Food and Agriculture Organization of the United Nations

WORLD ORGANISATION FOR ANIMAL HEALTH
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Handling, Packaging and Shipping of Rinderpest Virus Containing Materials

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1. Purpose

The purpose of this document is to define how rinderpest virus (RPV) and material likely or suspected to contain RPV must be handled, packaged and shipped. It is the responsibility of both individuals and institutions sending RPV to ensure that the RPV is packaged and shipped in accordance with international regulations under conditions that minimize the risk of accidental release of RPV. For the purpose of this document RPV shall mean rinderpest virus or any material reasonably expected to contain rinderpest virus.

2. Background

RPV is a negative-sense RNA genome virus of the morbillivirus genus. It is the causative agent of rinderpest, a fatal disease of cattle capable of devastating epidemic spread. The incubation period ranges from 8 – 11 days and the disease is characterized by pyrexia, nasal and ocular discharges, and necrosis and erosion of the nasal and oral mucosae. Animals develop diarrhoea, and death generally occurs between 7 and 12 days after onset of clinical signs. RPV has poor environmental stability and is sensitive to inactivation by heat, desiccation and exposure to sunlight. The last known case of rinderpest was diagnosed in Kenya in 2001 since which time the world has been free of the disease. Interruption of the chain of transmission was achieved by a global eradication campaign organized by the Food and Agriculture Organization of the United Nations (FAO). The vaccine used against rinderpest is an attenuated strain of RPV, and the possibility of reversion to virulence means that despite its widespread use, the vaccine strain may be handled under the same constraints as virulent strains since eradication has been attained.

The cost and effort of eradication, and the global emergency and severe consequences that are likely to accompany a re-emergence or release dictate that the containment procedures for handling, packaging and shipping RPV must be enhanced in the post-eradication era. RPV must now be handled at Biosafety Level 3 (BSL-3) Laboratory.

Vaccine stocks must be maintained until all RPV has been destroyed or gathered into internationally regulated repositories. However, the possibility of cross-contamination of vaccine stocks or seed-stocks with virulent virus dictate that vaccine and non-vaccine strains should be stored, handled and shipped separately.

RPV is non-infectious to humans and poses no direct hazard to human health. Containment and handling regulations aim to prevent the accidental transport and introduction of the virus to susceptible animals.

Transport of certain viruses, including RPV, are strictly regulated. RPV is classified as Dangerous Goods. To transport RPV by air, the Dangerous Goods Regulations (DGR)[1] issued by IATA should be followed.

[1] The UN Subcommittee of Experts on Transport of Dangerous Goods (SCETDG) develops recommended procedures for the transport of all types of dangerous goods except radioactive materials, These procedures, applicable to all modes of transport, are published in UN Recommendations on the Transport of Dangerous Goods - Model Regulations - Nineteenth revised edition (2015) (available at http://www.unece.org/trans/danger/publi/unrec/rev19/19files_e.html)

In the DGR, RPV is classified as Division 6.1 Infectious Substances, category A. RPV is assigned to United Nations number UN2900, and for shipping purposes is to be described and marked as "INFECTIOUS SUBSTANCE AFFECTING ANIMALS (rinderpest virus culture)".

RPV must be transported as cargo, in accordance with the DGR. Carriage of RPV in hand luggage or checked-in luggage on airplanes; in postal mail; or in diplomatic pouches is not permitted under international regulations.

For the purpose of safe RPV sequestration, RPV must not be shipped in a consolidated package with any non-RPV material. In addition the vaccine strain of RPV may not be shipped in a consolidated package with any non-vaccine strain.

Additional and up-to-date information on international shipping of infectious agents can be obtained online from IATA or the World Health Organization (WHO)[2].

3. Training

Receiving proper training on packing, marking and labelling the outer box, as well as proper documentation including the Dangerous Goods Declaration (DGD) is essential before sending RPV. Training[3] is the responsibility of the sender's employer. All persons directly involved in transport of category A infectious substances (e.g. RPV) including the shipper must be appropriately trained and certified within the past 2 years to package and ship such materials under international guidelines and regulations.
Classroom and online training on shipping of dangerous goods is available from numerous sources. For more information, see:
http://www.iata.org/services/ Pages/index.aspx
Online course: http://www.iata.org/training/courses/pages/tcgp43.aspx
Course materials: http://www.who.int/ihr/i_s_shipping_training/en/index.html

4. Packaging

Packaging requirement to send a category A infectious substances (e.g. RPV) is also defined in the DGR.

A triple layer packaging (see Figure 1 for an example) must be used:

1) Primary container in conformity with DGR Packing Instruction (PI-) 620

'Recommendations on the Transport of Dangerous Goods – Modal Regulations'. The International Civil Aviation Organization (ICAO) has used these recommendations as the basis for developing the regulations for the safe transport of dangerous goods by air by any aircraft. The ICAO regulations are codified in Annex 18 to the 'Convention on International Civil Aviation' and in its 'Technical Instructions for the Safe Transport of Dangerous Goods by Air'. The IATA Dangerous Goods Regulations (DGR) contains all of the requirements of the Technical Instructions.

[2] Guidance on regulations for the Transport of Infectious Substances 2013-2014 (Applicable as from 1 January 2013)
http://www.who.int/ihr/publications/who_hse_ihr_20100801/en/index.html

[3] a formal training conducted by a certified trainer to provide dangerous goods training.

2) Secondary container in conformity with DGR PI-620
3) Outer box in conformity with DGR PI-620

1) The primary container, which will hold the RPV, must be a leak-proof vessel such as a cryogenic tube with screw-top. **Use of flip-top tubes is forbidden, and glass tubes is strongly discouraged**. It must be made from polypropylene, with a polypropylene screw-cap with an internal o-ring seal. One must use vials that are compliant with IATA dangerous goods regulations. Vials with such specifications are commercially available.

2) The secondary container must be leak-proof and supplied as part of PI-620 compliant packaging. This must be placed in the outer box with appropriate cushioning material.

3) The outer box must be supplied as part of PI-620 compliant packaging for shipping category A infectious substances.

The packaging must meet United Nations class 6.2 specifications detailed in DGR PI-620; and the outer packaging must bear the appropriate United Nations packaging specification marking (Figure 1).

For the purpose of safe RPV sequestration, more than one primary container may be packaged in the same secondary container, as long as all primary containers contain RPV, and vaccine and non-vaccine strains are not included in the same secondary container. Sufficient absorbent material must be included in the secondary package to cushion the primary container(s) and to absorb all fluid in case of leakage.

There are many commercial suppliers for shipping containers. Some examples can be found in the DGR Annex E1 (page 825 of the 54th edition, 2013). Details can typically be found by internet searches with appropriate keywords (e.g infectious+substances+620+container).

5. Pre-agreement for shipping

To arrange shipment, the sender must first contact the Director of the destination laboratory. Permission from the Director of the destination laboratory must be obtained prior to shipping any RPV.

The Director or his/her nominee (Director/nominee) will supply necessary information and/or documentation to the sender including:

- the name of the contact person and exact shipping address that should be used for shipment;
- the name of the airport for the first port of entry (if so regulated);
- import permission or licence number allowing the laboratory to receive RPV (if so regulated);

- an inventory spread sheet which must be completed and returned;
- a form for a written description of the primary containers to be sent;

Only after the Laboratory Director/nominee is satisfied with the information, will approval for the shipment be given.

6. Confirmation of the domestic procedure

While communicating with the destination laboratory, the shipper should define how to send RPV, the Dangerous Goods UN2900 item by air. This requires:

- Identification of a certified shipper and trained person who can assist in packing and documenting, and sign the DGD (if there is no such person in the sender's laboratory, there may be appropriately trained people in clinical or public health laboratories who are involved in shipping human clinical or human pathogen samples who may be willing to undertake this);
- Confirmation of dry ice supply;
- Identification of the number of tubes (e.g. 500 vials) and the size of the tubes (e.g. 3mL vials) that will be sent (useful information in calculating approximate weight and volume of the shipment);
- Identification of a courier company who can handle Dangerous Goods UN2900 with dry ice for cooling; or
- Confirmation of Customs requirements for sending RPV by AIRFREIGHT (recommended only for scheduled direct flights) and approximate time required for the Customs procedures; and
- Confirmation with airline operator with appropriate direct flight destination whether UN2900 items can be accepted as AIRFREIGHT.

If the shipment is relatively large and therefore a large quantity of dry ice must be included, carriage may be at the discretion of the pilot or captain; or a courier may not be able to complete delivery of the shipment before expiration of the dry ice. Therefore even when a verbal guarantee of successful shipment is given, it may be prudent to send a test shipment first.

7. Preparation of the Material

Wherever possible, primary containers containing RPV should not be opened prior to packaging for transport. This is to prevent unnecessary exposure of the virus to the environment. The primary containers containing RPV should be removed from storage (e.g. a freezer) and examined. The vessel should be autoclave-sensitive (e.g. a polypropylene vial or tube). The cap should be screw-threaded and have an internal o-ring seal. If the vessel is **not** suitable for shipment (**e.g. a flip-top centrifuge vial**), then the vessel should be placed in a larger, appropriate vessel (with padding if necessary) which is then considered to be the primary container (if this is not possible, the material can be transferred to a new, appropriate primary container, provided specific pre-approval for this has been obtained from FAO and OIE)

The primary containers containing RPV should be surface-decontaminated by wiping or spraying with an appropriate disinfectant and placed immediately in the secondary container (a leak-proof container for Infectious Substances Category A as part of PI-620), appropriate to the size of the primary containers. Excess space in the crush-proof secondary container should be filled by loosely packing with cotton, tissue paper, or other appropriate absorbent material (note: must not use “air-cap” which is NOT absorbent) and the container then tightly closed using its screw-cap lid. The outside of the secondary container should be surface decontaminated with an appropriate disinfectant, and then the shipping container placed within the outer box supplied with the secondary crush-proof container.

8. Refrigerants

Preferably, RPV should be shipped in freeze-dried form which does not require refrigeration (note: freeze-dried material is often in flame-sealed or rubber-stoppered glass vials, which are not suitable as primary containers and must be placed in a suitable larger vessel which is then considered to be the primary container). If refrigeration is required, the only refrigerant that may be used is frozen carbon dioxide (dry ice). Wet ice and liquid nitrogen must not be used.

Where dry ice is used as a refrigerant, it must be placed outside the secondary container or alternatively in an overpack (i.e. dry ice must not be placed inside the primary or secondary container). This is because the primary and secondary containers are sealed as leak-proof, therefore expansion of carbon dioxide to the gas phase will result in explosion of the sealed container. The outer box must permit the release of carbon dioxide gas (i.e. must not completely sealed by packing tapes) to avoid explosion of the box that will result in re-dissemination of RPV.

9. Marking, labelling and documentation

The box must be addressed as agreed with the laboratory contact person.
A DGD must be prepared and signed by the ‘trained’ person.
The ‘trained’ person must ensure that the box is marked and labelled correctly in accordance to the DGR.
The box should be accompanied by a Material Safety Data sheet (MSDS) (see Annex A) for RPV, and this should also be supplied to the courier along with standard shipping documentation.

10. Disinfectants

Suitable disinfectants for surface decontamination of primary and secondary containers include:

1) 5% Virkon™ solution. Virkon™ solution must be made fresh on the day of use.

2) 10% Chloros solution. Chloros has a manufacturer's shelf life and should only be used if it is "within date" as specified on the container. 10% chloros must be made fresh on the day of use.

3) 2% sodium hydroxide.

If dry ice is used to ship RPV, the details must appear on the sender's Declaration for Dangerous Goods (DGD). In addition, the outermost packaging must carry the hazard label for dry ice.

11. Shipping

There is a remote possibility of theft of the RPV from a courier van or the sender's vehicle during transport to the courier's depot. In such a scenario, it is unlikely that RPV will have been deliberately targeted, and unlikely also that perpetrators or members of the public will correctly identify the package as containing a serious animal pathogen. Therefore, additional security to the airport should be considered.

It is recommended to use an international courier specialised in transporting infectious substances and with an established reputation for doing so. Wherever possible the receipt from the courier should have a unique tracking number for the package. When the courier is in possession of the package, the destination laboratory contact person should be informed immediately by phone or email. If a tracking number is used, it should be given to the destination laboratory contact person at this time.

Both the sender and the destination laboratory contact person must use the tracking number to track the package online at least once daily (subject to availability of internet connection) until it has arrived and receipt has been confirmed by the receiving laboratory.

12. Figures

Figure 1. An example of a shipping container meeting UN specification 6.2. The picture shows a secondary container and outer packaging, but not a primary container.

13. Annex A: MSDS for Rinderpest Virus

Name: Rinderpest virus

Type of Substance: Infectious agent

Synonyms: RPV, Cattle plague, steppe murrain, peste bovine, Чума крс, 牛瘟

Characteristics: Enveloped virus less than 300 nm wide, 1,000 to 10,000 in length. Negative-sense RNA genome.

Epidemiology: Extinct in the wild (subject to international certification).

Pathogenicity: Highly pathogenic. The disease is characterized by pyrexia, nasal and ocular discharges, and necrosis and erosion of the nasal and oral mucosae. Animals develop diarrhoea, and death generally occurs between 7 and 12 days after onset of symptoms.

Susceptible Hosts: Cattle and other bovine species. Not infectious for humans.

Mode of Transmission: Contact with infected animals or live virus.

Infectious Dose: As little as 100 virus particles.

Incubation Period: Eight to 11 days, but can be as little as four days.

Communicability: Highly transmissible between infected cattle

Disinfection: 5% Virkon™ solution (must be made fresh on the day of use); 10% Chloros solution (Chloros has a manufacturer's shelf life and should only be used if it is "within date" as specified on the container. 10% chloros must be made fresh on the day of use); 2% sodium hydroxide. The virus can also be killed by autoclaving.

Spillages: Do not handle the package if a spill has occurred, as this will spread the contamination. Saturate the package with disinfectant. Do not mix different disinfectants. If none of the listed disinfectants are available, use (in order of preference) household bleach, Dettol™, TCP™. **It is critical for any spillage that you immediately inform the sender, the recipient, local authorities and veterinary authorities.**