agricultural disorders of the chest

jud w gurney md
charles a dobry professor of radiology
Farm Economy

- 60,000 farms
- 47,000,000 acres
- 3rd corn, 11th wheat, 3rd beans
- 1,800,000 Cattle (2nd)
- 3,800,000 Feedlot Cattle (3rd)
- 3,900,000 Hogs (5th)
- Omaha Grain Storage Capacity: 32,500,000 bushels
Farming: The Most Dangerous Game

Work deaths per 100,000 workers

Agriculture

Mining

Construction

National Safety Council
Grain production

Almost all who make a living by a sifting or measuring grain are short of breath and cachetic and rarely reach old age
Ramazzini 1713

<table>
<thead>
<tr>
<th>Condition</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic bronchitis</td>
<td>50%</td>
</tr>
<tr>
<td>Asthma</td>
<td>15%</td>
</tr>
<tr>
<td>ODTs</td>
<td>1%</td>
</tr>
<tr>
<td>Farmers lung</td>
<td>2-4 / 1000</td>
</tr>
<tr>
<td>Chemical poisoning</td>
<td>6 / 15 million</td>
</tr>
<tr>
<td>Silo Fillers disease</td>
<td>1 / 30,000</td>
</tr>
</tbody>
</table>
Grain dust

Organic
- Fungi
- Insects
- Mites
- Bacterial Endotoxins

Inorganic
- Dirt
- Silica
Grain dust asthma
Grain elevators (Prairie Castles)

3rd largest particulate polluter
Dust concentration 5 - 50 mg/m³
1,800,000 tons dust/yr
Clayton Gurney Retires After 40 Years In Ag
Organic dust toxicity syndrome

initial

24 hours
Acute farmers lung
<table>
<thead>
<tr>
<th></th>
<th>Farmer's lung</th>
<th>ODTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exposure</strong></td>
<td>Moldy hay</td>
<td>Moldy hay</td>
</tr>
<tr>
<td><strong>Latent time</strong></td>
<td>4 - 8 hr</td>
<td>4 - 8 hr</td>
</tr>
<tr>
<td><strong>Insult</strong></td>
<td>Spores</td>
<td>Bact endotoxins</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td>Fever, cough</td>
<td>Fever, cough</td>
</tr>
<tr>
<td><strong>PFT's</strong></td>
<td>Restriction</td>
<td>Normal</td>
</tr>
<tr>
<td><strong>Lymphocytes</strong></td>
<td>Neutrophils</td>
<td>Lymphocytes</td>
</tr>
<tr>
<td><strong>BAL</strong></td>
<td>Allergic</td>
<td>Non-allergic</td>
</tr>
<tr>
<td><strong>Chronic Disease</strong></td>
<td>Possible</td>
<td>No</td>
</tr>
</tbody>
</table>
Chronic farmers lung
chronic farmers lung

idiopathic pulmonary fibrosis
Chemical Poisoning

Insecticides
Herbicides
Fertilizers
Organophosphate insecticides

Diazinon, Parathion, Malathion

- Related to nerve gas
- Inhibit acetylcholinesterase
- Respiratory paralysis
- Increased airway secretions
- Bronchospasm
- Noncardiac pulmonary edema - Aspiration
Organophosphate insecticides

**Today’s Top Story**

*Area cattle found poisoned*

The owner of 250 cattle found dead in a Colfax County feedlot believes they were intentionally poisoned.

Jim Barta, 61, of Fremont said today he believes someone dumped pesticide, a neurotoxin, into a bag of feed put out for the cattle.

"I've tried to find a way that this could be an accident," said Barta, also a longtime pharmacist in Fremont. "The only way it could be an accident is if somebody loaded a mineral bag at the factory with a neurotoxin."

**CATTLE DEATHS** - The carcasses of 250 cattle were found dead Saturday at a Colfax county feedlot, pictured here, near Richland. Officials with the State Patrol are investigating whether the cattle were poisoned accidentally or intentionally. Telegram photo by Todd Stepanek
Iraq shows 'pesticide factory'

Iraqi officials have given reporters a tour of a factory suspected of producing chemical weapons.

In the third such visit in a month, the journalists were shown Falluja-3 - about 80 kilometres west of Baghdad - which Iraq says is a pesticide factory.

"Accusations that Iraq has rebuilt the site and started using it for producing chemical and biological weapons are false and groundless"
Herbicide

Paraquat

Absorbed skin
Acute toxicity: noncardiac pulmonary edema
Subacute: rapid pulmonary fibrosis

Im AJR 1991
Paraquat poisoning CT

Im AJR 157 1991
Fertilizer

Anhydrous ammonia

Tracheal bronchitis
Pulmonary edema
Bronchiolitis obliterans
Anhydrous ammonia
Anhydrous ammonia
Tracks blocked after ammonia theft goes awry

By: JEFF HUMPHREY / KREM 2 News
4/8/03

Union Pacific Railroad tracks were blocked for more than 12 hours in Rockford, Wash. Monday after somebody tried and failed to steal a form of fertilizer also used to make methamphetamine.

SPOKANE - Union Pacific Railroad tracks were blocked for more than 12 hours in Rockford, Wash. Monday after somebody tried and failed to steal a form of fertilizer also used to make methamphetamine.

The would-be thieves' heist went awry, however, when their rented van became stuck in the mud, forcing the group to flee on foot.

There were no suspects in custody Monday night, but police were combing the scene for fingerprints.

The van, along with a variety of tools, including a large drill rig, were left behind, but not before the group caused thousands of dollars in damage as they attempted to steal hundreds of pounds of anhydrous ammonia.

Spokane County Sheriff's Deputies say the ammonia would likely be used in what has become known as the "Nazi" way of making methamphetamine.
Flagman
Lonely Crusade
One Man’s Suffering Spurs Doctors to Probe Pesticide-Drug Link
Tom Latimer, Tagamet User, Fell Ill After He Mowed Lawn That Was Treated
A Problem Little Understood

By Frank Edward Allen
Staff Reporter of The Wall Street Journal
DALLAS—Thomas Latimer used to be a vigorous, athletic man, a successful petroleum engineer with a bright future.

Then he mowed the lawn.

On a summer Saturday in 1985, Mr. Latimer spent an hour or so cutting the grass, picking up the clippings and edging the walkways around his modest two-bedroom home. Soon, something was terribly wrong. He felt dizzy and nauseated. His nose was running and his chest was tight. He had a pounding headache.

Ten days later, he was still sick, so he went to see a doctor. But he kept getting worse. He suffered constant head pain. His eyes began to jerk uncontrollably.

In November 1985, he developed testicular cancer. Now, six years and 20 doctors later—after liver biopsies, spinal-fluid taps, CAT scans, radioactive brain blood-flow studies, sleep studies and many other tests—Mr. Latimer, 36, ac-

25 million lbs herbicide
30 million lbs insecticides
EPA estimate
Toxic Gas Generation

"... from grain which has been long conserved in a closed chamber, for example in underground places as is the custom of Tuscany, arises an exhalation so dangerous as to be sufficient to cause death to anyone who enters such a place to collect the grain, unless the pernicious air is first allowed to escape for a while.

Ramazzini 1713
Silo

Loader

Unloading

Ladder

Safe NO₂ < 5 ppm
Silos > 2000 ppm

Blower

Nitrous Acid

Nitrogen Monoxide

Nitrogen Dioxide
123 patients and employees die

Fire in Radiology (~70,000 films or 4,200 lbs nitrocellulose) release NO₂ gas that fills the building
I am inclined to think some volatile acid is given off by this carnerine of filth when workers disturb it… such effuvia aught, one would think, to impair the lungs.

Ramazzini 1713
# Livestock Production disorders

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic bronchitis</td>
<td>70%</td>
</tr>
<tr>
<td>Asthma</td>
<td>15%</td>
</tr>
<tr>
<td>Farmers Lung</td>
<td>1%</td>
</tr>
<tr>
<td>Toxic manure exposure</td>
<td>1/100,000</td>
</tr>
<tr>
<td>Zoonosis</td>
<td>?</td>
</tr>
</tbody>
</table>
Confinement House
Hydrogen sulfide generation

- **500 ppm**: Unconsciousness and respiratory failure
- **200 ppm**: Paralysis of sense of smell
- **20 ppm**: Unrecognizable odor
- **10 ppm**: Maximum level safe exposure
- **0.02 ppm**: Odor of rotten eggs
Dung Lung: A Report of Toxic Exposure to Liquid Manure

LIDA N. OSBERN, M.D.; and ROBERT O. CRAPO, M.D.; Salt Lake City, Utah
Deaths of Five Men Devastate Farm Family

By Paige St. John

Menominee, Mich. (AP) — On the first day without wakes or funerals since the tragedy, children are running in the farmyard, spraying each other with a garden hose while their mothers shout for them to cut it out.

It would be a normal day but for one thing. Elmbrook, the dairy farm nurtured by five generations of Theuerkauf men over 108 years, has no one to run it but the widows and children.

Inside the great white farmhouse, Linda Theuerkauf and her children gather in a circle, surrounded by memories, and say the names:

"First Tom..."

Tom Theuerkauf, 27, was the first one into the manure pit, through a narrow hole and down the ladder to clear the drain 12 feet below.

"... then Danny..."

Dan Theuerkauf, 15, quiet and thoughtful like his uncle Tom, had been cutting hay by himself for two years, already part of the circle of Theuerkauf farmers. Dan saw Tom's head hit the ladder and slip into the dark. He sent his 8-year-old brother Brian for help and then went down.

"... and Brian got Bill first."

Bill Hofer, 63, was the third man down, a cousin who grew up across the lane from the Theuerkaufs, went to school with them and farmed with them.

"... and I lost my Grandpa..."

In the wake of the tragedy, life goes on... Brian Theuerkauf, 8, and his sister Carrie, 16, feed the calves on the family farm.
Zoonosis

Was rare medical curiosity
Mad Cow Disease
Anthrax
SARS
# Respiratory Infections

<table>
<thead>
<tr>
<th>Bacterial Disease</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q fever</td>
<td>Sheep, cattle</td>
</tr>
<tr>
<td>Anthrax</td>
<td>Livestock</td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Cattle, pigs</td>
</tr>
<tr>
<td>Psittacosis</td>
<td>Turkeys</td>
</tr>
<tr>
<td>Tularemia</td>
<td>Sheep</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Cattle, sheep</td>
</tr>
<tr>
<td>Plague</td>
<td>Rats</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fungal Disease</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coccidiomycosis</td>
<td>Farming contaminated soil</td>
</tr>
<tr>
<td>Histoplasmosis</td>
<td>Poultry waste</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Viral Disease</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SARS</td>
<td>Civets</td>
</tr>
</tbody>
</table>
Brucellosis (Suis)
Pasturella multocida
Histoplasmosis

Disease forms
- Primary pneumonia
- Progressive disseminated disease
- Chronic infection
- Reinfection
Pulmonary histoplasmosis in a farm family fifteen years later

Procknow, Am Rev Respir Dis, 1966
Epidemiology of Histoplasmosis

Intense Exposure - Acute Illness
   Father
   Son, age 21
   Son, age 5

Casual Exposure - Asymptomatic
   Daughter, 17
   Daughter, 19
   Son-in-law, 24

No Exposure - X-rays normal
   Mother
   Daughter, 24
This site provides information about the pathogenesis and imaging of inhalational anthrax. The content represents the combined efforts of the Armed Forces Institute of Pathology and the American Registry of Pathology, Washington DC and INOVA Fairfax Hospital, Fairfax VA.

We invite collaboration with other institutions who have experience with anthrax.

Our goal is to provide information that improves the understanding and recognition of inhalational anthrax. We extend our deepest sympathy to the families and friends of those who have died or been injured in this attack and hope that this information contributes to the prevention of future casualties.

A complete list of those responsible for the content, design and administration of this site is available on the credits page.

Jeffrey R. Galvin, MD
Department of Radiologic Pathology
Armed Forces Institute of Pathology
Anthrax

6 letters contained highly refined spores
  Senate: Leahy, Daschle
  News anchors: Brokaw, Rather
  Newspapers: New York Post, National Enquirer
11 inhalation anthrax: 5 deaths
  Photo editor (National Enquirer)
  2 mailmen Virginia
  61 y/o hospital stockroom Manhattan
  94 y/o widow, Connecticut
SARS

Nov 2002
Guangzhou, China
Coronavirus
Civets
Fatality Rate 10%
>8000 Cases
SARS Imaging

Nonspecific findings
CXR’s abnormal in those requiring hospitalization
CT more sensitive
# Radiographic Manifestation of Agricultural Disorders of the Lung

<table>
<thead>
<tr>
<th>Normal Chest Radiograph</th>
<th>Alveolar Pattern</th>
<th>Chronic Interstitial Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Bronchitis</td>
<td>Farmers Lung</td>
<td>Upper Lobes</td>
</tr>
<tr>
<td>Asthma</td>
<td>Silo Fillers Disease</td>
<td>Farmers Lung</td>
</tr>
<tr>
<td>Organic Dust Toxicity Syndrome</td>
<td>Dung Lung</td>
<td>Lower Lobes</td>
</tr>
<tr>
<td>Farmers Lung</td>
<td>Chemical Poisoning</td>
<td>Silo Fillers Disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paraquat Poisoning</td>
</tr>
</tbody>
</table>
Seasonal Presentation

Jan/Feb  | Mar/Apr  | May/Jun  | Jul/Aug  | Sep/Oct  | Nov/Dec

# Farmers 10 years

- Dung Lung
- Fertilizer
- Insecticide
- ODTs
- Farmers Lung
- Silo Fillers Disease
## Rural vs Big City

<table>
<thead>
<tr>
<th>Rural</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypersensitivity pneumonitis</td>
<td>Farmers lung</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>Silo fillers disease</td>
</tr>
<tr>
<td>Poisonings</td>
<td>Insecticides</td>
</tr>
<tr>
<td>ODTS</td>
<td>Moldy hay</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>Toxic manure</td>
</tr>
<tr>
<td>Fungi</td>
<td>chickens</td>
</tr>
</tbody>
</table>
Gurney Radiographics 1991
Cancer Among Farmers

Excess Risk
- Non-Hodgkin's Lymphoma
- Leukemia
- Hodgkin's Lymphoma
- Skin
- Multiple myeloma
- Lip
- Stomach

Decreased Risk
- Lung
- Colon
- Esophagus
- Bladder
Non-Hodgkin's Lymphoma

- Fertilizer: Nitrates
- Herbicide: 2,4-D
- Insecticide: Diazinon

Weisenburger  Am J Ind Med 1990
Zahm Epidemiology 1990