ONLY FOR THE BENEFIT OF LARGE SCALE HOG FACTORIES, SUCH AS ENVIROPORK AND IS DETRIMENTAL TO THE HEALTH AND WELFARE OF NORTH DAKOTA.

THIS BILL WOULD LOWER STANDARDS AND CURRENT REGULATIONS ON ODORS. THIS PIG FACTORY WON'T Comply WITH THE **LAW** NOW, SO THEY WANT TO CHANGE IT. THEY MADE NO ATTEMPT to REDUCE OFFENSIVE ODORS EMITTED FROM THEIR FACTORY, UNTIL A JUDGE ORDERED THEM TO DO SO, AND THEY STILL HAVEN'T SOLVED THE PROBLEM.

THEY PROMISE ANYTHING TO GET A PERMIT TO OPERATE, AND AFTER IT IS ISSUED HOPE NO ONE REMEMBERS THEIR PROMISES.

Do YOU WANT THIS KIND OF FACTORY IN YOUR DISTRICT?

Do you WANT OUT OF STATE INVESTORS WHO Don't RESPECT THE QUALITY OF AIR, AND THE RIGHT OF NORTH DAKOTA CITIZENS TO ENJOY THEIR HOMES?

THIS INDUSTRY HIDES BEHIND FARMER'S AND RANCHER'S THEY ARE NOT EITHER. THEY Don't RAISE ONE KERNEL OF GRAIN OR GRAZE THEIR LIVESTOCK ON ONE BLADE OF GRASS. IN FACT, THEY PROFIT FROM LOW GRAIN PRICES, WITH LOWER FEED COSTS.

WITH THE AGRICULTURE ECONOMY DEPRESSED AS IT IS NOW, IT'S EASY TO CRY WOLF, BUT WHAT PERCENTAGE OF <u>REAL</u> FARMER'S AND RANCHER'S WOULD BE INVOLVED IN THIS TYPE OF OPERATION? THERE ARE LAWS ALREADY IN PLACE TO PROTECT OUR <u>REAL</u> FARMER'S AND RANCHER'S.

THE NORTH DAKOTA LEGISLATURE CANNOT IMPROVE AGRICULTURE'S ECONOMY, ONLY A FAIR PRICE AT THE MARKETPLACE CAN ACCOMPLISH THAT.

THE LEGISLATURE IS SUPPOSED TO SAFEGUARD THE RIGHTS AND WELL-BEING OF ALL NORTH DAKOTA CITIZENS. IN MY OPINION MOST BILLS SUBMITTED IN THE LEGISLATURE BELONG IN ONE OF TWO CATEGORIES.

1- A BILL TO TAKE ALL WE CAN,

2- A BILL TO KEEP WHAT WE HAVE.

I THINK, FOR THE MOST PART, NORTH DAKOTA CITIZENS HAVE GOTTEN ALONG FAIRLY WELL. NOW OUTSIDE INTERESTS HAVE US FIGHTING AMONGST OURSELVES. LET'S TELL PURINA MILLS, MURPHY FARMS, SEABOARD INDUSTRIES, AND THE LIKE, TO KEEP THEIR FACTORIES OUT OF NORTH DAKOTA! WE WOULD LIKE TO KEEP WHAT WE HAVE.

RESPECTFULLY,

James A. Giffin