MISSISSIPPI STATE UNIVERSITY EXTENSION

Petroleum Product Poisoning of Cattle

Petroleum fractions have been used alone or as part of external parasite control product mixtures to combat flies and ticks in cattle for many years. In appropriate applications, they may be applied to the skin with few or no harmful effects on the animals. However, exposing cattle to large quantities of petroleum hydrocarbons or over prolonged periods can lead to petroleum product poisoning. This condition results from cattle exposure to petroleum, petroleum condensate, gasoline, diesel fuel, kerosene, crude oil, or other petroleum-based hydrocarbons. It can cause production losses, animal health problems, and possible death.

Sources of Petroleum Hydrocarbon Exposure

It is important for cattle producers to be aware of possible sources of petroleum hydrocarbon exposure and take appropriate steps to reduce or eliminate exposure risk. Animals may ingest petroleum hydrocarbons out of curiosity, in an attempt to add salt to their diets, when water is not available, or when feedstuffs or water supplies are contaminated. They can also be exposed to petroleum hydrocarbons through skin contact. In addition, cattle risk exposure when they are confined in areas with poor ventilation where these products are used or stored.

Fuels or other hydrocarbon materials left in open or leaky containers accessible by cattle put animals at risk for petroleum product poisoning. Toxic additives or contaminants such as lead make older formulations of lubricating oils and greases particularly hazardous to cattle. Leaded gasoline, used engine oil filters, used motor oil, grease (which may contain 50 percent lead), and oil field wastes are just some of the petroleum-related items that may contain lead. Cattle will readily drink or lick these oils and greases and can die after only small amounts are consumed. Lead poisoning results in anemia, blood vessel damage, bleeding, kidney damage, liver damage, and tissue oxygen deprivation, ultimately causing sterility, abortion, and death.

Crude oil is commonly produced and transported on and across land used for grazing by cattle. Cattle exposure to petroleum-derived hydrocarbons may occur at or near petroleum exploration and production sites. Crude oil or petroleum hydrocarbon components of crude oil can exist as liquid or vapor, attached to soil, or dissolved in water. Benzene, toluene, ethylbenzene, and xylene (BTEX) are petroleum components that are particularly soluble, mobile, and toxic, and these components are present in varying amounts in crude oil. Crude oil from accidental leaks and spills such as pipeline breaks, accidental storage tank releases, and car accidents can contaminate soil, forage, feed, and/or water. Cattle may then consume these contaminated items or become exposed through other means.

Incidental contaminated soil ingestion, contaminated water ingestion, and direct petroleum ingestion are the most likely avenues for crude oil exposure by cattle. Cattle may consume contaminated soil inadvertently during grazing or purposely ingest salty-tasting soil. The amount of contaminated water ingested by cattle varies by animal age, physiological status (pregnancy, lactation, growth, fattening), breed, size, diet composition, and environmental temperature.

Viscosity describes the "thickness" of a fluid. Low-viscosity fluids such as water flow freely, whereas highly viscous fluids such as honey resist flow more so. The viscosity of petroleum and petroleum-derived hydrocarbon mixtures influences animal exposure risk. Lowly viscous products such as gasoline, naphtha, and kerosene are more likely to be inhaled into the lungs and may induce vomiting, which increases aspiration hazard. These low-viscosity products also tend to irritate the trachea and lung tissues. In comparison, more viscous petroleum-based hydrocarbons are less likely to be breathed in and tend to be less damaging to lung tissue.

Evaluating Exposure Risk

It is possible to evaluate the potential risk to cattle exposed to petroleum hydrocarbons at a site. A toxicity reference value (TRV) is the daily amount of chemical exposure at or below which no adverse health or production effects are expected, even if exposure occurs over an extended duration. A TRV is determined from available toxicological data and expressed in milligrams of chemical per kilogram of cattle body weight. Toxicity

reference values are designed to help protect the herd from chemical toxicity (Table 1).

Risk-based screening levels (RBSL) are threshold concentrations of contaminants in soil and water, at or below which little to no likelihood of significant unacceptable risks to cattle are expected. Concentrations of petroleum hydrocarbons in soil in milligrams per kilogram (mg/kg) and water in milligrams per liter (mg/L) at a site can be compared to RBSL protective of cattle (Tables 2 and 3).

Signs of Petroleum Poisoning in Cattle

Monitor cattle closely for signs of petroleum poisoning, including pneumonia, smell of petroleum on breath, diarrhea, smell of petroleum in manure, and oil around mouth, nostrils, and legs. Petroleum product poisoning damages hide, nervous, respiratory, gastrointestinal, kidney, and liver tissue depending on the route of exposure. Skin lesions may develop after repeated or severe exposure. The hide may become dry, cracked, or blistered.

Acute (severe) bloat can occur shortly after consumption of petroleum hydrocarbons and result in death, but this does not happen in all cases. It is more common after consumption of highly volatile petroleum products. Affected cattle may appear thin or lethargic within 24 hours of exposure and lasting up to 2 weeks depending on the dose and content. Rumen motility (movement) slows within the first day after ingestion.

Normal digestive function may not return in some cattle, leading to a chronic wasting condition. Low blood glucose (sugar) levels are also sometimes found several days after ingestion. Manure may not be affected until several days after ingestion and can include oil up to 2 weeks after petroleum product consumption. Manure pats may appear excessively dry. Some reports show increased diarrhea incidence after crude oil consumption.

Ingestion of large volumes of crude oil results in vomiting and aspiration into the lungs. Nervous system damage is usually associated with inhalation of petroleum-based products. Excitability, depression, shivering, head tremors, vision disruption, and incoordination can arise following lung absorption of petroleum hydrocarbons.

The most serious consequence of breathing in these hydrocarbons is pneumonia. Severe pneumonia; coughing; rapid, shallow breathing; reluctance to move; head held low; weakness; dehydrated appearance; and oily nasal discharge can be seen in animals that breathe in highly volatile mixtures. Death often follows within days. Pneumonia causes decreased white blood cell counts followed by increased white blood cell numbers, as well as changes to other blood components.

Reproductive losses, production losses, and animal death are possible outcomes of petroleum hydrocarbon exposure. Reproductive and developmental effects have generally been reported at higher doses than those reported for other health effects. Secondary infections are another concern with petroleum product poisoning.

Response Actions Needed

If petroleum product poisoning is suspected, immediately consult with a veterinarian. A veterinarian can diagnose the condition and initiate a proper treatment program. Provide detailed information on petroleum product exposure, animal production conditions, and signs of illness to help address the problem more quickly and effectively.

Conduct immediate and ongoing assessments of the distribution of oil or other petroleum products with potential to affect livestock, forage, and watering resources. Remove cattle from the contaminated area to prevent additional exposure to petroleum hydrocarbons. Provide them with uncontaminated fresh water and feedstuffs adequate for their nutritional requirements.

Identify and obey applicable environmental laws and standards to establish cleanup criteria for contaminated areas. Do not allow any cattle to return to these areas until appropriate cleanup steps have been taken to endpoints that are protective of livestock. Follow up with long-term monitoring of soil, water, and forage for petroleum hydrocarbon contamination in previously contaminated areas.

For more information on petroleum product poisoning or beef cattle production, contact your local MSU Extension office.

Table 1. Beef cattle toxicity reference values (TRV) for petroleum and petroleum-derived products.

Petroleum product	Beef cow[1] (mg/kg body weight/day)	Calf[2] (mg/kg body weight/day)
Crude oil	211	211
Benzene	5.95	10.3
Toluene	37.1	64.5
Ethylbenzene	4.86	8.43
Xylene	29.8	51.7
Low molecular weight polycyclic aromatic hydrocarbons	0.833	1.45
High molecular weight polycyclic aromatic hydrocarbons	0.167	0.289

[1]Beef cow weighing 1,000 pounds.
[2]Calf weighing 110 pounds.
Source: Adapted from Pattanayek and DeShields, 2003.

Table 2. Beef cattle risk-based screening levels (RBSL) for petroleum and petroleum-derived products in soil.

Petroleum product	Beef cow[1] (mg/kg)	Calf[2] (mg/kg)
Crude oil	44,894	44,894
Benzene	1,266	2,198
Toluene	7,901	13,715
Ethylbenzene	1,033	1,794
Xylene	6,331	10,990
Low molecular weight polycyclic aromatic hydrocarbons	177	308
High molecular weight polycyclic aromatic hydrocarbons	35.5	61.5

[1]Beef cow weighing 1,000 pounds, eating 25.1 pounds of feedstuffs per day.
[2]Calf weighing 110 pounds, eating 2.8 pounds of feedstuffs per day.
Source: Adapted from Pattanayek and DeShields, 2003.

Table 3. Beef cattle risk-based screening levels (RBSL) for petroleum and petroleum-derived products in drinking water.

Petroleum product	Beef cow[1] (mg/L)	Calf[2] (mg/L)
Crude oil	1,114	293
Benzene	31.4	14.3
Toluene	196	89.5
Ethylbenzene	25.6	11.7
Xylene	157	71.7
Low molecular weight polycyclic aromatic hydrocarbons	4.40	2.01
High molecular weight polycyclic aromatic hydrocarbons	0.880	0.402

[1]Beef cow weighing 1,000 pounds, drinking 22.7 gallons of water per day.
[2]Calf weighing 110 pounds, drinking 9.5 gallons of water per day.
Source: Adapted from Pattanayek and DeShields, 2003.

References

American Petroleum Institute. (2006). Protecting livestock: Answers to frequently asked questions about livestock exposure to crude oil in oilfield operations.

Getter, C. D., Taylor, E., & Macgregor-Skinner, G. (2002). Managing agricultural resources during oil spills: Case of the OSSA II pipeline spill in Bolivia, 2000. 2002 Freshwater Spills Symposium Proceedings. U.S. Environmental Protection Agency, Office of Emergency Management.

Merck and Co., Inc. (2008). Petroleum product poisoning. *Merck Veterinary Manual*.

Pattanayek, M., & DeShields, B. (2003). Characterizing risks to livestock from petroleum hydrocarbon exposure. 10th Annual International Petroleum Environmental Conference Proceedings

Stickney, J. A., Gates, M. M., Rainey, E. M., & Day, C. H. (2001). Determination of acceptable risk-based concentrations of BTEX in cattle's drinking water. 8th Annual International Petroleum Environmental Conference Proceedings.

Publication 2621 (POD-10-24)

Reviewed by **Brandi Karisch**, PhD, Associate Extension/Research Professor, Animal and Dairy Sciences. Written by **Jane A. Parish**, PhD, Professor and Head, North Mississippi Research and Extension Center.

MISSISSIPPI STATE UNIVERSITY EXTENSION

Produced by Agricultural Communications.

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. ANGUS L. CATCHOT JR., Director