Vaccination Techniques

We know that a huge amount of effort, time and money goes into the research, development, manufacturing, regulation and distribution of vaccines. Such efforts are necessary to ensure vaccines are delivered to the clinic or farm in optimum condition so that they will reliably perform to induce the most appropriate immune response safely and efficaciously.

Despite all of the care that goes into vaccine production and distribution, most of the problems associated with vaccination, e.g. poor immune response, are associated with carelessness and thoughtlessness in terms of vaccine storage, handling and administration. The following article establishes clear guidelines and directions for the correct storage and administration of vaccines.

Correct Storage of Vaccine

Correct storage of vaccine plays an extremely important role in maximising the health and well being of your flock. When receiving vaccine from the supplier, the vaccine should be immediately checked to ensure the correct vaccine has been delivered. The vaccine should go into proper storage immediately. Record details of the vaccine into a vaccine record book (name, number of vials, expiry date and serial number).

Store vaccines according to the manufacturer’s instructions. For most live and killed poultry vaccines, a properly operating refrigerator that maintains a temperature of between 2 – 7ºC is necessary.

The refrigerator should preferably be locked and inaccessible to children. There should be consideration given to limiting the amount of times it will be opened during the day as this causes temperature fluctuations. Ensure that the vaccine is not exposed to direct sunlight during storage or during use.

Exposure of vaccines to unfavourable conditions will lead to accelerated loss of potency. Variable storage conditions will change the integrity in the structure of the vaccine. These changes are often not obvious on visual inspection. Therefore it is important to follow the manufacturer’s storage instructions on each vaccine label to ensure that your flock is getting the best possible protection.

Recommendations for Live Vaccines Stored in Liquid Nitrogen

Some Marek’s disease live vaccines are unstable and must be stored below -100ºC in order to keep them viable. This is only achieved by utilising liquid nitrogen that maintains the vaccine at -196ºC. The vaccine is therefore stored in liquid nitrogen tanks. The tanks must be checked routinely to ensure adequate levels of liquid nitrogen cover the vaccine. If at any stage vaccine is allowed to defrost, the vaccine cannot be refrozen and must be destroyed.
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Recommendations for Storing Live Freeze Dried Vaccines

Live freeze dried vaccines contain live infectious agents (usually viruses) that are used to mimic the disease that is being controlled without actually causing the disease. The principles of storage for these vaccines are as follows: the colder the conditions are, the longer the viability of the vaccine. The hotter the storage conditions are, the shorter the shelf life, with acceleration in organism destruction as the temperature increases. Therefore live freeze dried vaccines should be stored between 2 – 7ºC for optimum potency.

Recommendations for Storing Inactivated (Killed) Vaccines

Temperatures that range from 2 – 7ºC are most suitable for long-term storage of killed vaccines. Vaccines held at temperatures higher than this for any significant time can change the vaccine in ways that will alter its potency and lead to potential vaccine failure. Freezing will disrupt the vaccine adjuvant (carrier) as well as cause physical changes to the viruses or bacteria themselves. Never use an inactive vaccine that has been frozen. Particular care must be taken to maintain suitable storage temperatures in winter months when refrigerator temperatures can become colder or even sub-zero, particularly if the vaccine is stored close to the cooling elements at the back of the fridge.

Recommendations for Storing Diluents

Most diluents are in liquid form. Diluents can be stored at room temperature, however if temperature variations occur then the potential exists for contaminants to gain entry into the bottle, as the stopper can move due to pressure variations. Ideally diluents should be held at a constant room temperature (around 18 to 20ºC).

Correct Vaccine Administration Procedures

All vaccines are approved for use by a specific route or routes of administration. Careful planning and preparation, as well as consistency in the vaccine application, are the key to a successful outcome. Faults in the administration of vaccines are by far the most common cause of a flock’s poor response to a vaccination. Therefore it is important to have all vaccination staff well trained in the principles of handling vaccines as well as in their administration.

All staff need to understand the importance of following vaccine administration procedures carefully. Staff need to maintain an exceptionally high level of hygiene throughout the day when administrating vaccine. For example, clean hands and vaccinating equipment, especially the needles.

During some vaccination procedures chickens may need to be handled or exposed to a change in their normal routine (e.g. a 1 to 2 hour period of having no access to drinking water). Such short-term stresses have minimal effect on the response to the vaccination.

Poor stockmanship and bird handling practices can result in significant chicken losses, both on the day of vaccination and in the weeks to follow. This can be due to smothering, overcrowding or damage sustained while being handled. Once again it is extremely important that all staff are well trained in the handling of chickens. This training will result in minimal stress and discomfort to the chickens.

Stop vaccination if chickens become stressed. Do not vaccinate stressed chickens or vaccinate on days where stress can become an issue, e.g. hot weather.

After the vaccination is completed, record the vaccination details including the flock identification and the number of chickens vaccinated. Also record the vaccine used, the batch number and expiry date into the medication and vaccination record.
Quick Vaccine Preparation Checklist

• Read the vaccine ‘directions for use’ leaflet carefully before beginning any vaccination procedure.
• Assemble all the required vaccination equipment before removing the vaccine or vaccines from the refrigerator.
• Once the vaccine has been removed from the fridge, check the expiry date to make sure it is still valid. This information should now be recorded along with the number of birds that were vaccinated at the end of the procedure.
• Mix only the amount of vaccine that can be used in 1 hour or less and handle only one vial at a time to maintain the highest possible potency of the vaccine.
• Mix vaccine in a clean room away from the chicken processing area.
• Only authorised, trained staff will carry out mixing of the vaccine.

Reconstituting Freeze-dried (Lyophilised) Vaccine with Diluent

1) To begin mixing a vaccine that requires reconstituting with a diluent, start with a new, sterile, disposable 5 or 10mL syringe with a new 18 gauge x 1 or 1 1/2 inch needle attached.
2) Draw up a maximum 2mLs of diluent into the syringe.
3) Inject the diluent into the vaccine vial and gently agitate the vial to combine the vaccine and diluent.
4) Draw the contents from the vaccine vial back into the syringe.
5) Re-insert the syringe back into the diluent bottle and very slowly inject it into the diluent mixture.
6) Mix by gently turning the bottle.
7) Using the same syringe, draw another small amount of diluent and inject this back into the empty vaccine vial.
8) Gently agitate and repeat the above procedure of injecting it back into the diluent bottle. Repeating the procedure is essential to get maximum recovery of the vaccine from the vaccine vial.
9) Once this is done turn the bottle of diluent over gently about 10 times without shaking or making any foam on the surface. This will ensure all the vaccine is fully mixed into the diluent.
10) During vaccination, the diluent should be kept at a temperature between 20 to 27° C.
11) The reconstituted vaccine must be used within 1 hour.

Valuable Tips

• Structure staff rest breaks around vaccinating – not vaccinating around these breaks.
• If transporting vaccine is necessary, keep vaccine cold in a chilly bin with an ice pack.
• Reconstitute the vaccine just prior to administration.
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Reconstituting Frozen (Liquid Nitrogen) Marek’s Vaccine

1) Prepare a clean, wide-mouthed container with a capacity of 4 to 19 litres. (see photo)

2) Fill the container to half of its capacity with water that has a temperature of 27°C. A controlled temperature water bath is ideal for this purpose.

3) Take precaution by wearing protective overalls, boots, gloves (cryogenic) and full-face mask.

4) Lift the metal cane containing the glass vials of vaccine from the liquid nitrogen tank.

5) Remove the vials from the metal cane and place quickly into the water bath.

6) When the vials are completely thawed, dry them with a clean towel.

7) Thawing only takes a couple of minutes. Only thaw enough vaccine to be used within one hour. Mix with the Marek’s vaccine diluent immediately after thawing.

8) To open the vial, wrap it carefully in a cloth, holding the vial upright and snap the top off.

9) Using a sterile 5 mL syringe with an 18 gauge by 1½ inch needle, draw up 2 mLs of diluent.

10) Draw the contents from the vaccine vial into the syringe and agitate it slowly for 5 seconds.

11) Slowly expel the contents of the syringe into the diluent, keeping the end of the needle in the liquid by tipping the diluent bottle. (see photo)

12) Gently agitate the diluent container, draw a maximum of 2 mLs of the reconstituted vaccine into the syringe and rinse the vaccine vial.

13) Draw the rinsed vaccine back into the syringe and add back to the reconstituted diluent and vaccine then gently agitate.

14) During vaccination, gently agitate the diluent containing vaccine to ensure the vaccine is evenly suspended throughout the solution.

15) For proper administration technique for Marek’s Vaccination, see below.

Subcutaneous Administration Procedure for Marek’s Vaccination (Manual Vaccination)

Proper vaccination technique is crucial for Marek’s vaccination. Vaccination crews should be well trained and be fully aware that their vaccination technique does matter.

1) Connect the calibrated vaccination gun to the vaccine diluent bottle by inserting the plastic tubing into the diluent bottle. Secure the tubing with insulation tape. Insert another single needle through the rubber stopper on the diluent bottle to allow air to enter bottle, or use a proper ‘bleed off’ valve.

2) Test and clear air from the vaccination gun. Pump the gun to draw vaccine into the gun (0.2mL) and take vaccination equipment and vaccine into the chicken processing area.

3) Place a basket of chickens beside the vaccination equipment.

4) Place new, sterile needle (20 gauge x 1/2 inch) onto the syringe and check it is secure and not leaking. Change needles as frequently as required by company policy to ensure that needles are sharp and hygiene practices are observed.
5) Pick up a chicken. Compress skin at the back of the chicken’s neck between index finger and thumb to form a mound of skin.

6) Pick up vaccination gun in the other hand, insert the needle into the raised mound of skin, pointing the needle slightly away from the skull. Inject vaccine underneath skin (subcutaneously) - take care not to hit the neck muscle.

7) Check vaccination site to ensure the vaccine has not leaked out or was merely injected into the chicken’s down.

8) Place vaccinated chicken into another basket and proceed quickly to the next chicken. Speed and efficiency is necessary as the vaccine loses its potency, but a chicken that is missed or does not receive its full dose will not be protected against Marek’s Disease.

Subcutaneous Administration Procedure for Killed Fowl Cholera Vaccine

1) Do not attempt to hold and vaccinate the chicken yourself. To vaccinate chickens subcutaneously requires at least two people: a bird handler to hold and present the chicken while the other person prepares and gives the injection.

2) Bring the vaccine out of the refrigerator and allow sufficient time for the vaccine to reach ambient temperature. Warm vaccine flows more easily when vaccinating, resulting in less stress to the chicken. Chickens may die from shock if injected with a cold vaccine.

3) The bird handler picks up and holds the chicken securely.

4) The vaccinator, prior to giving the injection, compresses the skin on the back of the chicken’s neck between the index finger and thumb to form a mound of skin.

5) Pick up the vaccination gun in your other hand and insert the needle into the raised mound of skin, pointing the needle slightly away from the chicken’s head.

6) Inject the vaccine underneath the skin (subcutaneously) as shown, taking care not to hit the neck muscle.

7) Check the vaccination site to ensure the vaccine has not leaked out or was merely injected into the chicken’s down.

8) Place the vaccinated chicken into a separate location ensuring vaccinated chickens and unvaccinated chickens are not mixed.

9) Proceed to the next chicken.

10) Sharp needles (18 or 19 gauge x 1/2 inch) are important and should be changed regularly (e.g. at least every 200 birds).

11) Always use new needles. Do not clean and reuse needles.

12) Used needles, should be disposed in a proper ‘sharps’ container

Intramuscular Administration Procedure for Inactivated Vaccines

An intramuscular injection is the route of administration employed for oil emulsion inactivated vaccines. The site of administration is most commonly into the breast muscle.

To vaccinate birds by the intramuscular route requires at least two people: a bird handler to hold and present the bird while the other person prepares and gives the injection.
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Accuracy of placement of the needle is essential as incorrect placement can lead to abscess formation or liver puncture depending on the injection site. The method and care of handling birds during this procedure is also important as this can contribute to lameness in birds. The needle (18 or 19 gauge x 1/2 or 3/4 inch) should be changed at least every 200 birds in order to avoid spread of bacteria and viral contaminants and to ensure sharp needles are always used.

1) Bring the vaccine out of the refrigerator and allow sufficient time for the vaccine to reach ambient temperature. Warm vaccine flows more easily when vaccinating, resulting in less stress to the bird. Birds may die from shock if injected with a cold vaccine.

2) There are different accepted ways to hold the bird for injection to avoid self-injection as well as to ensure correct placement of the vaccine. An example in the accompanying photo showing the handler holding the bird with the breast facing upwards and the chicken’s head presented towards the vaccinator.

3) If a lot of birds are to be vaccinated, sometimes a table is helpful to rest the birds on.

4) Intramuscular injections are given in the thickest part of the breast muscle parallel to the keel. This avoids striking any bones.

5) Always use new needles, do not clean or reuse them.

Wing Stab Administration Technique

The wing web procedure is used for fowl pox vaccines in birds that are six weeks or older. The vaccine comes with diluent and wing stabber. Wing stab vaccination also requires a team of two people: one person to hold the bird and spread the wing while the other prepares the wing stabber and jabs the web.

1) To vaccinate birds using the wing web administration technique reconstitute one vial of vaccine with one vial of diluent.

2) Always use new needles. Do not clean and reuse wing stabbers. Use only wing stabbers supplied by the manufacturer with the vaccine.

3) Remove the stopper from the vial and have the vaccine stabber ready.

4) The bird handler holds the bird with the underside of the wing facing upwards.

5) The second person dips the wing stabber into the reconstituted vaccine.

6) Make sure both needles on the stabber are wet.

7) Spread the feathers to the side in the web of the wing to make a clear space.

8) Stab the needles through the web quickly and remove the stabber.

9) Avoid blood vessels, bones and wing muscles.

10) The vaccine should not touch the feathers, bird’s face or head, or the skin, except at the vaccination site.

11) Be very careful with fingers becoming wet with vaccine and accidentally touching the bird elsewhere.

12) All flocks are to be checked for ‘takes’ about 5 to 6 days post vaccination.

13) The usual vaccine reaction or ‘take’ consists of some swelling at the site of the puncture as early as the fourth day following vaccination.

14) The swelling may increase during the next 5 days until a scab is formed. The scab and swelling rapidly disappear after a week.
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Where chickens under 6 weeks of age are vaccinated with Chick-N-Pox TC, it is common not to see widespread ‘takes’ post-vaccination. The flock however will be immune. In flocks vaccinated with a normal pox vaccine, e.g. Poxine, at an older age (post 6 weeks), it is normal to see widespread ‘takes’. If at least 50% of the flock do not show some vaccination site response, it may be necessary to repeat the vaccination.

Intraocular (Eye Drop) Vaccination Procedure

Intraocular (eye drop) administration of vaccine stimulates humoral and cell-mediated immune responses via the Harderian gland just behind the eye socket, to provide a strong immune defence.

1) One vial of vaccine is reconstituted with one vial of diluent.
2) Prepare the vaccine and diluent by removing the aluminum seal from the vaccine vial and diluent bottle and then removing the rubber stopper, which should be kept free from contamination.
3) Half fill the vaccine vial with the accompanying diluent.
4) Replace the stopper and shake the vial to dissolve vaccine material.
5) Carefully pour the rehydrated vaccine back into the plastic diluent bottle.
6) Replace the plastic diluent cap and shake again to obtain a uniform mixture.
7) Remove the diluent bottle cap and fit a drop dispenser into the bottle. The vaccine is now ready to vaccinate intraocularly.
8) Use only the dropper supplied by the manufacturer with the vaccine. Use a fresh dropper each time don’t wash and reuse.
9) Avoid touching the dropper or cleaning it with your fingers. Have fresh clean tissues available if the dropper needs to be cleaned.
10) Hold the bird and place one drop of vaccine into the eye. Take care not to scratch the bird’s eye with eye drop dispenser.
11) Allow the vaccine to spread over the eye before releasing the bird into a holding area for vaccinated birds. Only one eye needs to receive the vaccine.

Drinking Water Administration Technique

Drinking water administration of live poultry vaccines is a great labour saving procedure designed to vaccinate large numbers of chickens simultaneously. While it is a simple procedure, carelessness and attention to detail can cause problems with chickens not establishing a good immune response. Follow instructions carefully and do not be tempted to use short cuts or attempt to dilute the vaccine dosage beyond the number of doses indicated on the label.

1) Discontinue use of any medications, disinfectants and sanitisers in the chicken’s drinking water for at least 24 hours before the vaccine is to be administered. Resume water medications, disinfectants and sanitisers as directed by the vaccine manufacturer.
2) Never use chlorinated drinking water to administer vaccines. Chlorine will kill the live vaccine virus that is necessary to stimulate the chicken’s immunity.
3) Use clean, cool well water, bottled spring water, or town water that has sat overnight so the chlorine disappears.
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4) As an added precaution, if you are unsure of whether there is any residual chlorine or sanitiser left in your water system use Avi-Blue. Alternatively, skim milk ('Trim' or 'Green Top') should be added at the rate of 0.25% (1 litre of skim milk for 400 litres of water) to neutralise residual chlorine.

5) Waterers should be clean and free from organic matter or disinfectant residue.

6) For best results, deprive birds of drinking water for 1 to 2 hours prior to vaccination. Shorten the time in hot weather or tropical climates. Optimal time is first thing in the morning.

7) Remove the vial of vaccine from the refrigerator. Remove the metal seal and rubber stopper from the vial and half fill with cool, clean water. Replace stopper and gently shake until the vaccine is dissolved. Pour the reconstituted vial into the Avi-Blue or the milk/water mixture. Rinse vial again with water and pour this into the Avi-Blue or the milk/water mixture.

8) To calculate the amount of water needed, use these guidelines:
   - For chickens 2 to 8 weeks of age, add 1000 doses of vaccine up to a final volume of 10 to 20 litres of drinking water.
   - For chickens above 8 weeks old, add 1000 doses of vaccine up to a final volume of 20 to 40 litres of drinking water.

9) Always count on providing one full dose per chicken.

10) Resume regular water administration only after all the vaccine water has been consumed. Use unchlorinated water for 24 hours after vaccine.

Spray Administration Techniques

Spray administration techniques differ according to the age of the chicken being vaccinated, the vaccine being used, and the type of equipment. We cover three types of spray administration techniques: coarse spray at day of age, at day of age with a spray box and vaccinating older birds in sheds or battery cages.

Coarse Spray for Day of Age Chickens

Spray vaccination of day old chickens with some live vaccines (e.g. Salmonella) is a common and simple method that is usually performed at the hatchery. This method is fast and easy to administer. The immune response is also excellent from coarse spray vaccination.

1) Use a household sprayer that has a 2-litre capacity and a good quality adjustable spray nozzle. This sprayer should only be used for vaccinating and not used for any other purpose.

2) For every 1000 chicks to be vaccinated add 100 to 120 mL of cool distilled or clean non-chlorinated water to the sprayer container. (For example, for 10,000 chickens, use 1.2 litres).

3) Remove the vaccine vial from the refrigerator. Take off the metal seal, remove the rubber stopper, and half fill the vial with cool distilled or clean non-chlorinated water. Replace the stopper and gently shake the vial until the vaccine is reconstituted.

4) Pour the reconstituted vaccine into the sprayer container. Rinse the vial with more cool distilled or clean non-chlorinated water and pour the contents into the sprayer.

5) Replace the spray head and gently swirl the sprayer for 30 seconds to mix the vaccine uniformly.
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6) Adjust the spray head to a coarse spray that settles quickly (not a mist that will hang in the air).

7) Spray over each chicken transport box (100 chickens) for approximately 1 to 2 seconds maximum. Simply let the spray settle onto the chickens. A light spray over the chickens is quite sufficient to establish the desired immune response.

8) After vaccination is completed the sprayer should be washed out and rinsed several times in hot, clean water. Do not use a sanitiser or detergent. Store sprayer in a suitable dust free cabinet.

9) It is essential for inexperienced hatchery staff to practise initially by spraying dyed water into empty chicken boxes to get uniformity right.

Spray Box for Day of Age Chickens

Before using the spray box method it is essential to contact your vaccine supplier to ensure proper use.

Spray Techniques for Sheds and Layer Cages

We recommend for small flocks a 1 to 2 litre pump sprayer. For larger flocks, use a 15-litre knapsack type sprayer (with either a hand or electric pump). Any sprayer equipment is dedicated for vaccination only and used for no other purpose.

It is important to use protective clothing including dust mask, goggles, overalls and disposable gloves (see photo below).

1) Vaccinate during the coolest time of the day (usually early morning).

2) To calculate how much water you need to use with the vaccine, make a trial run through the chicken shed with water only. This is to measure how much water it will take to cover the area and the number of chickens.

3) To minimise the disruption to the chickens, turn the shed lights down to allow the chickens to settle prior to vaccination.

4) Remove the vaccine vial from the refrigerator. Take off the metal seal, remove the rubber stopper and half fill the vial with cool, distilled or clean non-chlorinated water. Replace the stopper and gently shake the vial until the vaccine is reconstituted.

5) Pour the reconstituted vaccine into the sprayer container. Rinse the vial with more cool, distilled or clean non-chlorinated water and pour the contents into the sprayer.

6) Replace the spray head and gently swirl the sprayer for 30 seconds to mix the vaccine uniformly.

7) Adjust the spray head to a droplet size that settles quickly (not a fine mist that will hang in the air).

8) It is important to ensure all birds are sprayed.

9) After vaccination, rinse the sprayer with hot water, air dry and store in a clean plastic bag or closed box to keep it clean.
Gel Puck Administration of Immucox and Pacific Oasis

If you are using either Pacific Oasis or Immucox vaccine manufactured in a gel format it is important to remember excellent hygiene practices whilst preparing to feed it to day old chickens.

1) Open the plastic casing at one end and slide the gel out carefully to a clean tabletop or tray.

2) With a clean knife, cut the gel into 1.5 cm thick slices (3000 doses will equal 30 slices). One slice is enough to treat 1 box of 100 chickens.

3) For best results cut each slice into 4 to 6 pieces and scatter through the shipping box.

4) For chicken boxes that are divided, place a quarter of a slice into each corner (for 25 chickens). Allow 2 to 3 hours for chickens to consume the gel.

Gel Spray Administration of Immucox

Before using the gel spray method for administering Immucox, it is essential to contact your vaccine supplier to ensure proper method of administration.

**Equipment hygiene**

Dropper bottles, wing stabbers and needles should not be cleaned and reused.

**Vaccination Machines**

Each vaccination machine is supplied with a manual from the manufacturer. This includes details on dismantling, cleaning and reassembling the machine. It is important to follow the detailed instructions to avoid contaminating the vaccine.

**Vaccination Syringes**

1) After vaccination, dismantle the syringe to its basic parts.

2) Syringes, draw off tubes and O-rings should be completely dismantled.

3) O-rings must be removed from the syringe barrel.

4) Clean the dismantled equipment in hot, soapy water and rinse well with hot fresh water.

5) If an autoclave or pressure cooker is not available for proper sterilisation, vaccinator equipment must be boiled for at least 30 minutes.

6) Once boiled, lay equipment out on a clean paper towel and allow to completely air dry.

7) Packing away wet equipment or improperly cleaned syringes may result in pseudomonas infections.

8) The equipment should then be stored in an airtight bag and kept in a suitable container or cabinet.
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Proper Disposal of Vaccine and Equipment

Any unused vaccine and all empty vials should be destroyed by approved methods and not simply discarded in the rubbish.

Best practice is to use an approved medical waste disposal company using proper disposal containers (e.g. sharps container). (See photo)

Using Vaccine Safely

As a general rule poultry vaccines are not harmful to people. However, there are certain instances where precautions need to be taken when working with vaccines.

Any safety issue regarding vaccine use should be addressed as part of every farm’s Occupational, Safety and Health obligations.

Live Vaccines

There are three issues in using live vaccines:

1) Accidental stabbing when using the wing-web stabber for fowl pox vaccination.
2) Accidental injection with Marek’s vaccine.
3) Ingestion or exposure to spray with live Salmonella vaccine.

Careful use of vaccine and following directions will avoid these issues.

Killed Vaccines

Accidental self-injection can become a major problem due to the oil emulsion contained in these vaccines as it causes serious tissue damage. These vaccines are:

1) Killed Mycoplasma vaccines (MG-Bac, MS-Bac)
2) Killed Infectious Bronchitis Vaccine (Inacti/Vac IB1)
3) Killed Fowl Cholera Vaccine (Poulvac Pabac IV Vaccine)
4) Killed Bursal Disease Vaccine (IBD)
5) Killed Egg Drop Syndrome Vaccine (EDS)

Information regarding accidental self-injection with killed vaccines must be available for the person responsible for occupational safety and health on your farm. He or she should keep a copy handy in case of an accidental self-injection which must be treated as an emergency.

If you accidentally inject vaccine into your hand or finger, it can remain in a small area or migrate far from the injection site. There is some direct injury to tissue at the time of injection but within 24 hours, there is usually an inflammatory response resulting in significant swelling and increasing pain. Subsequent problems may occur with the onset of bacterial infection from contaminated needles and damage to the blood supply.

If the blood supply of the tissue remains intact, on-going problems of pain and stiffness may occur.

Suggested Possible Treatment: The best treatment is prevention! These injuries occur more often in persons less experienced in the use of injection equipment. Proper instruction in their use and the serious nature of the injury should be stressed.

If an accidental self-injection does occur the recommendation is that the victim be immediately referred to a physician. Surgery may be required. It is extremely important not to delay treatment.

Liquid Nitrogen

Take all precautionary measures when handling Liquid Nitrogen, including the use of gloves and face shield or goggles to avoid any potential hazards. Long sleeves should also be worn and a dustcoat to prevent damage caused from any possible splashes of the liquid.

Beware of any possible explosions of the glass ampoules as they are taken form the Liquid Nitrogen canister and placed in the thawing container. When removing a vial from the cane, hold palm of gloved hand away from face and body. Immediately replace cane with remaining vials back into the canister. If the cane is empty dispose of it immediately.