

ANNEX 14 Disinfection Procedures

(Source: FRS)

Marine Laboratory Aberdeen

Field Guide

DISINFECTION PROCEDURES

WITH REGARD TO THE ISA VIRUS

(Version II)

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**FIELD GUIDE
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1.1 Introduction

Infectious Salmon Anaemia (ISA) is a contagious viral disease of farmed Atlantic salmon (*Salmo salar*) which was first described in Norway in 1984. ISA is required to be eradicated under European legislation [Directive 91/67/EEC (as amended) and 93/53/EEC], transposed into UK law via the Fish Health Regulations 1997 and the Diseases of Fish (Control) Regulations 1994.

At sites where ISA is confirmed the fish must be removed and the site disinfected under the supervision of the Marine Laboratory Aberdeen (MLA). If the fish are of marketable size and not under withdrawal or show no clinical signs of disease, they may be marketed for human consumption. All sites within ISA designated infected areas are placed under strict Control Regulations (Gate Orders). Approval from MLA must be sought for all movements of personnel, equipment and live or dead fish to and from sites located in these areas.

Infected fish are often lethargic and have difficulty maintaining a horizontal position in the water. Mortality is high during the acute stage of the disease. The infection is characterised by anaemia (pale gills and heart), ascites (fluid in the body cavity), petechial haemorrhage of the visceral fat and congestion and enlargement of the liver and spleen. The liver is frequently dark but may range in colour from yellow/pale to black. Exophthalmia (pop eye), haemorrhage in the eye chamber and inflammation of the foregut may be present.

ISA is transmitted via seawater, fish wastes and mucus, fish blood and waste waters from processing plants. Live fish movements have been identified as a major risk factor in the spread of ISA. For an assessment of the risks associated with specific tasks, such as harvesting, broodstock movements, and well-boat movements, the reader is referred to the Report of the Joint Government/Industry Working Group on Infectious Salmon Anaemia (ISA) 1999. Copies are available from The Librarian, Marine Laboratory Aberdeen.

This Field Guide to Disinfection Procedures (Version II) should be regarded as best practice at fish farm sites and processing plants. It is intended for distribution to relevant industry personnel. The disinfection procedures described have been developed based on current scientific knowledge and practical experience.

Discharge of disinfectants to the environment is controlled under the Food and Environment Protection Act 1985 Part II Deposits in the Sea, As Amended by the Environment Protection Act 1990 (FEPA) and The Control of Pollution Act 1974 as amended by the Water Act 1989 and the Environment Act 1995 (COPA). COPA discharge consent is issued by the Scottish Environment Protection Agency (SEPA) and must be obtained for discharges made during activities such as net and cage disinfection at both cage sites and shore bases and for effluent disinfection at processing plants. A list of SEPA addresses is given in Appendix I.

Epidemiological evidence to date suggests that the risk of ISA transfer is reduced by the implementation of good sanitary practices by fish farmers and the application of effluent

the 4 steps to containment of ISAV - educate, clean, disinfect and quarantine

disinfection systems in the processing industry. Basic equipment must include footbaths and brushes, detergent and disinfectant sprays. Large vessels, such as well-boats, must carry an adequate supply of detergent and disinfectants onboard. Staff should be aware of the dangers associated with the use of chemicals and seek guidance from management on their use.

2.1 Disinfectants effective against ISA

Sodium hypochlorite is an effective disinfectant against the ISA virus (ISAV). In common with many methods of disinfection/virus-inactivating agents, the effectiveness of sodium hypochlorite is markedly reduced by organic material. Thus, the concentration required is dependant on the amount of organic material present. Generally, 100-1,000 mg/l in fresh water for a minimum of 30 minutes is adequate to inactivate ISAV. It is essential that all equipment is cleaned thoroughly before being disinfected. Sodium hypochlorite is commonly supplied as a solution containing 14% (wt/vol) available chlorine. To obtain a 1,000 mg/l solution, make 1 litre of sodium hypochlorite up to 140 litres with fresh water.

Other effective disinfectants include:

- iodophors (100 -200 mg/l for 5 minutes)
- formaldehyde (0.5% for 16 hours)
- formic acid (pH < 4 for 24 hours);
- sodium hydroxide (pH > 12 for 7 hours)
- heat (>55°C for > 5 minutes)
- ozone (8 mg/l/min for 3 minutes - corresponding to a Redox potential of 600-750 mV)
- UV radiation (5 mJ/cm², 120 mJ/cm² recommended for processing plant effluent to kill IPN virus).

SEPA maintains a presumption against the authorisation of the discharge of chlorinated effluents regardless of source. This was set aside at the onset of the ISA outbreak to allow fish farmers and processors to implement effective disinfection procedures rapidly. However, SEPA will be obliged to reinstate this presumption and the use of sodium hypochlorite (and other active chlorine compounds where there is a risk of the formation of organochlorine compounds) will require to be phased out.

2.2 Disinfection Procedures

2.2.1 Well-boats, Fish Farm Vessels and Ancillary Equipment

The following procedure is recommended for cleaning and disinfection of well-boats, fish farm vessels, helicopter buckets, killing tables and most other fish farm equipment —

PROCEDURE 1

- Step 1** Remove all gross fouling and organic matter by scraping and brushing.
- Step 2** Clean using a detergent solution to remove particulate matter, fats and oils, which are likely to bind to ISAV. (Hot water may give optimum performance but check detergent manufacturer's instructions).
- Step 3** Disinfect with iodophor or other suitable disinfectant.

Steps 2 and 3 may be combined as one step if a foaming detergent solution containing hypochlorite (minimum 100 mg/l hypochlorite) is used as a disinfectant.

Note: On well-boats, a disinfection checklist (Appendix II) must be kept with the ship's log. The Skipper is responsible for overseeing all procedures and must sign the checklist on completion.

Guidelines on the disinfection requirements for well-boats in different operational circumstances are given in the Report of the Joint Government/Industry Working Group on Infectious Salmon Anaemia (ISA) 1999.

- Well-boats and fish farm vessels operating between sites of equal ISA risk status, eg two non-suspect sites within a surveillance area, are required to disinfect the surface structure and hull of the vessel, down to and including the waterline, between sites.
- Vessels which have been operating at ISA-confirmed or -suspect sites must be slipped to disinfect the hull below the waterline before operating at sites of lower ISA risk status. While travelling to a slip, the vessel must be routed to minimise contact with any fish farm site.

Anyone unsure of the disinfection requirements for a specific operation should contact MLA for advice. In ISA infected areas, approval must be obtained from MLA for the movement to or from a site of all items of equipment liable to transmit infection. The form given in Appendix III may be used for applications seeking approval to move equipment.

2.2.2 Pallets

Wooden pallets in use at ISA-confirmed or -suspect sites must not be recirculated to other sites as the absorbent nature of wood means it is difficult to ensure successful disinfection. Pallets from ISA-confirmed or -suspect sites must be labelled for future identification. Pallets returned to the distribution or holding yard from ISA-confirmed or -suspect sites, together with those which may have been contaminated in transit, must be kept in a designated 'dirty' area for disposal. Plastic pallets should be disinfected according to the procedure described in Section 2.2.1.

2.2.3 Nets

If nets from a site in an ISA infected area are to be removed from the site before disinfection they must be transported in sealed containers. The net must be immersed in sodium hypochlorite solution at a concentration of 1,000 mg/l for 6 hours then rinsed with fresh water. The sodium hypochlorite solution must be agitated to ensure an even concentration of hypochlorite. Alternatively, the nets can be heat treated by immersion in hot water so that the entire net is subjected to a temperature of more than 55° for at least 5 minutes. Nets may be destroyed by incineration, disposed of in an approved landfill site or buried.

If nets are very heavily fouled the sodium hypochlorite concentration should be increased to ensure the presence of at least 5 mg/l active free chlorine after 6 hours. Free chlorine concentration can be measured by commercially available kits.

Note

- Iodine based disinfectants are not suitable for use on nets treated with copper based compounds. Iodine will render the antifoulant process ineffective.
- Heat treatment of nylon nets above 71°C significantly affects their breaking strain.

2.2.4 Cages and Moorings

The requirements for disinfection of cages are dependent on how the cages are to be deployed after the fish have been removed ie whether they are to be moved to another site or reused on the original site after the fallow period. The requirements are given in Table 1.

Table 1.

Site type/location	Disinfection requirements	
	Cages to be used on another site (Level 1 disinfection)	Cages to be reused at same site (Level 2 disinfection)
ISA confirmed/ suspect Infected area Surveillance area	All removable items, including nets, must be disinfected by an approved method. Cages, barges etc must be scraped clean, using divers if necessary, and fully disinfected by an approved method. The cages can be moved to shore for disinfection or wrapped in a tarpaulin at sea (discharge consent required).	Level 1 disinfection is recommended but if this proves impractical - all removable items, including nets, must be disinfected by an approved method. Cages, barges etc must be scraped clean, using divers if necessary, and the surface structure disinfected by an approved method. The cages must be left to fallow <i>in situ</i> for the required fallow period.
Elsewhere	A fallow period is not compulsory for sites in this area, thus, site disinfection is not mandatory. However, a 6 week fallow period following site disinfection is recommended.	

Sub-surface moorings can be considered as part of the seabed and as such they can be fallowed *in situ*. If moorings from a site within a designated ISA infected area are required for use on another site, and the appropriate fallowing period has not been observed, they must be disinfected prior to transfer. Metal chains etc must be disinfected as described in section 2.2.1, while ropes must be disinfected as described in section 2.2.3.

2.2.5 Divers and diving gear

ISA and other diseases can be transmitted via equipment or personnel who come into contact with infected fish during working practices. It is essential that strict hygiene procedures are followed on a daily basis. It is recommended that staff and visitors, including divers, should use the protective clothing supplied at sites within designated ISA high risk areas. Divers removing dead fish from an infected site before diving on an unaffected site, without first thoroughly disinfecting their equipment, pose a serious threat to disease transmission. Fish farm companies and diving companies should consider allowing for site specific gear. Dirty and disinfected suits and associated equipment must be kept separate at all times.

Diving suits and equipment must be treated as follows —

PROCEDURE 1

- Step 1.** Remove organic debris
- Step 2.** Immerse in fresh water containing iodophor (minimum 100 mg/l free iodine) for 20 minutes or heat treat by immersing equipment in clean fresh water so that the gear is maintained at a minimum of 55° C for at least 5 minutes.
- Step 3.** Rinse thoroughly with clean fresh water.

In situations where it is not practical to heat diving equipment to this temperature, the following procedure may be used for routine disinfection of diving equipment on fish farm sites out with ISA high risk areas —

3.1 Harvesting

All fish farm sites with a Designated Area Order (DAO) or other Control Regulations in place for ISA must obtain approval from MLA prior to harvesting. The form given in Appendix IV may be used for such applications. The slaughter of salmon is particularly hazardous with regard to the spread of ISA because of the risk of transmission of the disease via fish blood. Full containment of blood is recommended at all on-site slaughtering operations and is mandatory at sites within ISA infected areas. If necessary, tarpaulins should be placed underneath killing tables and any spillage collected and disinfected using sodium hypochlorite (1,000 mg/l for 30 minutes). Care must be taken to ensure that there are no escapes and morris must be disposed of as high risk waste. Fish showing clinical signs of disease cannot be marketed for human consumption and should be disposed of as high risk waste.

Harvest bins must be leakproof, lined with polythene bags and have well fitting lids strapped on tightly. The bins must not be over filled to prevent spillage of blood in transit. Leaking bins or bins with broken straps or poorly fitting lids must not be used. All bins should be labelled for identification purposes and disinfected as described in Section 2.2.1 between sites. Separate bins should be used in ISA infected areas.

Vehicles used to transport harvest bins should be fitted with a drainage pipe and sump to collect any spillage. In the event of spillage the lorry bed and sump must be disinfected. Lorries must carry disinfectant and drivers must be trained in the use of the equipment and chemicals to be applied on leaving a site and in the event of spillage in transit. Contingency plans should be in place to deal with a major spillage or loss of a harvest bin in transit.

3.2 Processing Plants and Ensiling

Fish blood and viscera are particularly infectious, therefore, strict hygiene practices must be maintained during the processing of fish and staff must be trained in observing recommended procedures. In addition, staff must be trained to recognize clinical signs of disease as diseased fish cannot be placed on the market for human consumption.

Disinfectant foot baths and brushes must be used on entering and leaving the facility. Suitable notices must be in place at entrances restricting access and at disinfection points compelling the use of foot baths. The concentration of disinfectant should be checked and logged at least once a day and maintained at an effective level. Protective clothing should be regularly cleaned and disinfected, at least at the end of each shift, and kept on site. Plant managers may find the checklist in Appendix V useful.

The ISAV is inactivated by the process of ensiling. Mortalities and viscera may be ensiled by a process of blending the fish to a liquefied state, then mixed with propionic and/or formic acid. Full ensiling requires a minimum of 24 hours at pH <4.0. Logs recording pH measurements must be kept and be available for inspection by MLA.

Note: Although ensiling inactivates ISAV this process does not inactivate all fish viruses, eg Infectious Pancreatic Necrosis (IPN) virus is not inactivated at low pH. Consequently, ensiled waste must still be treated as high risk waste.

All equipment associated with the delivery of harvested salmon, morts and fish waste, including lorries, tubs, lids, barrels, tote bags, skips and covers etc, must be thoroughly cleaned and disinfected as described in Section 2.2.1. Washing and disinfection must be carried out within a designated area, ensuring that all waste is collected and disinfected before disposal.

All effluent and blood water associated with fish processing should be contained and passed through an approved disinfection procedure. This is mandatory for processing of fish from ISA infected areas. Approved treatments for disinfecting blood water include sodium hypochlorite, ozone and UV. All these treatments are inactivated by organic material and it is important to remove as much of this as possible eg by filtration.

Sodium hypochlorite must be added to ensure a residual chlorine concentration of at least 5 mg/l for more than 30 minutes. Generally, an initial concentration of 1,000 mg/l (wt/vol) sodium hypochlorite is sufficient. If the effluent treatment system includes a bacteriological digestion system, the required concentration of hypochlorite will be reduced. Sodium hypochlorite may be neutralised with sodium thiosulphate prior to discharge but care must be taken to ensure adequate mixing, eg by aeration. Treated water must be disposed of through a SEPA-approved location.

Ozone and UV treatment are only effective if particulate matter, including red blood cells, is removed prior to disinfection. This can be achieved by eg a bacteriological treatment plant or a filter capable of removing particles down to 7 µm in size. The sludge must be treated as high risk waste and ensiled by mixing with propionic and/or formic acid to a pH of less than 4.0 for 24 hours. Ozone must be added to give a minimum of 8 mg/l/min (equivalent to a redox potential of 600 - 750 mV) for 3 minutes. If UV is to be used the dose must exceed

120 mJ/cm². There must be a logging system to monitor the dose and a back-up method must be in place in the event of failure of the disinfection system.

The movement of waste must be accompanied either by a waste transfer note, or consignment note if it is high risk waste (available from SEPA). This material must be disposed of at a waste management facility which is licensed to handle high risk waste.

APPENDIX I

SEPA contact addresses for further information —

North Region

North Region HQ, Graesser House, Fodderty Way, Dingwall, IV15 9XB
Tel: 01349 862021; Fax: 01349 863987.

Fort William Area Office, Carr's Corner, Lochybridge, Fort William, PH33 6TQ
Tel: 01397 704426; Fax: 01397 705404.

Thurso Area Office, Thurso Business Park, Thurso, Caithness, KW14 7XW
Tel: 01847 894422; Fax: 01847 893365

Western Isles Area Office, 1 Quay Street, Stornoway, Isle of Lewis, HS1 2XX
Tel: 01851 706477; Fax: 01851 703510.

Orkney Area Office, 58A Junction Road, Kirkwall, Orkney, KW15 1AG
Tel: 01856 871080; Fax: 01856 871090

Shetland Area Office, The Esplanade, Lerwick, ZE1 0LL
Tel: 01595 696926; Fax: 01595 696946

West Region

West Region HQ, 5 Redwood Crescent, Peel Park, East Kilbride, G74 5PP
Tel: 01355 574200; Fax: 01355 264323

Argyll and Bute Area Office, 2 Smithy Lane, Lochgilphead, Argyll, PA31 8TA
Tel: 01546 602876; Fax: 01546 602337

Appendix II Checklist for Cleaning and Disinfection of Well-boats

Cleaning	Tick	Disinfection	Tick
Hull below waterline		Hull below waterline	
Hull above waterline		Hull above waterline	
Wells		Wells	
Grid plates		Grid plates	
Pumps (including vacuum pump)		Pumps (including vacuum pump)	
Bilge pumps		Bilge pumps	
Sea valves		Sea valves	
Deck		Deck	
Railings		Railings	
Bulkhead/casings		Bulkhead/casings	
Hatches and covers		Hatches and covers	
Derrick		Derrick	
Crane		Crane	
Ladders		Ladders	
Counting table		Counting table	
Ballast tanks		Ballast tanks	
Other equipment (specify)		Other equipment (specify)	
Water temperature used		Disinfectant used	
.....		
Detergent used		Disinfectant concentration	
.....		

I,, skipper of the

have overseen the Cleaning and Disinfection procedures outlined in The Field Guide to Disinfection Procedures with regard to ISA virus (Version II)

Signed:.....Skipper),(Witness)

Date:..... Date:.....

Appendix III

APPLICATION FOR APPROVAL TO MOVE EQUIPMENT

This form may be copied and used when making an application for approval to move equipment to or from a fish farm site within an ISA designated infected area. Fill in the details required and fax or post to Marine Laboratory Aberdeen.

To: The Duty Inspector, Marine Laboratory Aberdeen, PO Box 101, Victoria Road, Torry, Aberdeen AB11 9DB

Fax No.: 01224 295 620

For Official Use only:	
Ref. No. : _____	Inspector : _____

Site Name	Site No FSI
Business Name	
Contact Name	Tel:
Contact Address	Fax:

Equipment source:.....

Equipment destination:

Proposed date of movement:.....

Equipment to be moved:.....

Reason for movement:.....

Official Use only	
Approved by : _____	Date _____

Appendix IV

APPLICATION FOR APPROVAL TO HARVEST FISH

This form may be copied and used when making an application for approval to harvest fish from a fish farm site with a Designated Area Order (DAO) or other Control Regulations for ISA. Fill in the details required and fax or post to Marine Laboratory Aberdeen.

To: The Duty Inspector, Marine Laboratory Aberdeen, PO Box 101, Victoria Road, Torry, Aberdeen AB11 9DB

Fax No: 01224 295 620

For Official Use only:	
Ref. No. : _____	Inspector : _____

Site Name	Site No FS/
Business Name	
Contact Name	Tel:
Contact Address	Fax:

Proposed start date for harvest.....

Proposed finish date for harvest.....

Number of fish to be harvested	
Process plant for harvested fish	

Proposed method of transport.....

Official Use only	
Approved by : _____	Date _____

Appendix V Check List for Processing Plants

Check	Tick
Notices restricting access posted at all entrances	
Disinfectant foot baths with brushes provided at all entrances and exits with suitable notices	
Disinfectant concentration checked and maintained at effective level	
Vehicles entering and leaving the site pass through disinfection procedure	
Transport of fish in sealed, clean and disinfected containers	
On-site vehicles, forklift trucks routinely cleaned and disinfected	
Drains connected to disinfection plant via filters	
Yard clean and disinfected - no blood water evident	
Foot baths in place between discrete work areas, eg yard, factory, chill etc	
Protective clothing cleaned and disinfected (at least after every shift)	
Processing equipment, utensils etc routinely cleaned and disinfected	
System in place to prevent wind blown effluent when emptying fish bins	
Fish receiving hopper/tank designed to prevent spillage of fish and effluent	
System in place to prevent access to carcasses by predators eg birds	
Cleaning and disinfection system in place for empty bins	
Bins from ISA high risk areas kept separate from other bins	
Eviscerated material pumped into ensilage system and fully contained	
Log in place to monitor pH of silage (pH <4.0)	
Filter in place to remove particulates from effluent before treatment	
Log in place to monitor effluent treatment method (eg residual free chlorine level > 5 ppm after 30 minutes)	
pH and effluent disinfection logs sent to the MLA on a monthly basis - for the attention of the Duty Inspector	

Inspected by:.....

Date:.....

Recommendations for improvements: Y / N

Specify:

