

# Cattle Vaccine Handling and Management Guidelines

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## Introduction

STUDIES FROM the University of Arkansas<sup>1</sup>, the University of Nevada<sup>2</sup>, and the University of Idaho<sup>3</sup> have indicated that veterinary vaccine product efficacy is at risk due to improper handling and storage by vaccine retailers and livestock producers. Most animal vaccines require maintenance at refrigeration temperatures of 35–45°F. Yet these studies showed that anywhere from 25% to 76% of refrigerators used for vaccine storage in the livestock industry failed to maintain these temperatures.

In addition, other improper handling and storage procedures, including exposing vaccine to ultraviolet light from the sun or to temperature extremes and using improper injection techniques, can render vaccine less efficacious or even useless. Livestock do not gain immunity from vaccines that are damaged, destroyed, or altered through improper handling and storage practices. Furthermore, vaccines can be costly and average anywhere from \$0.25 per head to \$3.50 per head depending upon the vaccine utilized. These costs, although necessary, can be very expensive long term if vaccines are not effective in protecting your animals' health.

This publication gives best management practices to help producers, distributors, and retailers ensure vaccine use results in effective disease immunity in livestock. Its guidelines cover vaccine purchasing, storage in refrigerators and in coolers at chute-side, handling, injection techniques, and disposal.

## Vaccines and How They Work

INFECTIOUS DISEASE in beef cattle can cost producers a significant loss of production and profit. One way to reduce these losses is to increase the animal's ability to fight disease through good

vaccination practices. Vaccines stimulate the body's immune system to build immunity or resistance against disease-causing organisms. Most vaccines are manufactured by growing a particular organism that is later weakened or killed.

When a vaccine is introduced to the body, the immune system must first recognize it as a foreign antigen or protein, such as a virus, bacterium, toxin, or parasite. An immune response is then produced in which the body develops specific antibodies and immune cells to remove or kill the infectious agent. Memory cells are then developed for each antigen.

When the body is later re-exposed to the same antigen, the memory cells will recognize the infectious agent and remember the most effective way to protect the body. It generally takes 7 to 14 days after primary exposure for the body to develop immunity to an antigen and as little as 48 hours to mount an immune response to that same antigen in a vaccinated animal.

It is important to understand that some animals' immune systems fail to develop an immune response sufficient to create immunity to a disease. Factors contributing to this failure are inadequate nutrition, poor health, stress, and environmental conditions. Healthy animals on a sound nutrition program should develop the best immune response. However, remember that vaccinating your animals is not a 100% guarantee all vaccinated animals will gain immunity to that particular pathogen. The degree of protection is dependent upon animal health and vaccine efficacy at the time of administration.

## Killed vaccines

Two common types of vaccine are killed and modified-live. Killed vaccines are made by growing an organism in a growth medium. The organism is then inactivated

or killed by utilizing chemicals or heat. A killed vaccine can be produced for viruses, bacteria, or toxins. Adjuvants, which are specific chemical materials that help stimulate immunity and hold the organism at the injection site to strengthen the immune response, are regularly added to killed or inactivated vaccines.

Killed vaccines often require two separate inoculations over 2–4 weeks to obtain a full immune response. Therefore, it is very important to administer both inoculations. An example of a killed vaccine is Triangle® 5 by Boehringer Ingelheim. Triangle® 5 protects against infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD types 1 and 2), parainfluenza 3 (PI3), and bovine respiratory syncytial (BRSV) viruses. These and other killed vaccines are already constituted and ready to use when purchased.

### Modified-live vaccines

Modified-live vaccines (MLV) are made with a virus or bacterium that is attenuated, or weakened, so the organism will not cause disease in most healthy animals but will still stimulate immunity. These types of vaccine are not stable in solution so the isolates are freeze-dried to a cake in a vaccine bottle. To use a MLV, a special sterile liquid or a specified killed liquid vaccine is added to the “cake” to make a vaccine solution ready for injection.

Modified-live vaccines are very unstable and have a short efficacy life once they are reconstituted, often as short as 1–2 hours. Therefore, reconstitute MLVs only as needed. These vaccines should be mixed gently when reconstituted as some constituents in the vaccine may be damaged or destroyed when mixed too vigorously. Discard any MLV that is not used within 2 hours. An example of a MLV is Vista® Once SQ by Merck. Vista® Once SQ protects against IBR, BVD type 2, PI3, BRSV, bovine virus diarrhea virus (BVDV) type 1, *Mannheimia haemolytica*, and *Pasteurella multocida*.

### Temperature Effects on Vaccine

MOST ANIMAL HEALTH PRODUCTS require refrigeration at 35–45°F. University of Idaho<sup>3</sup> research conducted in 2010 found that 67% of tested producer refrigerators and 66% of tested retailer refrigerators were unacceptable. Temperature adjustment, monitoring, and improved record-keeping practices were some of the study’s recommendations for producers. Monitoring and improved employee training at the retail level were also recommended.

### Killed vaccines

Storing animal health products at temperatures below 35°F is the most damaging to killed vaccine products. Freezing temperatures will change the adjuvant

structure (figures 1 and 2). This change affects vaccine efficacy by altering the immune response to the antigen. Refrigerators that freeze vaccine are the worst! Frozen killed vaccines may have deadly consequences due to the release of bound toxins from the adjuvant. Take precautions to avoid freezing your vaccines and monitor their expiration dates. Do NOT use vaccines that are or have been frozen.

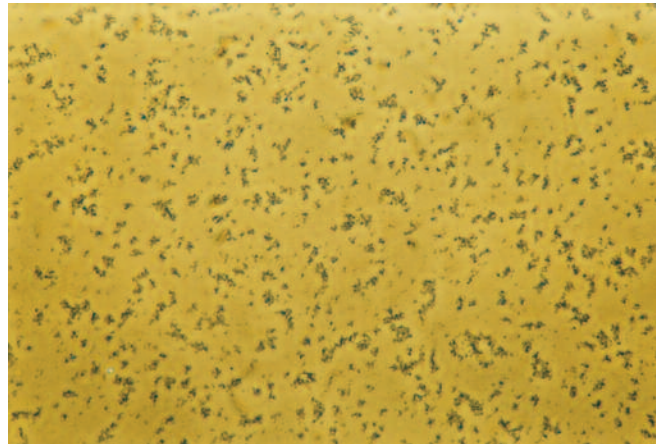


Figure 1. Vaccine stored properly between 35° and 45°F has a fine-grained, uniform structure. Photo by Dr. Umit Kartoglu, World Health Organization.

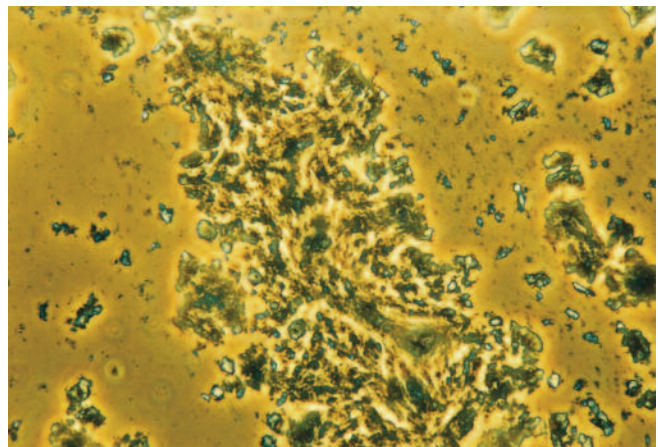


Figure 2. Vaccine that has been frozen has a conglomerated structure, demonstrating broken bonds between adsorbent and antigen. Photo by Dr. Umit Kartoglu, World Health Organization.

### Modified-live vaccines

For MLVs, temperatures below 35°F or above 45°F do not necessarily destroy the active ingredient. In the freeze-dried state (cake), these vaccines are remarkably stable. However, over time, repeated cycles above or below the recommended holding temperatures will inactivate MLVs. High ambient temperatures (higher than 75°F) will reduce the efficacy of MLVs even in the dried state.

Once MLVs are activated (made into a solution through the addition of the appropriate liquid), they need to be used within 2 hours and kept cool at temperatures between 35° and 45°F. To accomplish this while vaccinating animals, keep vaccine in a cooler next to the chute. Keep the cooler out of direct sunlight to prevent premature warming and keep the vaccine out of the sun to avoid both warming and UV damage.

## Refrigerator Monitoring

REFRIGERATOR TEMPERATURES can be monitored through the use of minimum/maximum thermometers (figure 3). Monitoring refrigerator temperature on a weekly or even daily basis will help you determine if the refrigerator is functioning properly. Monitor and record temperatures at least weekly.

Also consider the age, type, and location (barn, porch, or other storage areas) of the refrigerator. Refrigerator location can have a substantial impact on how efficiently the refrigerator operates. For example, a refrigerator kept in a noninsulated barn may be adversely affected by high and low ambient temperature extremes. These temperature extremes can damage products stored inside the refrigerator.

## Vaccine Disposal

PROPER DISPOSAL of animal health products at the farm and ranch level is as important as proper use. Environmental contamination, particularly of water, with hazardous or potentially hazardous biological wastes is one of the top 30 environmental public concerns. Consequently, questions arise as to the proper disposal of these materials and the associated syringes, needles, empty vials and bottles, and expired products.

As of 2012, federal and state laws, as well as the Idaho State Department of Agriculture, Washington State Department of Agriculture, and Oregon State Department of Agriculture, do not specify how animal vaccine should be disposed of. These states allow animal vaccine to be discarded in household trash receptacles. Additionally, animal vaccines containing live attenuated virus may enter a municipal solid waste landfill without being autoclaved or otherwise treated to inactivate the virus. However, some landfills may have special treatment requirements and policies for discarded live and attenuated animal vaccines.

It is recommended that you contact your state veterinarian's office, state department of agriculture, or landfill manager to find out possible requirements for accepting animal vaccine. Many county landfills accept veterinary waste as non hazardous provided the

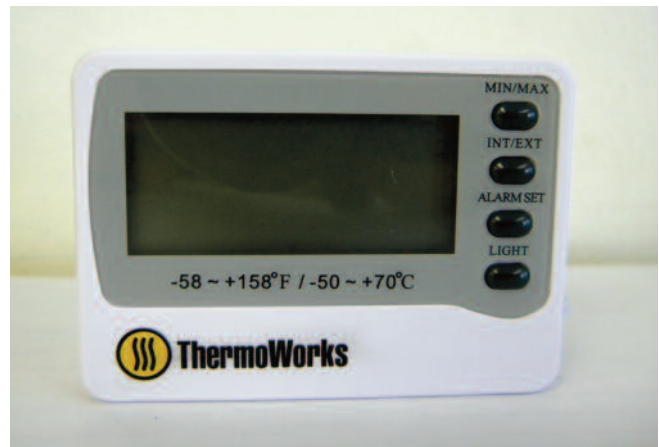


Figure 3. Refrigerator temperatures can be monitored with minimum/maximum thermometers. Photo by K. Scott Jensen.

material is adequately packaged. Community take-back events or household hazardous waste collection facilities may also accept unused and expired animal vaccine.

Although many live and killed vaccines can be disposed as household waste in trash receptacles and/or incinerated, vaccines containing thimerosal (an ingredient containing mercury) should be disposed of in a lined landfill.

## Vaccine Best Management Practices

### Purchasing vaccine

- Consult your local veterinarian prior to purchasing vaccine to determine what vaccinations are necessary for your operation and area.
- Only purchase vaccines you can use in a timely manner.
- Check expiration dates when you purchase and/or receive vaccine. If vaccine is expired do not purchase it or return the product immediately.
- If you order vaccine by mail, order on Mondays to prevent weekend delays at unknown storage temperatures and to ensure the vaccine does not sit in a warehouse or on a truck over the weekend. Vaccines handled and stored by shipping personnel may not be maintained at adequate temperatures, reducing vaccine efficacy.
- Check the shipping cooler as soon as it arrives and refrigerate the vaccine immediately.
- If you have any concerns regarding vaccine handling before and during shipping, contact your distributor immediately.
- If you purchase vaccine locally request multiple ice packs for keeping vaccine cool on the way home or bring ice packs with you to the store.
- Purchase vaccine in small-dose vials to minimize waste.
- Ask the retailer the following questions. If you are not satisfied with the retailer's answers, locate another distributor.

*Is there a thermometer in your vaccine refrigerator?*

*Are minimum and maximum temperatures monitored and recorded on a regular basis?*

*Is the temperature maintained within the recommended range?*

*Did you immediately check and store the vaccine when it arrived?*

*How do you handle the vaccine after you receive it?*

### Storing vaccine

- Read and follow label instructions.
- Use a minimum/maximum temperature thermometer to monitor temperatures in the refrigerator where you store vaccine.
- Check and log temperatures at least weekly.
- Discard any vaccine that freezes.
- Check expiration dates and discard expired vaccine. (Federal code states that biological products shall be considered worthless after the expiration date has passed.)
- Store vaccine that will expire first near the front of the refrigerator and use it first.
- Do not overstock vaccine because it was a “good deal” if you cannot use it by the expiration date.
- Train employees, family members, and others on proper vaccine handling.

### Using chute-side coolers

- Pre-cool the cooler for at least 1 hour prior to placing the vaccine inside.
- Use enough ice or cold packs to maintain a steady temperature, 35–45°F.
- Take enough vaccine for the morning or for afternoon, not for both.
- Keep the cooler out of sunlight.
- Identify any leftover unopened bottles of vaccine and use them first the next time.

### Handling vaccine

- Read and follow all label directions prior to using animal health products.
- Refrigerate all vaccines at 35–45°F unless otherwise specified on the label.
- Mix vaccine gently and thoroughly prior to filling vaccine guns or syringes. Remember that excessive agitation can diminish vaccine efficacy.
- Dispose of all expired and unused animal health products according to the label.

- Do not mix products or combine different vaccine products in the same bottle or syringe.
- Do not use the same vaccine gun for different vaccines.
- Keep vaccine cool in a dark environment and out of sunlight when storing and using it.
- Do not mix modified live vaccines if you won't be able to use them within 1–2 hours of reconstituting them.
- Use transfer needles for mixing modified live vaccine to prevent contamination and accidents.
- Discard bottles of killed vaccine that have been opened for more than 2 days because vaccines can be contaminated by repeated introduction of air and needles.

## **Injecting vaccine**

- Follow your state's beef quality assurance guidelines.
- Read and follow all label instructions.
- Give injections in front of the shoulder in the middle neck region.
- Avoid giving injections in the nuchal ligament of the neck region.
- As indicated by state beef quality assurance guidelines, give injections subcutaneously unless otherwise specified on the label.
- Remove air from syringes and/or guns prior to injecting vaccine.
- Use the correct gauge and length of needle as specified by the label.
- Change needles every time you fill a syringe or vaccine gun.
- Change needles that become burred, bent, or broken.
- Never straighten and reuse a broken needle.
- Space multiple injections 4 inches apart on the animal to avoid mixing different products.
- Most vaccines have 21-day withdrawal periods; those with oil-based adjuvants generally have 60-day withdrawal periods. Always read the label to determine withdrawal times and follow them appropriately.
- A major problem is contamination from repeated entry into bottles with used needles. Use a new needle each time syringes are filled.

## **Disposing of vaccine**

- Always read the vaccine label or package insert and follow any disposal instructions that are provided.
- Unused vaccines are recommended for incineration or sterilization via autoclave, chemically, or by other approved means.
- If disposal instructions are not provided or you are unable to incinerate or sterilize vaccine, discard vaccine in the household trash.
- State departments of environmental quality and the United States Department of Agriculture Veterinary Services recommend that expired or unused vaccine be placed into a rigid plastic container with cat litter, coffee grounds, or compost, sealed and placed into a trash receptacle.
- Remove any personal information that may be listed on the packaging.
- DO NOT place vaccine into sewer or septic systems or water sources by flushing down the toilet or draining in a sink unless the label instructs you to do so.
- Burn unused and empty vaccine containers in burn barrels or incinerators. Any remaining glass can be recycled or discarded with household waste.

## **General Recommendations for all Injectable Drugs**

- Read and follow label instructions.
- Practice good sanitation of equipment and the working environment.
- Clean syringes with hot water only and dry them completely.
- Never use soap or disinfectant to clean internal parts of syringes and vaccine guns. They will leave a residue that can affect vaccine efficacy.
- Use a minimum/maximum refrigerator thermometer.
- Record product lot numbers of animal health products, administration dates, and withdrawal times.
- Maintain vaccination records for a minimum of 3 years.
- Have all members of your operation complete beef quality assurance (BQA) certification and routinely follow its guidelines.

## Notes

- <sup>1</sup>Troxel, T. R., and B. L. Barham. 2009. Case Study: The Temperature Variability of Refrigerators Storing Animal Health Products. *The Professional Animal Scientist* 25:202-206.
- <sup>2</sup>Torell, R. 2006. Back to Basics: Frozen Vaccines. *Angus Beef Bulletin* Oct.: 72, 74.
- <sup>3</sup>Fife, T. E., J. B. Glaze, Jr., K. S. Jensen, N. Rimbey, S.L. Kane, S. D. Baker, J. Church, S. J. Etter, D. Gunn, G. Keetch, S. Nash, S. Williams, and R. L. Wilson. 2013. Animal Health Product Handling and Management by Idaho Producers and Retailers. *The Professional Animal Scientist* (in press).

## Resources

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- Idaho Beef Quality Assurance Certification Manual, version 3. December 2005. University of Idaho Extension. Available from Idaho Beef Quality Assurance Program, 16952 South 10th Avenue, Caldwell, ID 83607, telephone (208) 459-6365.
- Department of Immunization, Vaccines, and Biologicals, World Health Organization. 2006. *Temperature Sensitivity of Vaccines*. Ordering code WHO/IVB/06.10, World Health Organization, Geneva, Switzerland.

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ALWAYS read and follow the instructions printed on the animal health product label. The recommendations in this publication do not substitute for instructions on the label. Use animal health products with care in conjunction with a licensed veterinarian consultation.

**Trade Names**—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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