Agricultural Injuries: Not Your Everyday Call

DR. AMY JOHNSON, RN, DNP, FNP-C

Objectives

- Introduction
- Discuss statistical significance of agricultural injuries
- Describe various types of farming modalities
- Identify common mechanisms of injury
- Discuss various injury patterns
- Identify unique characteristics of agricultural injuries that compound morbidity and mortality
- Discuss prevention strategies

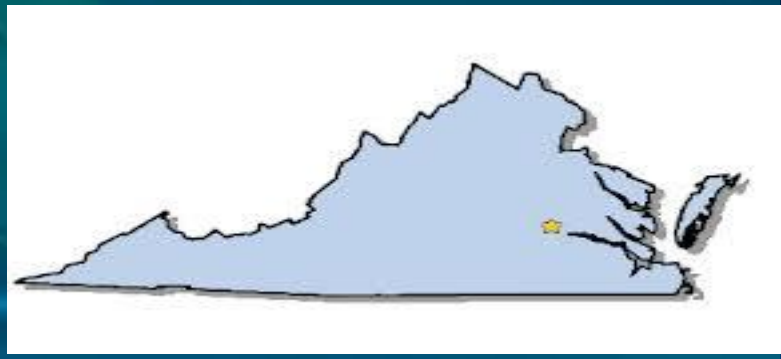
Virginia Agriculture

- Largest industry
- > 47,000 farms
- Average age 58.2
- Average farm 171 ac
- Total farming acres 8.1mil ac

- Broilers #1

  Cattle/Calves #2

- Top exports to Morocco, China, Canada and Switzerland



Statistical Background

- Top 3 hazardous occupations
- Largest industry in most states
- 2.2 mil farms in US
- 5-6 mil farmers
- Over 1.8 million workers
- Annual injury risk 10-40%
- High cost burden

Statistical Background

- 700 deaths annually
- 140,000 debilitating injuries
- What's wrong with these numbers?

Injury Burden

- 243 agricultural workers with lost time injury
- 5% result in permanent impairment
- $600,000 – avg cost of agricultural fatality

Types of Farms

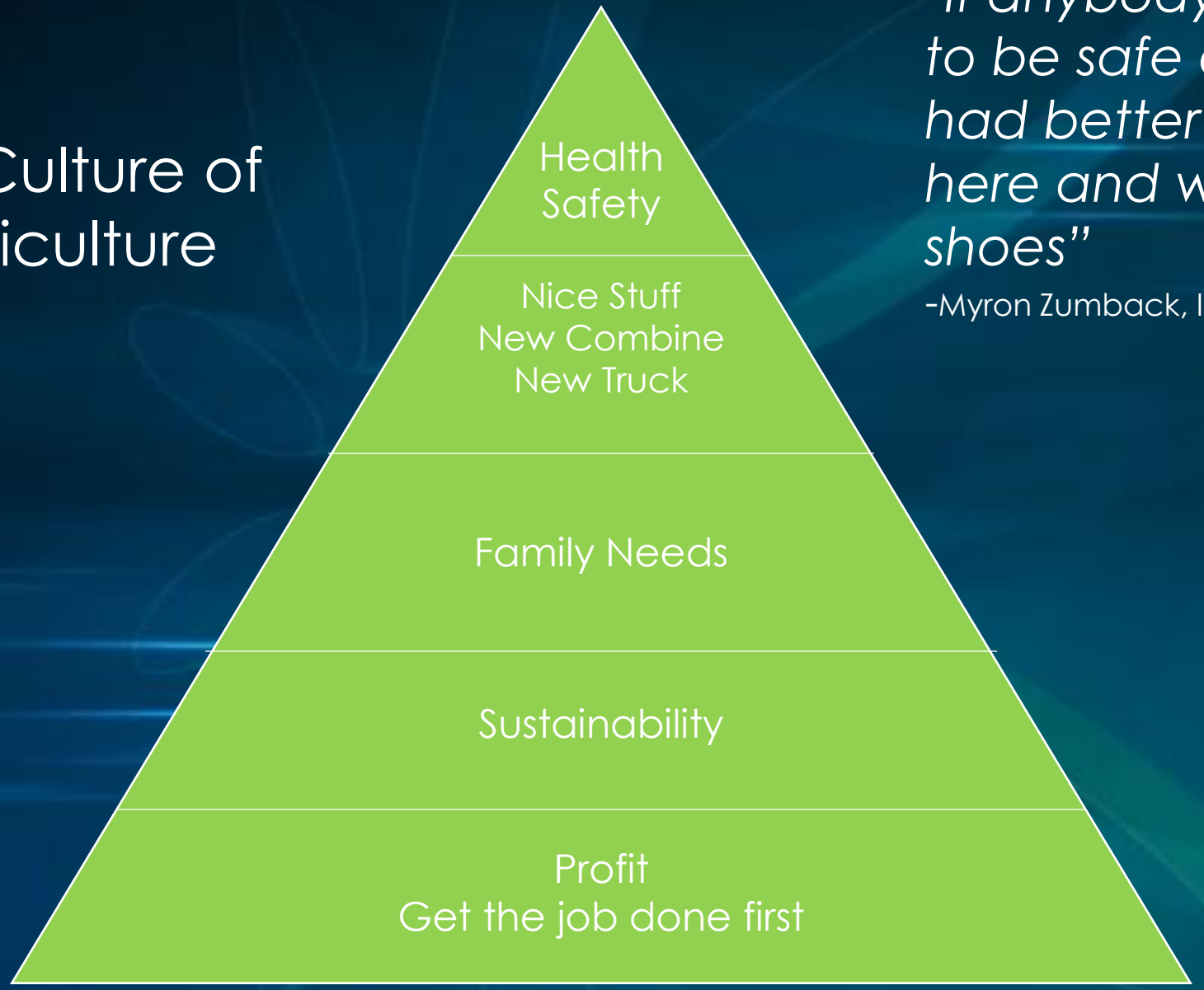
- Traditional
- Industrial
- Niche/Alternative farms

Agriculture Culture

- 2%:98%
- Jeffersonian Principle
- Independent
- Stoic
- Risk takers
- Work
- Land
- Proud
- Mistrustful


Once in your life you need a doctor,
a lawyer, a policeman and a
preacher but every day, three times
a day, you need a farmer.
FARM
LIFE

The Culture of Agriculture



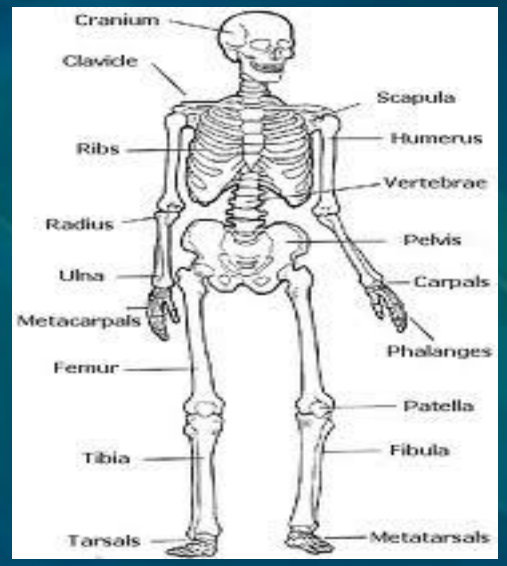
"If anybody is going to tell me to be safe on my farm, they had better first come out here and walk a mile in my shoes"

-Myron Zumback, Iowa cattle producer

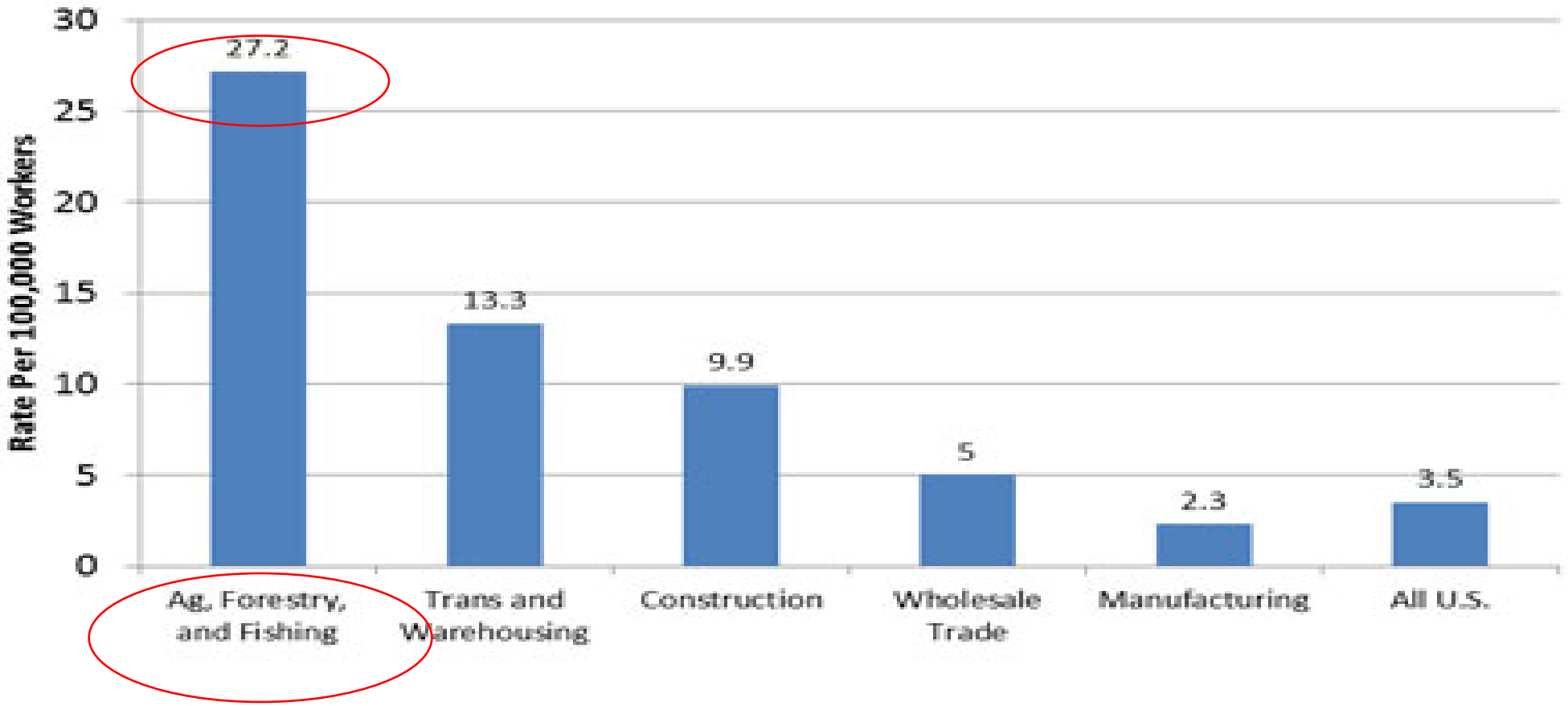
Maslow's Theory, 1968; Modified

Occupational Risks

- Respiratory
- Zoonotic infections
- Chemicals
- Skin conditions
- Mental Health
- Cancer
- Pharmaceuticals
- Musculoskeletal Injuries
- Acute/Chronic Trauma



Occupational Fatality Rate by Industry, U.S., 2009

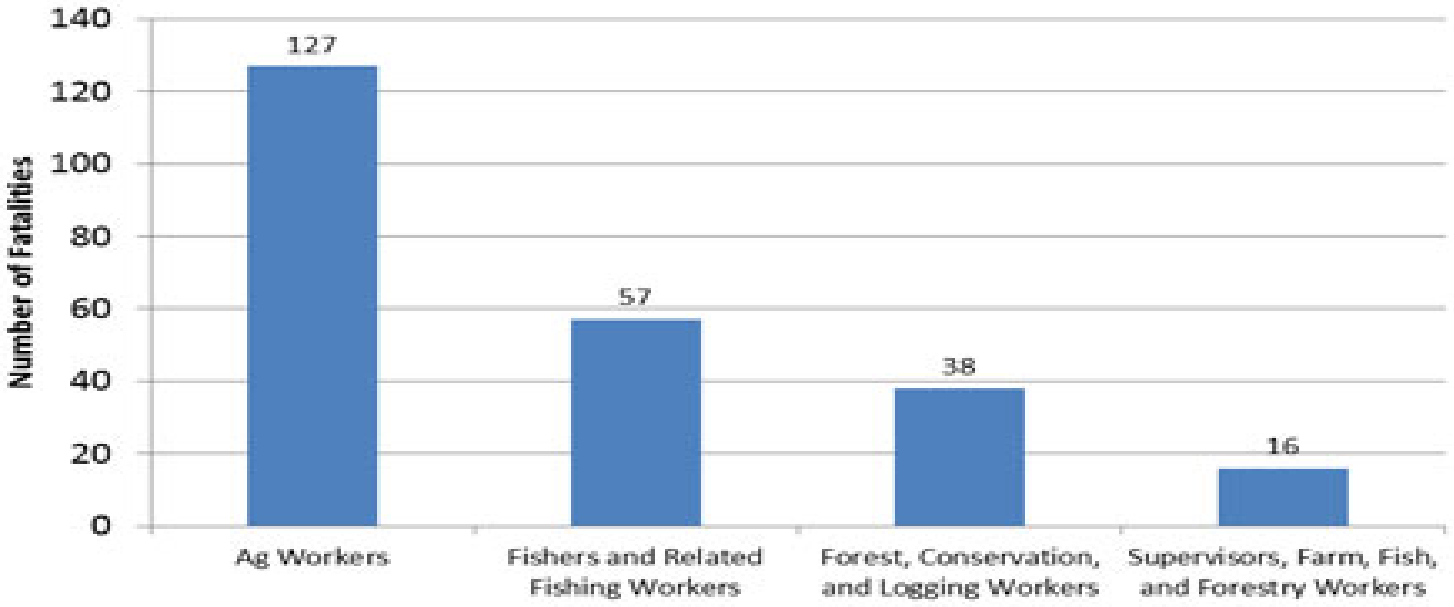


Center for Disease Control

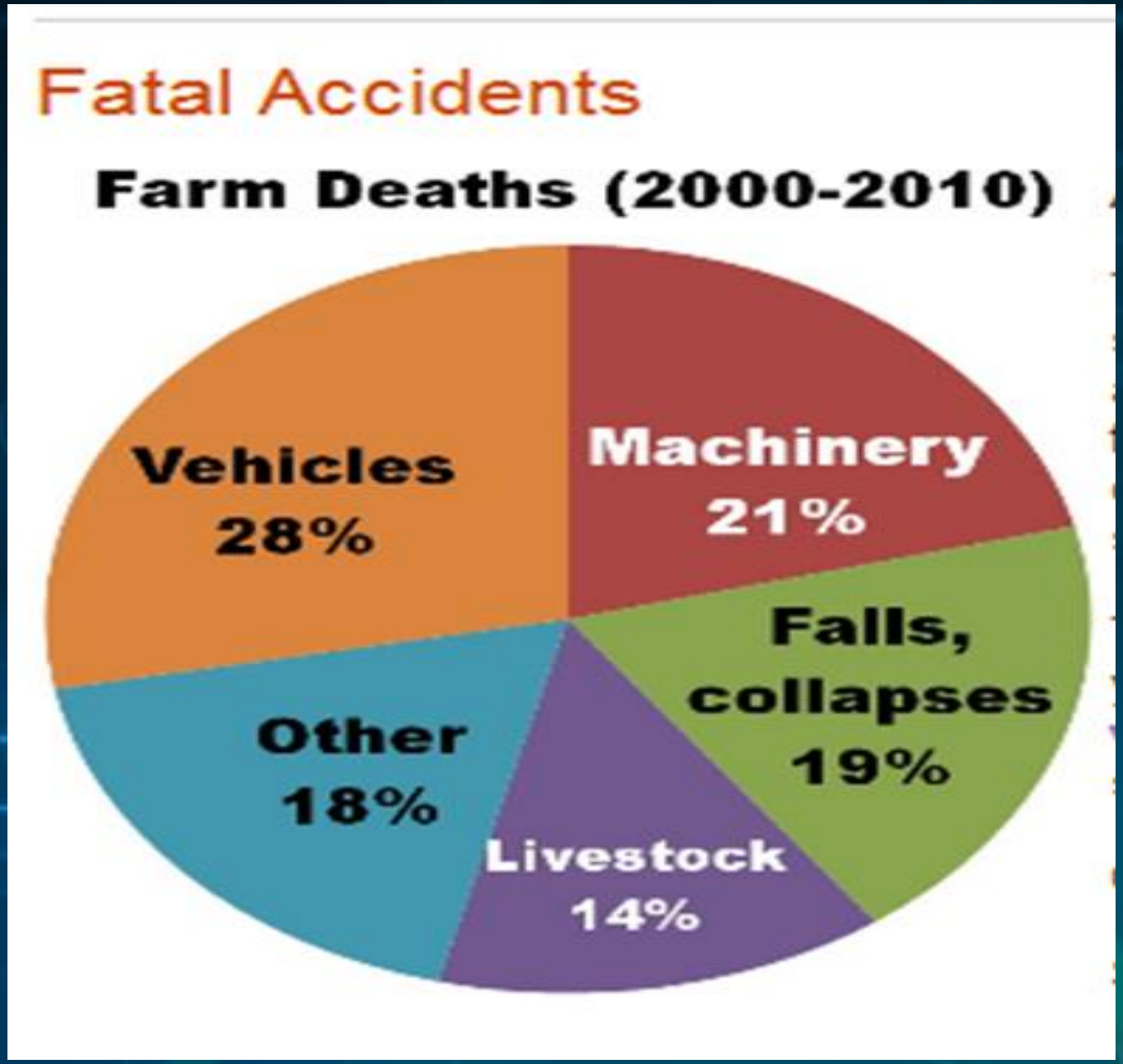
NUMBER OF NONFATAL OCCUPATIONAL INJURIES AND ILLNESSES INVO
INJURIES BY SELECTED WORKER AND CASE CHARACTERISTICS, UNITED

Characteristic	Nonfatal cases[b]	Fatalities
Total	16,080	672
Sex		
Men	13,370	648
Women	2,580	24
Age		
Under 16	—	8
16 to 19	610	14
20 to 24	2,110	32
25 to 34	3,910	68
35 to 44	3,680	93
45 to 54	3,200	117
55 to 64	1,800	137
65 and over	370	201
Occupation		
Management, business, and financial	450	327
Professional and related	170	—
Service	420	15

Fatal Occupational Injuries by AgFF Occupation Group, U.S., 2009



Fatal Accidents



http://www.hsa.ie/eng/your_industry/agriculture/#top

National Occupational Research Agenda (NORA)

- Began in 1996
- Stimulate knowledge, generate research and improved safety and health practices
- Collaboration of government, academia, industry and labor
- Guidance about research prioritization, evidence-based practice, evaluation and long-term surveillance
- 8 different sector councils

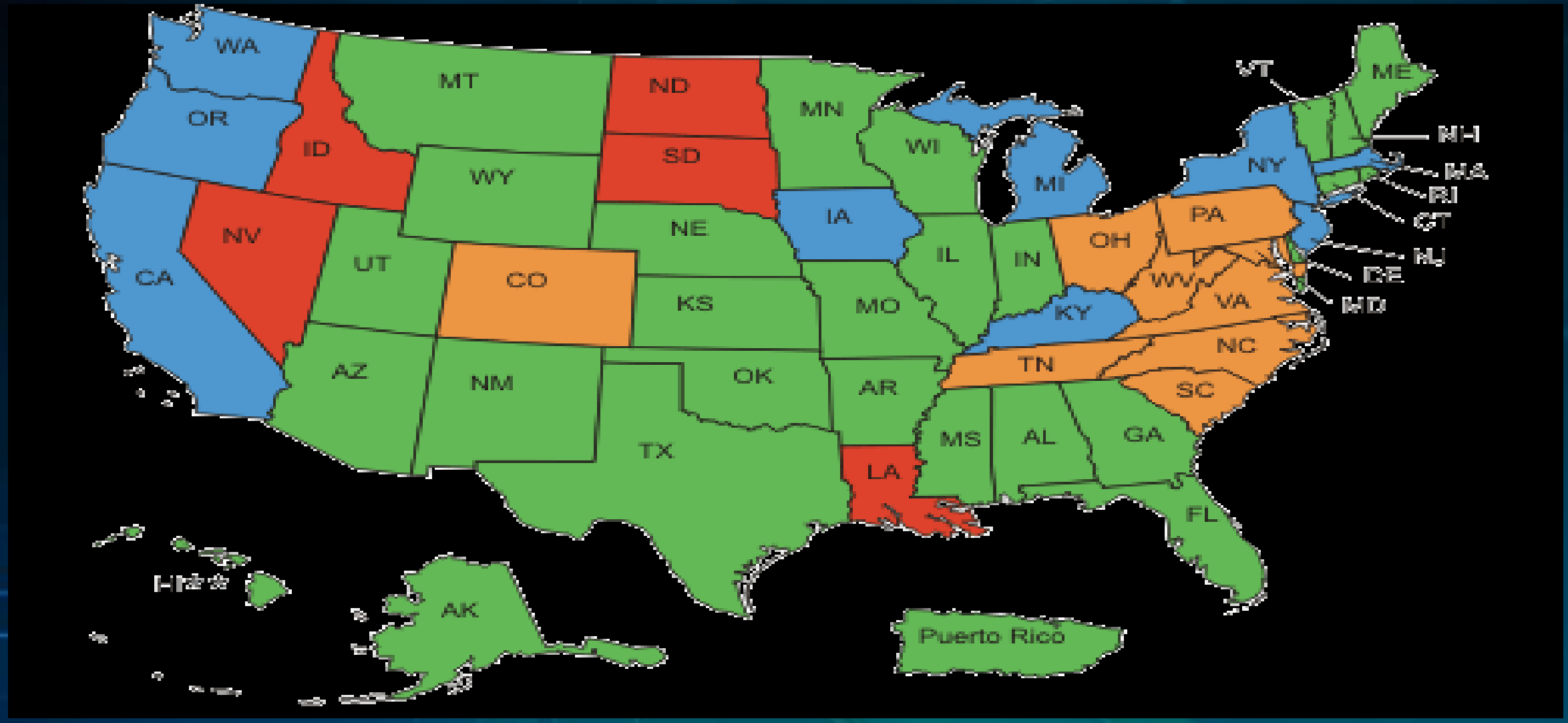
National Occupational Research Agenda (NORA)

- Strategic Goals
  - Surveillance
  - Vulnerable Workers
  - Outreach, Partnerships and Communications
  - Agricultural Safety
  - Agricultural Health
  - Forestry Safety
  - Forestry Health
  - Fishing Safety
  - Fishing Health

http://www.cdc.gov/niosh/nora/comment/agendas/AgForFish/pdfs/AgForFishDec2008.pdf

NIOSH FACE Program

- Fatality Assessment and Control Evaluation
- Research program
- Identify and study occupational fatalities
- Deaths associated with machinery, foreign born workers, energy production and construction falls
- State program began in 1989



State FACE

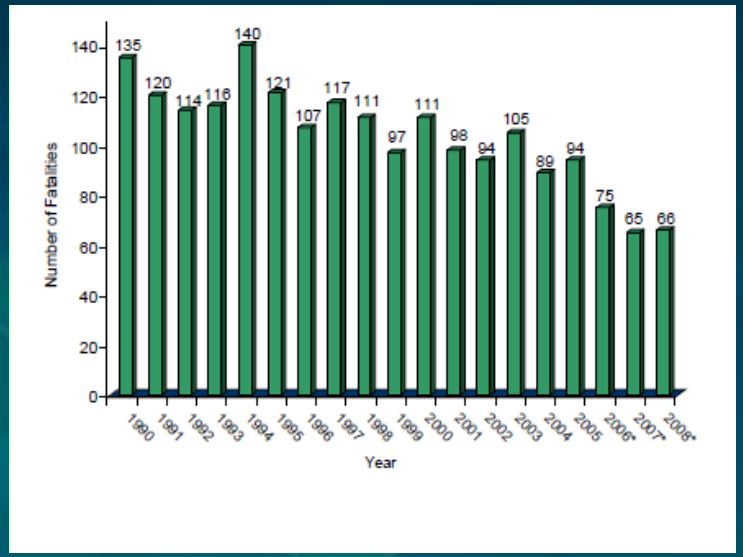
NIOSH FACE

Non-FACE where investigations have occurred

States without any FACE investigations

Canadian Agricultural Injury Reporting

- Established in 1995
- Comprehensive database of injuries and fatalities
- Run by volunteers through grant assistance
- Work provincially to collect data from stake holding agencies
- Investigations and data collection



Current Data

- Lack of reporting systems
- "Donut Hole" excluding family farm
- Lack of medical evaluation

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment
www.vdh.virginia.gov

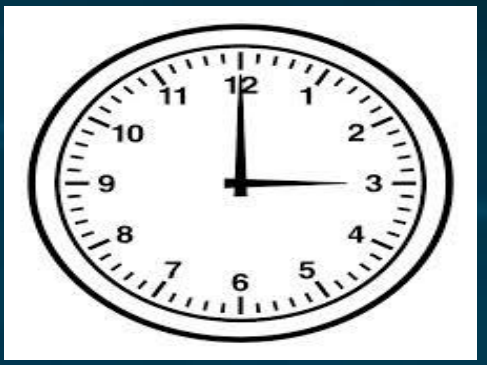
Agricultural Trauma

- Most debilitating injury/illness

- Most likely to encounter as first responder

Why are injuries occurring?

- Stress
- Long hours
- Solitude
- Weather
- Hazardous situations
- Familiarity
- Tradition



How are injuries occurring?

- Machinery
- Animal Handling
- Field/crop work

Mechanisms of Injury

- Tractors
  - 50% of fatalities
  - Overturns = 50%
    - Side – 85% of total
    - Rear – 85% are fatal
  - High center of gravity/rough terrain

Mechanism of Injury

- Tractors
  - Run-overs
    - 50% due to falling from tractor
    - 27% bystanders
    - Bypass starting

"2 sleeping children & 1 sleeping dog makes 1 cramped tractor."

Mechanism of Injury

- Tractors
  - Roadway collisions
    - 13% fatal
  - Wide loads, slow speed, inadequate markings or lighting, turning across traffic

Case Study

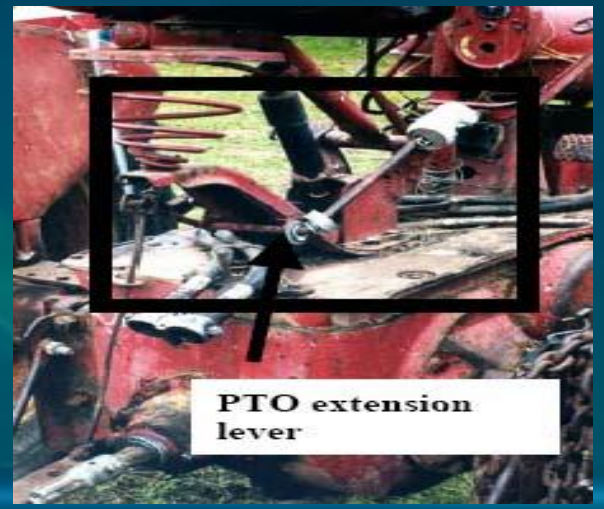
- September 2, 2003
- 78 yo male
- Died when tractor rolled over
- Cutting brush on hillside
- Attempted to drive tractor backward up hill then turned to align parallel with hill
- Slope 20-30%
- Tractor rolled twice, coming to rest on victim

Mechanism of Injury

- Machinery
  - Combines, balers, mowers, rakes
    - Slips and falls
    - Belts and pulleys
    - Augers
    - PTO shaft

Case Study

- May 23, 2003
- 13 yo killed
- Entangled in ungaurded PTO shaft
- Older model tractor w/o shield in place
- Owner-modified extension lever to activate PTO
- Unknown how victim dismounted tractor or how PTO shaft was engaged



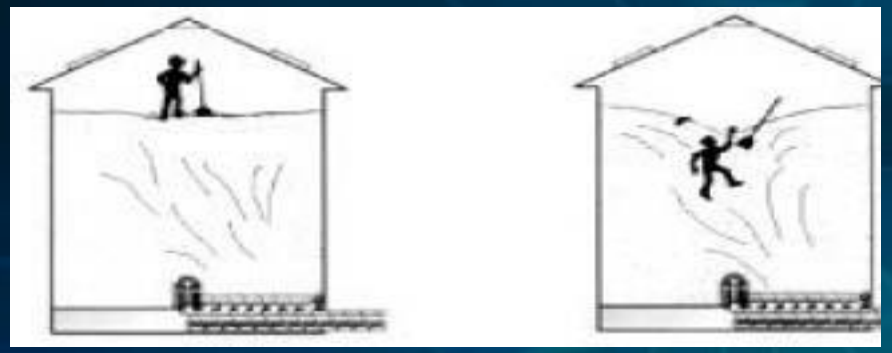

MASSEY FERGUSON

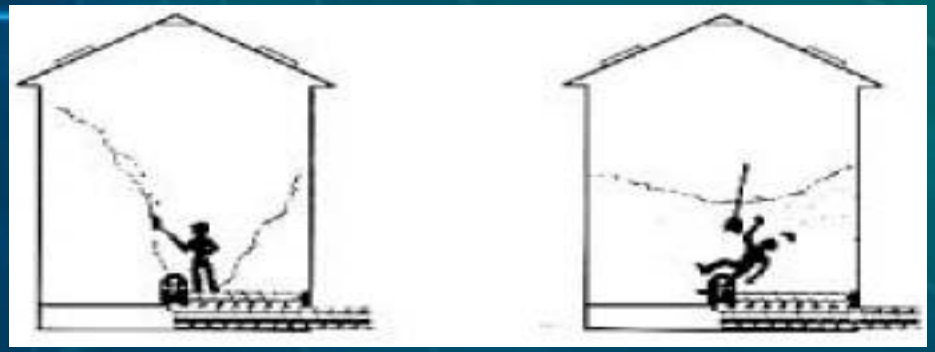
Case Study

- 38 yo male
- Adjusting belt on pickle harvester
- Slipped
- Arm trapped in roller
- Amputated at shoulder
- Victim called 911

Mechanism of Injury

- Silos





Case Study

- 64 yo male
- Unloading corn from 12,000 bushel silo
- Started grain auger
- Climbed into silo to “walk” corn down
- Unwitnessed
- Not found for 4 hours
- Family shoveled by hand for 2 hrs before finding victim

Mechanism of Injury

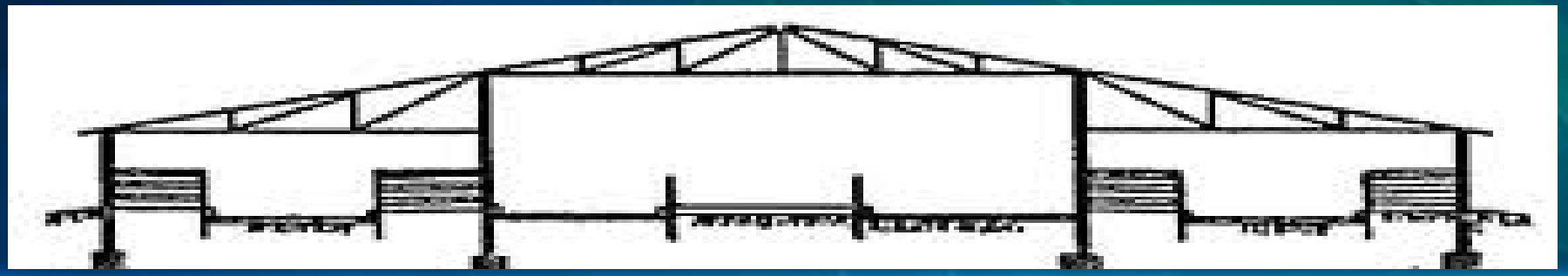
- Animals
  - Aggressive
  - Unpredictable
  - Size
  - Small spaces

Case Study

- 58 yo male
- Transported group of cattle including 3yo Angus bull to new field
- Bull became agitated
- Attempted to calm animal which charged
- Owned bull ~14mo
- Began to show aggressive behavior

Mechanism of Injury

- Confined Spaces
  - Manure Pits
    - Hydrogen Sulfide
    - Ammonia
    - Methane
    - Carbon Monoxide
    - Drowning
    - Chemical fumigants



ROCKINGHAM COUNTY
Four Family Members, Farmhand Killed by Gas Fumes in Manure Pit

By Bill Brubaker
Washington Post Staff Writer
Wednesday, July 4, 2007

Four members of a Shenandoah Valley dairy farming family and a hired hand died Monday evening after breathing methane gas fumes inside a manure pit, Rockingham County authorities said yesterday.

The deaths occurred in rapid succession, as the hired hand tried to save the farmer, who was overcome with fumes while working inside the pit, which was enclosed and poorly ventilated, authorities said. The farmer's wife and two daughters then jumped into the 10-foot hole, where they also died from exposure to the odorless gas, a byproduct of liquefied manure.

Federal safety officials have been warning farmers about the dangers of entering manure pits for almost two decades.

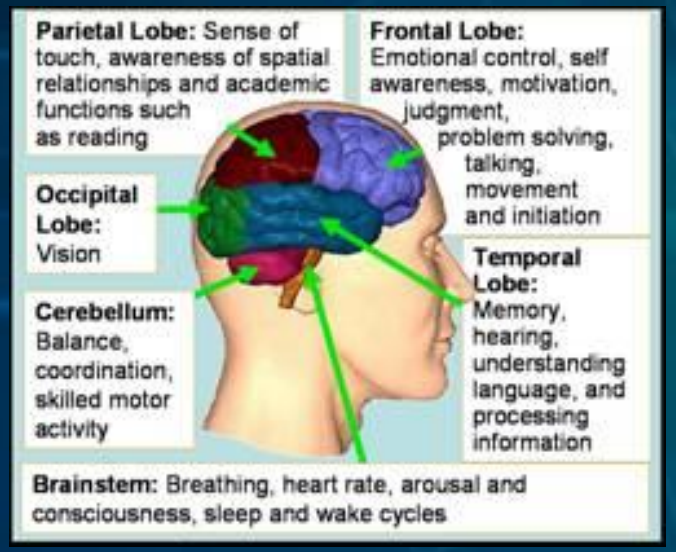
The National Institute for Occupational Safety and Health warned in a 1990 bulletin that "many farm workers appear to be unaware of the immediate danger posed by entry into manure pits. Like other types of confined spaces, manure pits present special problems regarding worker awareness of hazards."

Common Injuries of Concern

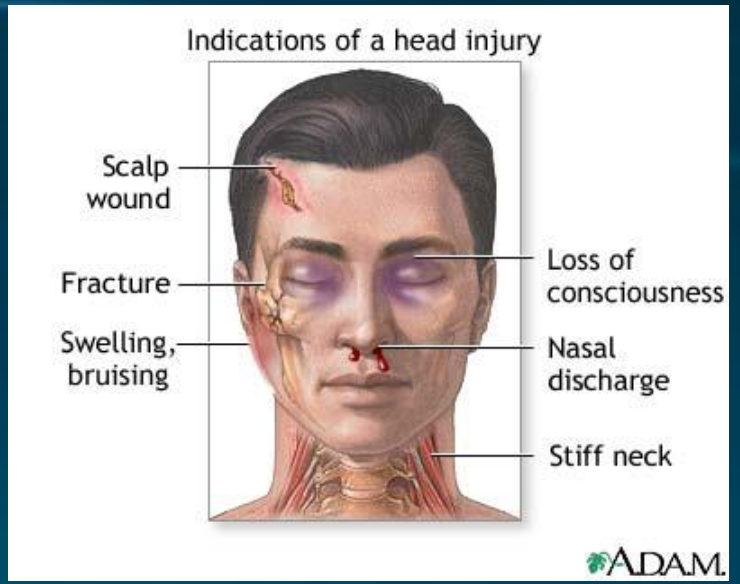
- Head trauma
- Blunt force trauma
- Penetrating Trauma
- Crush injuries
- Amputation/Degloving
- Fractures

Head Trauma

- Loss of consciousness
- Intracranial pressure
- Cerebral perfusion
- Kellie-Monro principle

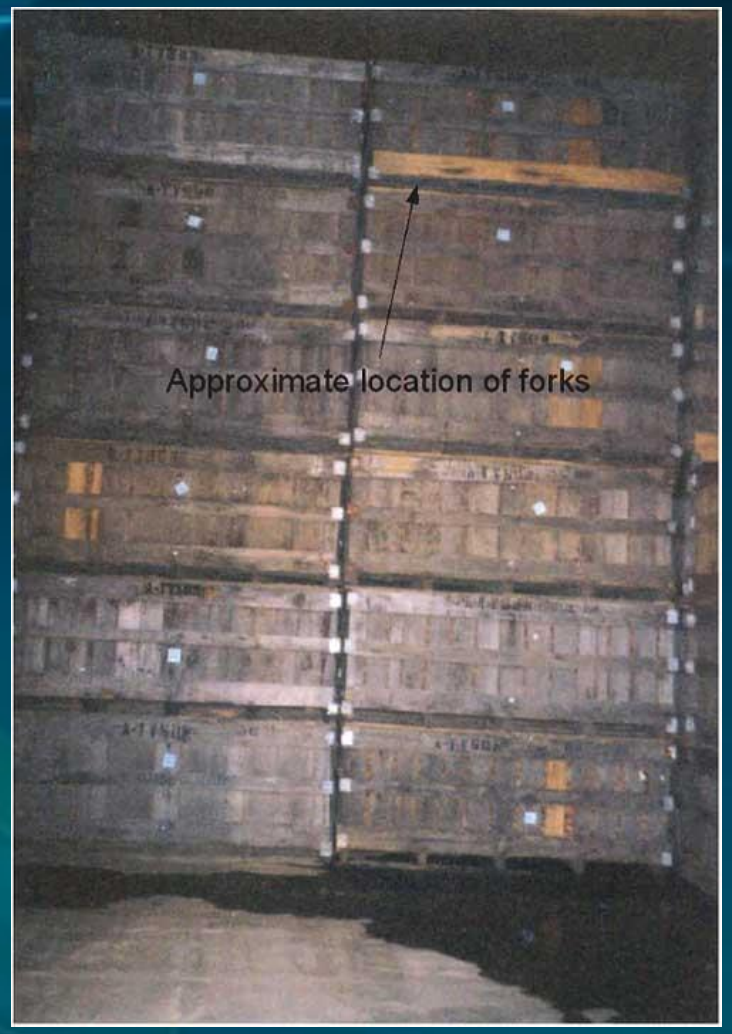


- Concussion
- Diffuse Axonal Injury
- Hematomas
- Fractures
- Open wounds
- Traumatic Brain Injury



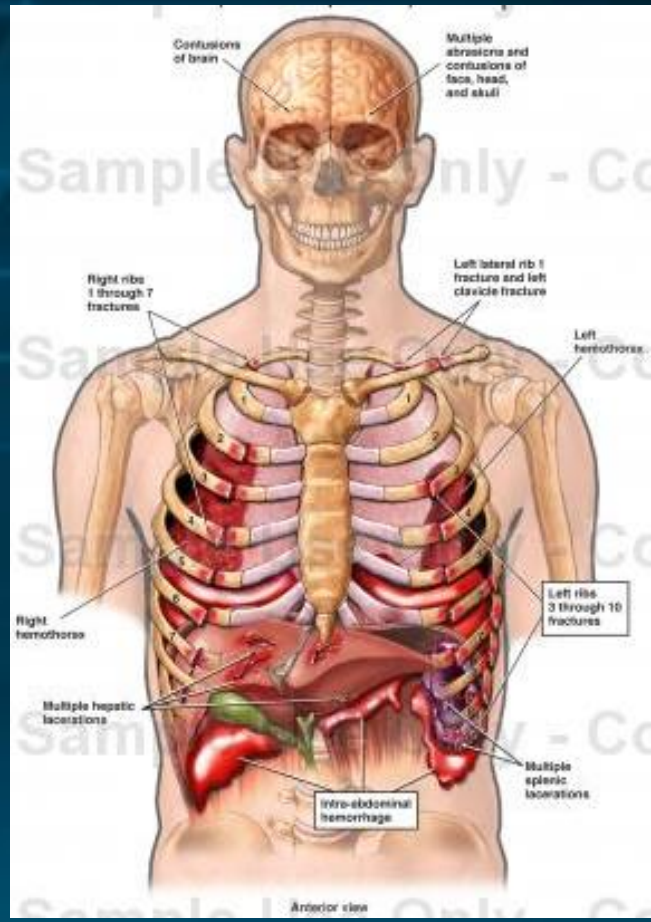
Case Study

- 37 yo Hispanic female
- Standing on forklift forks
- Packing sweet potatoes
- Fell 20 ft
- COD: Depressed skull fracture, epidural



Blunt force injuries

- Head, Chest and Abdomen
- Physical injury due to impact
- Compression, Deceleration
- Outward signs not indicative of internal injury
- High level of suspicion



Case Study

- 35 yo male
- Unfamiliar tractor, unfamiliar field
- 45* slope, 6 ½ bank
- Tractor rolled once over victim
- Rolled second time, drove into tree
- COD: blunt force trauma head and chest

Penetrating Trauma

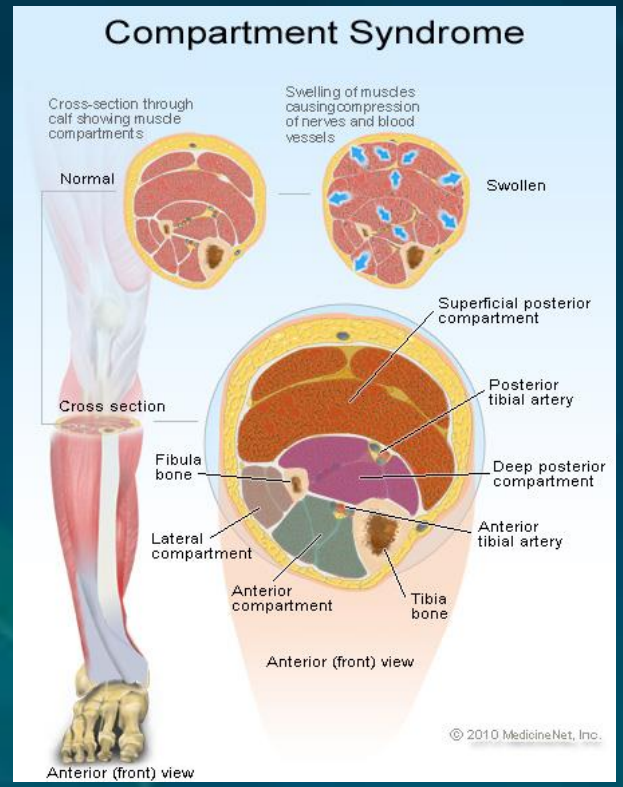
- Mechanical parts, flying objects, hydraulic injection
- Soft tissues are breached
- Impalements, Shrapnel
- Cavitation, shock wave – common to high velocity projectiles
- Significance dependent on body area
- Surgical disease

Crush Injuries

- Due to high degree of force or pressure
- Causes muscle swelling, destruction and neurological compromise
- Compartment syndrome
- Crush syndrome – Reperfusion syndrome
- "Smiling death"

Table 1: Chemicals, Enzymes and Compounds Released During a CS/CI Event

Chemical	Effects
Histamine	Vasodilation, bronchoconstriction
Leukotrienes	Lung injury, hepatic injury, development of systemic inflammatory response syndrome (SIRS) and acute respiratory distress syndrome (ARDS)
Lysozymes	Cell-digesting enzymes that destroy cellular structures
Nitric oxide	Vasodilation
Phosphate	Displaces the calcium balance, leading to hypocalcemia and ultimately, cardiac dysrhythmias
Prostaglandins	Vasodilation, lung injury
Uric acid	Acidifies urine, promoting renal failure and eventually SIRS and disseminated intravascular coagulation (DIC)

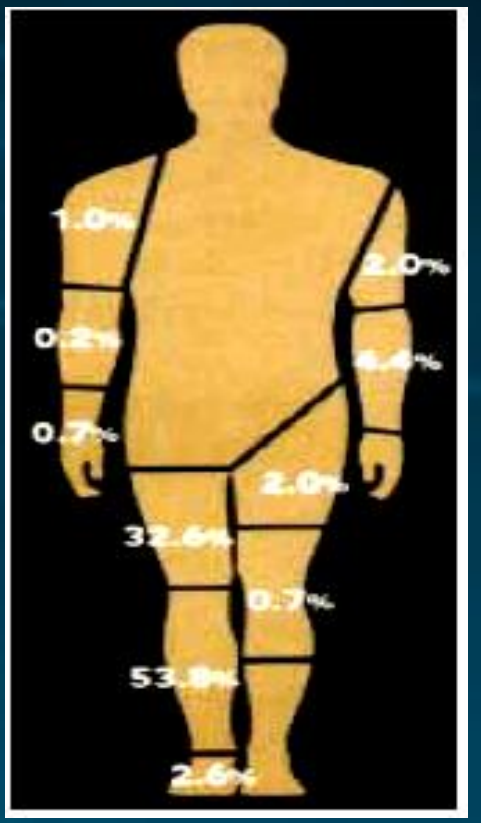


Case Study

- ~24 yo male
- Working alone
- Loaded hay wagon to take to barn
- After pulling hitch pin, wagon rolled forward
- Pinned at pelvis between tractor and wagon
- Trapped 6 ½ hours before being found

Amputation/Degloving

- Removal of a body part
- Agriculture is one of most common causes
- Entanglement, entrapment, crush, infection
- Bleeding, shock

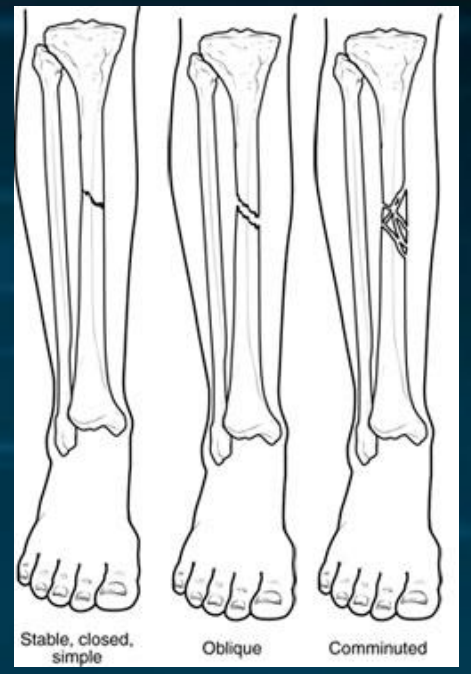


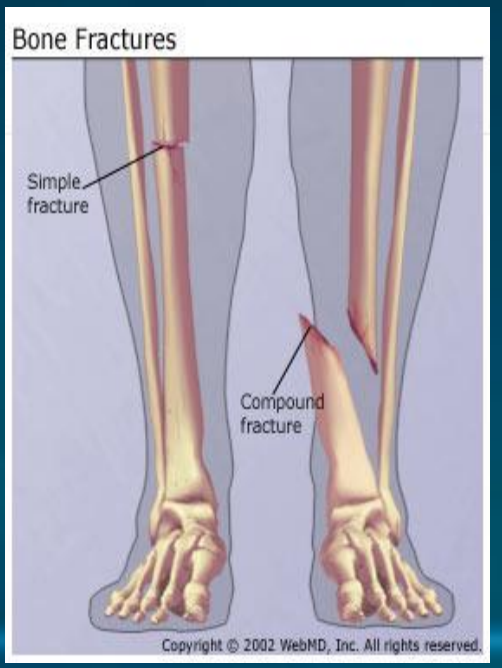
Fractures

- Occur when physical force exerted on bone exceeds strength of bone
- Trauma is most common cause of fracture
- Falls, machinery entanglement and entrapment,

animals

- Complicated by infection, nerve damage, bleeding





Unique Features of Ag Injuries

- Severity
- Location
- Delay in finding pt
- Physical access
- Entrapment
- Weather
- Specialized tools
- Hazardous situations
- Lack of training
- Trauma center/ Transport
- Chemicals/ Pharmaceuticals
- Co-morbidities

Unique Features of Ag Injuries

SEVERITY

LOCATION

Unique Features of Ag Injuries

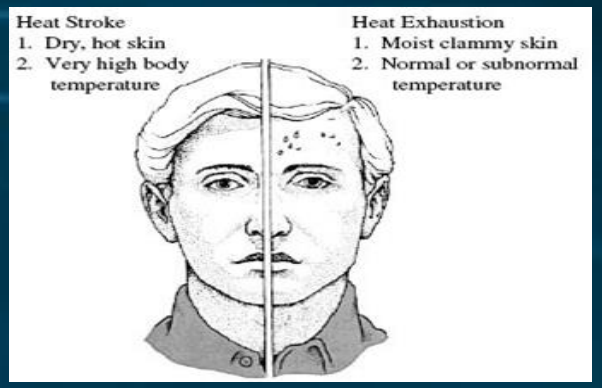
DELAY IN FINDING PATIENT

PHYSICAL ACCESS

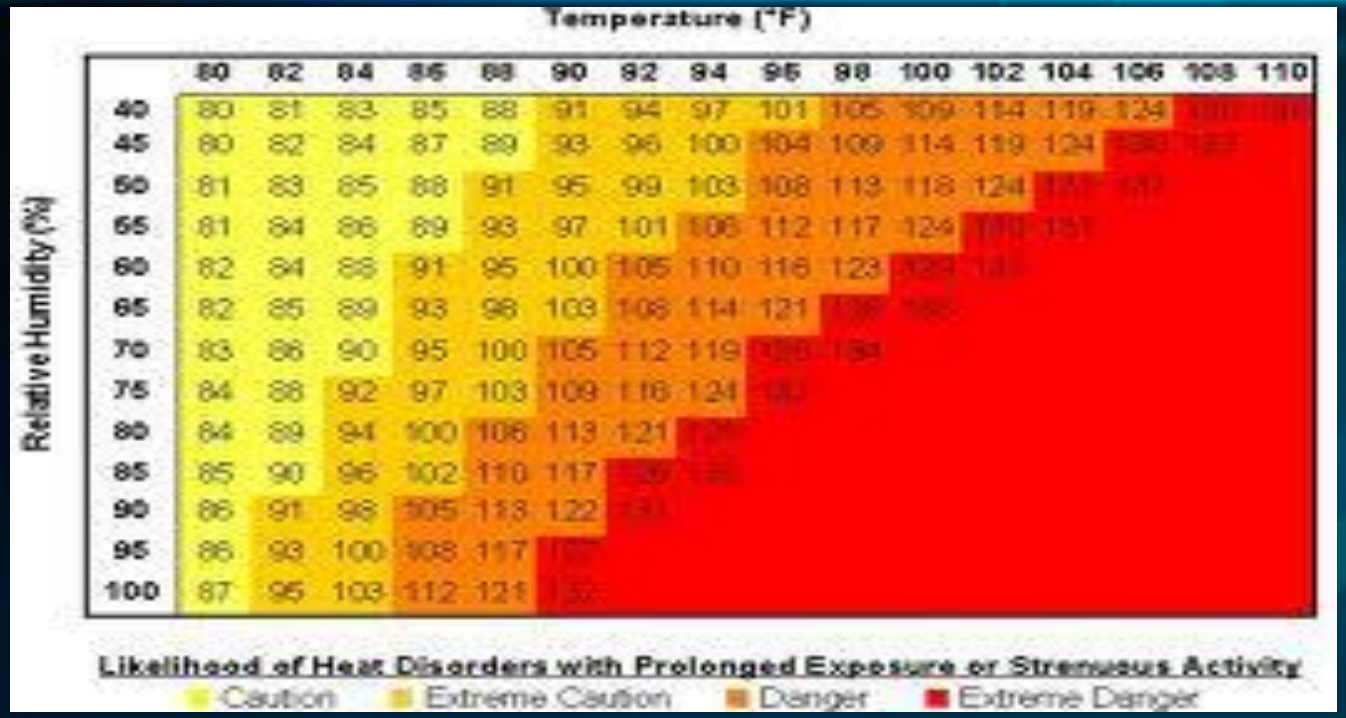
Unique Features of Ag Injuries

ENTRAPMENT

WEATHER




LIVESTOCK FARMERS TAKE CARE OF THEIR ANIMALS
365 DAYS A YEAR.
THERE ARE NO SNOW DAYS.



Heat Index

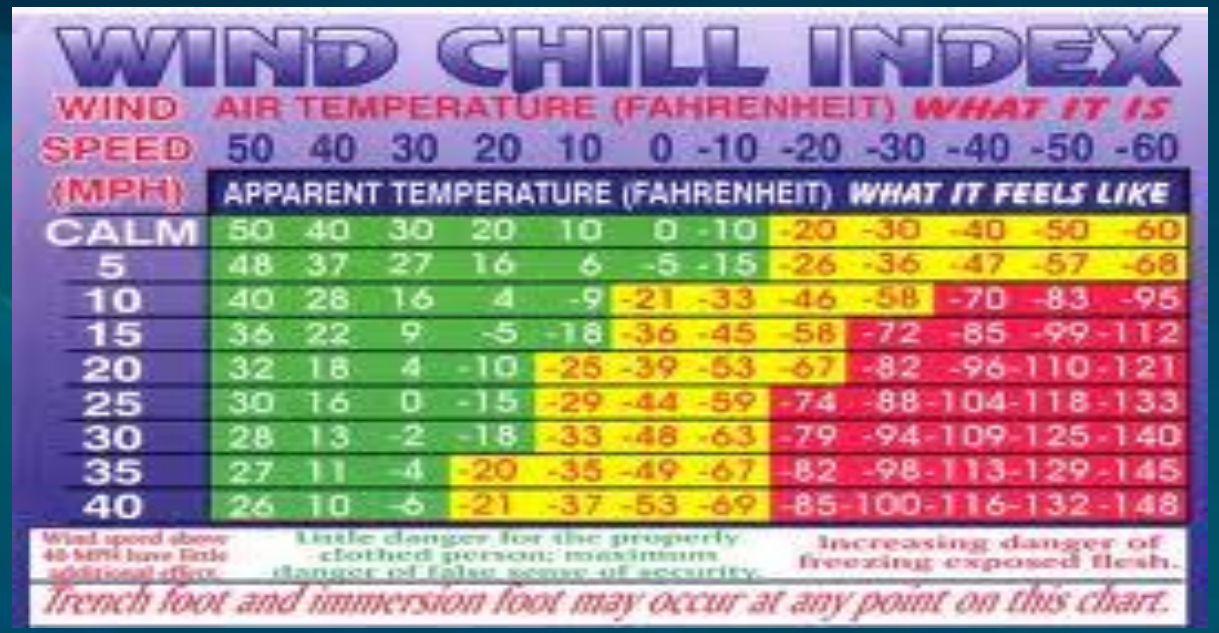
90 deg @ 80% humidity
Temp 113 – Danger of heat disorder

Can lose up to 1L of fluid per hour

Wind chill factor

40 mph winds @ 20 deg
-21 degrees, moderate danger if properly clothed

This also applies to rescuers!!!



Case Study

- 44yo migrant farm worker
- Arrived from Mexico July 21
- July 24 assigned to tobacco field
- Began work at 7am
- Heat Index 100-110
- 3pm not feeling well
- Taken to house and left
- Found unconscious 45 min later
- COD: heat stroke, core body temp 108

Unique Features of Ag Injuries

SPECIALIZED TOOLS

HAZARDOUS SITUATIONS

Unique Features of Ag Injuries

LACK OF TRAINING

TRAUMA CENTER/TRANSPORT

Unique Features of Ag Injuries

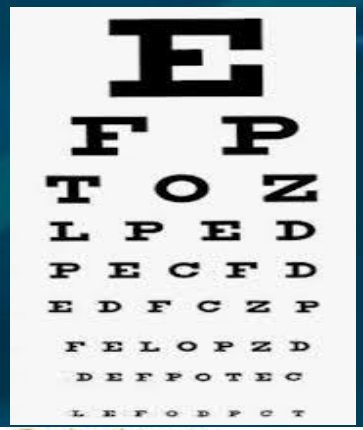
PHARMACEUTICALS

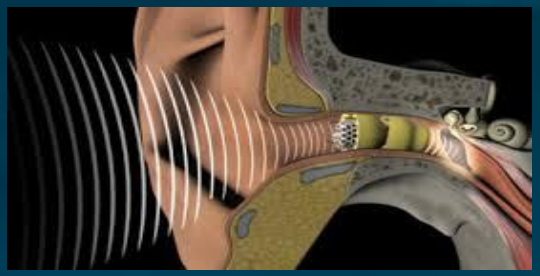
CHEMICALS

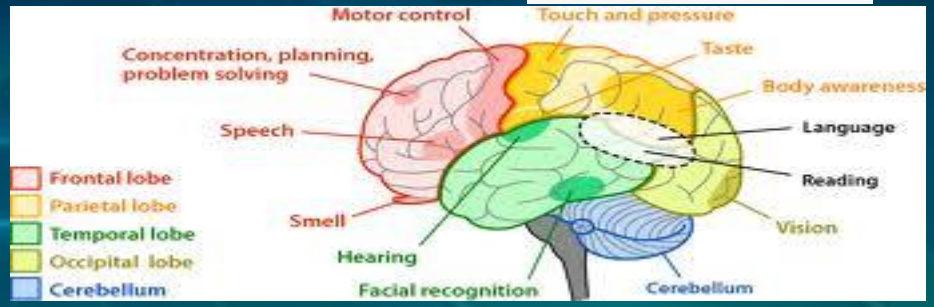
- March 8, 2003
- 38 yo cattleman
- Preparing to vaccinate heifer and had 12cc syringe in hand
- Charged by another cow and knocked to ground
- Injected unknown amount of antibiotic

Unique Features of Ag Injuries

- **Co-Morbidities**
  - Diabetes
  - Hypertension
  - Heart Disease
  - CVA
  - Arthritis
  - Vision Loss
  - Hearing Loss
  - Medications







Triad of “T’s”:

Excessive Time until treatment

Excessive Trash in wound

Excessive Trauma to tissue and organs.

Preparedness

- Farm Machinery Extrication
  - Machinery upset
  - Entrapped victims
  - Grain bins
  - Toxic gasses
  - Ag chemicals
- FarMedic Course
  - Developed by Cornell University
  - Classroom, farm tours and extrications
  - Emphasizes cooperation
  - More specialized rescue techniques

SCENE SAFETY

What is in the future?

- Increase research concerning agricultural injuries, particularly on small family farms

- Raise awareness about the burden of injuries and death related to agricultural

- Promote on farm safety practices

- Develop reporting system to collect injury data

Virginia Farm Bureau creates website for the reporting of farm accidents

By Associated Press, Published: May 6

RICHMOND, Va. — The Virginia Farm Bureau has launched a website for reporting farm accidents.

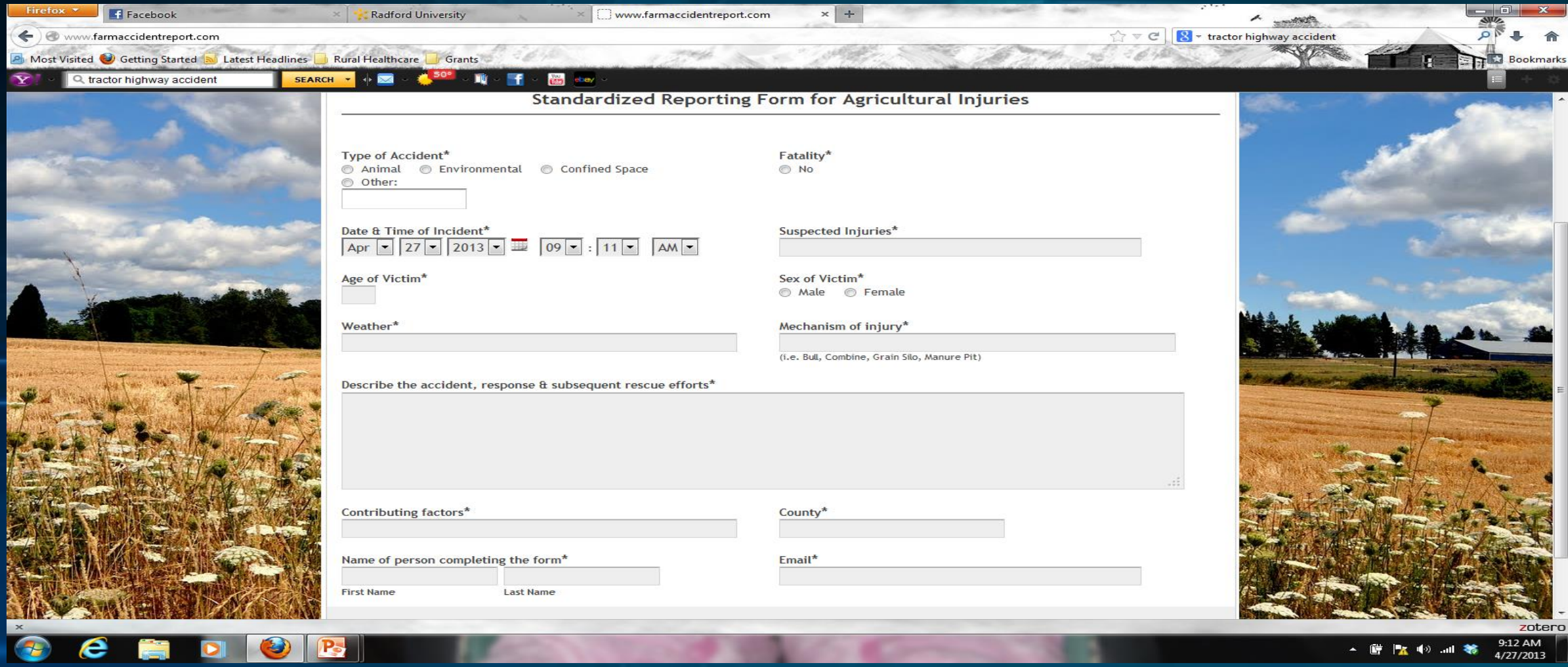
The site, FarmAccidentReport.com, allows anyone to report accidents they witness on Virginia farms.

Jimmy Maass is the Farm Bureau's safety manager. He says the website is intended to make it easier for first responders and others to report accidents so the Farm Bureau can compile accurate information on farm accidents.

According to Farm Bureau findings, since 1994 a total of 107 people have died when their tractors overturned; 61 were involved in unspecified tractor or equipment mishaps; and 49 were run over by tractors or other farm equipment.

Sixty-one other farm deaths were attributed to operating farm equipment on public roads and to incidents involving animals or all-terrain vehicles.

Virginia Farm Bureau
www.farmaccidentreport.com




Any Questions?

References

- http://www.nsc.org/search/results.aspx?k=agricultural&start1=31
- http://agrability.org/Documents/AgrAbility_20_YR_WEB.pdf
- http://www.sdstate.edu/abe/extension/sofy/resources/upload/PTOSafety.pdf
- http://www.nasdonline.org/document/1672/d001553/farm-accident-rescue.html
- East Carolina University, Agricultural Medicine Course Materials, Jan 2013-April 2013
- http://www.nasdonline.org/static_content/documents/926/d000767.pdf
- http://www.nasdonline.org/browse/236/personal-safety-and-health.html
- http://www.nasdonline.org/document/129/d001677/cold-weather-exposure.html
- http://www.nasdonline.org/document/137/d001702/heat-stress.html
- http://www.nasdonline.org/document/98/d001655/whmis.html
- http://www.farsha.bc.ca/resources_publications.php?resource=233
- http://www.mayoclinic.com/health/hypothermia/DS00333/DSECTION=symptoms

References

- http://www.nass.usda.gov/Statistics_by_State/Virginia/Publications/County_Estimates/augusta.pdf
- http://www.cdc.gov/niosh/face/brochure.html
- http://www2a.cdc.gov/NIOSH-FACE/state.asp?state=ALL&Incident_Year=ALL&Category2=0001&Submit=Submit
- https://en.wikipedia.org/wiki/Amputation
- http://www.huffingtonpost.com/2012/07/20/amputation-farmers-accidents_n_1690129.html
- http://farmagain.com/amputation.html
- http://farminjuryresource.com/farming-injuries/amputation-victims/
- http://www.imba.com/resources/nmbp/assessing-and-treating-head-injuries
- http://www.rch.org.au/clinicalguide/guideline_index/Head_Injury_Guideline/
- http://en.wikipedia.org/wiki/Blunt_trauma
- http://www.nlm.nih.gov/medlineplus/ency/article/000024.htm
- http://orthoinfo.aaos.org/topic.cfm?topic=a00139

References

- http://www.vdacs.virginia.gov/agfacts/index.shtml
- www.wikipedia.com
- http://www.cair-sbac.ca/about-cair/who-we-are/
- Donham, L and Thelin, A. (2006). Agricultual Medicine: Occupational and Environmental Health for the Health Professionals
- www.google.com: Google Images
- http://www.bedfordfarmtour.org/
- http://en.wikipedia.org/wiki/Crush_syndrome
- http://www.bt.cdc.gov/masscasualties/blastinjury-crush.asp
- http://www.emsworld.com/article/10321291/beyond-the-basics-crush-injuries-and-compartment-syndrome?page=4
- http://www.webmd.com/a-to-z-guides/understanding-fractures-basic-information
- http://www.cair-sbac.ca/wp-content/uploads/2012/03/National-Report-1990-2008-FULL-REPORT-FINAL.pdf