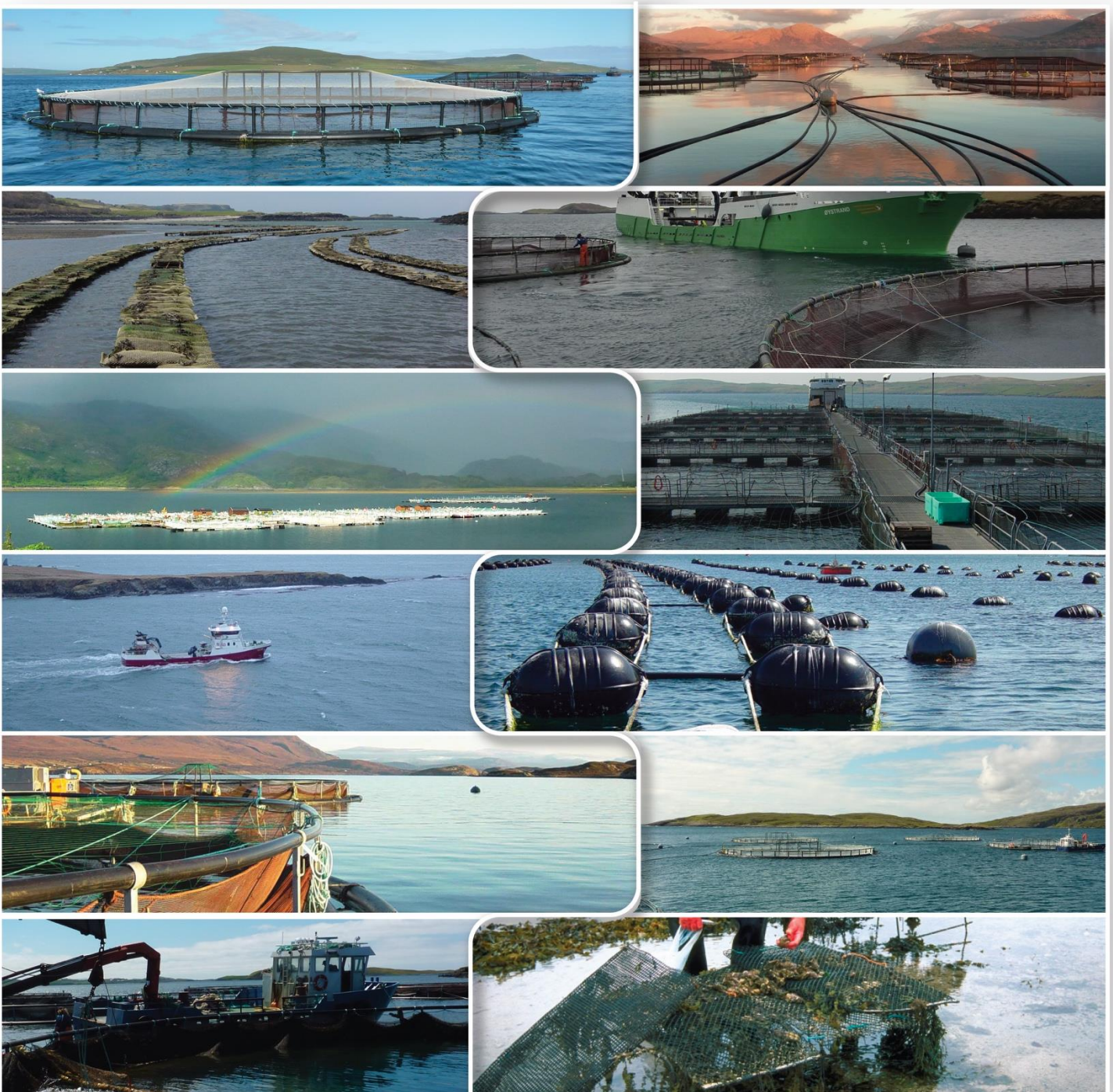


## DISINFECTION GUIDE (VERSION IV)

### PRACTICAL STEPS TO PREVENT THE INTRODUCTION AND MINIMISE TRANSMISSION OF DISEASES OF FISH



The FRS Disinfection Guide (Version IV) is used and referred to by the Marine Directorate in relation to disinfection and biosecurity. The guide is currently subject to review and a revised version will be published in due course. Marine Directorate Fish Health Inspectorate, July 2025.

Not to be quoted without prior reference to the authors

© Crown Copyright 2006

Fisheries Research Services Internal Report No 13/06

**DISINFECTION GUIDE VERSION IV  
PRACTICAL STEPS TO PREVENT THE INTRODUCTION AND MINIMISE  
TRANSMISSION OF DISEASES OF FISH**

D I Fraser, P D Munro and D A Smail

January 2006

Fisheries Research Services  
Marine Laboratory  
Victoria Road  
Aberdeen  
AB11 9DB

## TABLE OF CONTENTS

1.	Introduction .....	1
2.	Health and Safety (H&S).....	1
3.	Discharge of Disinfectants .....	2
4.	Cleaning and Disinfection .....	2
4.1	Cleaning.....	2
4.2	Disinfection.....	2
4.3	Protocol for general cleaning and disinfection of equipment.....	3
4.4	Choice of Disinfectant .....	3
5.	Disinfection Procedures .....	5
5.1	Fish Farm Vessels and Ancillary Equipment.....	5
5.2	Well-boats and Feed Delivery Boats.....	5
5.3	Delicate Ancillary Equipment .....	7
5.4	Pallets .....	7
5.5	Nets.....	7
5.6	Cages and Moorings .....	8
5.7	Fish Farm Staff, Divers, Diving Gear and Site Visitors.....	8
5.8	Harvesting .....	9
5.9	Processing Plants and Ensiling.....	10
5.10	Disinfection of Salmonid Ova .....	11
6.	Disposal of Dead Fish.....	12
7.	Prevent the Introduction of <i>Gyrodactylus salaris</i> into Scottish Waters.....	12
8.	Fisheries.....	12
9.	Disinfectant Approval Scheme .....	13
	References .....	13
	Appendix I-VI	

---

# **DISINFECTION GUIDE (VERSION IV) PRACTICAL STEPS TO PREVENT THE INTRODUCTION AND MINIMISE TRANSMISSION OF DISEASES OF FISH**

D I Fraser, P D Munro and D A Smail  
FRS Marine Laboratory, 375 Victoria Road,  
Aberdeen, AB11 9DB

## **1. INTRODUCTION**

Emerging diseases have had a significant impact on development of the Scottish aquaculture industry, highlighting the importance of preventing their introduction and minimising their transmission. The risk of disease spread is reduced by the implementation of good sanitary practices by fish farmers, and fisheries and the application of effluent disinfection systems in the processing industry.

To maintain healthy fish stocks and minimise the introduction and spread of disease, the aquaculture industry should ensure best practice on farm sites, during transportation of live or dead fish and equipment, at the processing plant and during subsequent effluent and waste disposal. For an assessment of the risks associated with specific tasks, reference should be made to the *Final Report of the Joint Government/ Industry Working Group on Infectious Salmon Anaemia (ISA)* available from the Fisheries Research Services (FRS) web site, at [www.frs-scotland.gov.uk](http://www.frs-scotland.gov.uk).

The protocols described in this guide are based upon current scientific knowledge and practical experience and will continue to be developed as the needs of industry change. This guide is intended for distribution to relevant industry personnel.

## **2. HEALTH & SAFETY (H&S)**

Current health and safety guidelines must be followed at all times. Higher concentrations of disinfectant than necessary can be dangerous to personnel. Label instructions should be followed carefully, referring to the manufacturer's guidelines, including expiry date. Staff must be aware of the appropriate COSHH and risk assessments and must be trained before undertaking any disinfection procedure. Facilities, including operating structures, cages, tanks or vessels must be fit for purpose.

It should be noted that in rare cases some disinfectants may cause a hypersensitive reaction in susceptible individuals.

### **3. DISCHARGE OF DISINFECTANTS**

Discharge of disinfectants to the environment is controlled under:

- The Control of Pollution Act 1974 as amended by the Water Act 1989 and the Environment Act 1995 (COPA)

and

- The Food and Environment Protection Act 1985 Part II Deposits in the Sea, as amended by the Environment Protection Act 1990 (FEPA).

COPA discharge consents are 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. Certain disinfectant agents, such as chlorine and iodine, should be neutralised (see section 5.9.3) before discharge. A list of SEPA addresses is given in Appendix I.

FEPA discharge consents for disposal of waste at sea are issued by Fisheries Research Services (FRS).

### **4. CLEANING AND DISINFECTION**

#### **4.1 Cleaning**

Surfaces and equipment must be thoroughly cleaned, with detergent if necessary to remove any grease or fats, prior to disinfection as the presence of organic material during the disinfection process impairs the effect of the disinfectant. Much infectious material may be removed or inactivated at this important stage.

#### **4.2 Disinfection**

A disinfectant is an agent that deactivates infection-producing organisms. Disinfectants are usually applied to inanimate objects and are often toxic or harmful to living tissue. To ensure effective treatment, disinfectants should always be applied at the recommended concentration and temperature and for the recommended contact time. The concentration and contact time are dependent on the conditions and procedure undertaken. Organic loading (dirt) has a negative impact on the efficacy of most disinfectants. Any disinfectant which has past its expiry date should not be used.

It should be noted that good cleaning and disinfection procedures minimise the risk of disease transmission. However, disinfection is not synonymous with sterilisation.

### **4.3 Protocol for General Cleaning and Disinfection of Equipment**

- Remove all visible organic material, using detergent if necessary to remove any grease or fats.
- Choose an appropriate disinfectant. In general, use a disinfectant which is effective against a broad spectrum of disease agents.
- Dilute the disinfectant to the recommended concentration, referring to the manufacturer's instructions.
- Apply the disinfectant to all surfaces to be treated and leave for the recommended contact time.
- Rinse with clean water, if necessary.

### **4.4 Choice of Disinfectant**

A list of suitable disinfectants and dose rates for various applications is given in Table 1. This list is not exhaustive and will be subject to change as new information becomes available. The effective concentration of disinfectant is dependent on factors such as contact time, temperature and cleanliness of the substrate to be disinfected. It is assumed that all equipment is thoroughly cleaned and that effluent is properly filtered or pre-treated prior to the disinfection process. Certain conditions require special treatments, such as effluent from processing plants or nets, where the organic loading is very high.

**TABLE 1**

Disinfectants, doses and applications

Disinfectant	Example*	Dose	Application	Comments
Sodium hypochlorite	Klorsept (Jencons Scientific, UK)	100 ppm, 10 min 1000 ppm, 10 min 1000 ppm, 6 hrs	Boats, cages, tanks, hand nets, harvest equipment Processing plant effluent Cage nets	Reported effective against ISA (Torgersen, 1998 and Smail <i>et al.</i> , 2004) and IPN (Elliott & Amend, 1978) Ensure an active free chlorine level of at least 5 ppm after treatment.
Chloramine T	Halamid® (Axcentive, France)	1% (w/v), 5 min	Foot bath, non-porous surfaces	Reported effective against ISA (Smail <i>et al.</i> , 2004) ( <a href="http://www.halamid.com">www.halamid.com</a> )
Chlorine dioxide	Zydox AD-05 activated by DRA-2 (Zychem Technologies, Norway)	100 ppm, 5 min	Processing plant effluent	Effective against ISA (Smail <i>et al.</i> , 2004)
Iodophor	Buffodine, FAM30 (Evans Vanodine, UK) or Tegodyne (DiverseyJohnson, UK)	100 ppm, 10 min	Foot bath, clothing, diving gear, hand nets, salmonid ova, non-porous surfaces	Reported effective against ISA (Smail <i>et al.</i> , 2004) and IPN (Elliott & Amend, 1978) Fading colour from brown to yellow indicates inadequate concentration. Not suitable for nets treated with antifoulant.
Peroxy compounds	Virkon S (Antec international, UK)	1% (w/v), 10 min (IPN ) 0.5% (w/v), 30 min (ISA)	Foot baths, non-porous surfaces	Reported effective against IPN, ERM and BKD. Reported effective against ISA and furunculosis ( <a href="http://www.antecint.co.uk">www.antecint.co.uk</a> ).
Peracetic acid, hydrogen peroxide and acetic acid mix	Proxitane® 5 (Solvay Interlox, UK)	0.4% (v/v), 5 min	Non-porous surfaces	Reported effective against ISA (Smail <i>et al.</i> , 2004).
Quarternary ammonium compounds	Cetrimide (FeF Chemicals A/S, Denmark)	125 ppm, 5 min	Plastic surfaces	Reported effective against VHS & furunculosis (Dorson & Michel, 1987). Not effective against IPN at 12,500 ppm.
Formic Acid		pH < 4, 24 hours	Ensiling fish waste	Reported effective against ISA (Torgersen, 1998). Also, effective against BKD & furunculosis but not against IPN. (Smail <i>et al.</i> , 1993)
Ozone		8 mg/l/min, 3 min (Corresponding to redox potential 600-750 mV)	Water – intake and effluent	Reported effective against IPN, furunculosis, ERM and <i>Vibrio anguillarum</i> (Liltved <i>et al.</i> , 1995). Filtration, pre-treatment is recommended.
Heat		70°C, 2 hours (IPN) 60°C, 2 minutes (ISA) 37°C, 4 days (Noda)	Cage nets, diving gear, steam cleaning non-porous surface	Reported effective against IPN (Whipple & Rohovec, 1994). Reported effective against ISA (Torgersen, 1998). Reported effective against nodavirus (Frerichs <i>et al.</i> , 2000). Heat treatment above 71°C may reduce nylon net breaking strain.
UV		122 mJ/cm <sup>2</sup> /sec (IPN) 290 mJ/cm <sup>2</sup> /sec (Noda)	Freshwater intake supply	Reported effective against IPN (Liltved <i>et al.</i> , 1995). Reported effective against Nodavirus (Frerichs <i>et al.</i> , 2000). Efficacy compromised by organic loading. May be combined with ozone for treating effluent from processing plants.

\*Inclusion of brand names is for illustrative purposes only and does not imply endorsement by Fisheries Research Services. Other products may be equally efficacious.

## 5. DISINFECTION PROCEDURES

### 5.1 Fish Farm Vessels and Ancillary Equipment

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

- 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. Hot water may give optimum performance but check detergent manufacturer's instructions.
- Step 3** Apply disinfectant at recommended concentration for appropriate contact time.
- Step 4** Rinse with clean water if required.

Steps 2 and 3 may be combined as one step if a foaming detergent solution containing an appropriate disinfectant is used.

### 5.2 Well-boats and Feed Delivery Boats

The number of live fish transfers and feed deliveries made by boat is increasing and may involve serial deliveries to a number of sites. The risk of disease transmission by well-boats and feed delivery boats is highest where contact is made with fish or contaminated seawater. Well-boats and feed delivery boats may transmit disease via:

- Fish
- Transport water
- Bus stop deliveries
- Feed
- Personnel
- Ship structure
- Scavengers.

To minimise the risk of horizontal transmission of disease:

- Restrict access by farm staff to the vessel and from the vessel to the farm cages and other farm equipment.
- Avoid simultaneous carriage of waste and fresh feed.
- Ensure feed is processed to ensure a microbiologically safe product.
- Feed should be contained in clean containers, sealed to prevent scavenging by birds or rodents.
- Deliveries should be made to a single farm management area, to sites of the same health status or to those of highest health status first.

- The order of delivery should normally be to the youngest year class of fish first.
- Ensure appropriate vessel cleaning and disinfection procedures are followed.

Appropriate protocols for disinfection of well-boats and feed delivery vessels under different operational circumstances are given in Table 2. A risk assessment should be conducted before any operation involving the movement of vessels between sites or from a site to another location, such as a processing plant. In certain circumstances it may be necessary to employ a more rigorous stage than described in Table 2.

**TABLE 2**

Disinfection stages required by well-boats and feed delivery boats under different operating circumstances

Operation	Stage 1	Stage 2	Stage 3
Arriving from out with UK waters	X	X	X
Leaving a site suspected or confirmed infected with a notifiable disease	X	X	X
Leaving a Control <sup>1</sup> or Surveillance Zone <sup>2</sup> for a new operating location of greater health status	X	X	X
Leaving a Surveillance Zone on shuttle runs, to destinations of greater health status	X		
Operating between sites of equal health status within a single management area	X		
Operating on shuttle runs between sites of equal health status	X		
Leaving operations in one management area to start in a different management area	X	X	
Before and after operating on a broodstock site	X	X	
Routine anti-fouling (following company inspection)	X	X	X

<sup>1</sup>In coastal areas - a control zone is defined as a circle of radius equal to one tidal excursion centred on the infected farm. In inland areas - a control zone may comprise all or part of a water catchment area.

<sup>2</sup>In coastal areas - a surveillance zone is defined as an area surrounding the control zone of overlapping tidal excursion zones. In inland areas - a surveillance zone comprises an extended area outside the established control zone.

**Stage 1** Brush/clean solids from surfaces. All pipe work, including vacuum pumps, must be cleared of fish. Pressure clean (with detergent) the following areas as appropriate:

- Deck
- Wells
- Equipment
- Protective clothing
- Pumps.

Hot water may give optimum performance but check manufacturer's instructions.

**Stage 2** Complete Stage 1 then steam clean and disinfect all surfaces, including the hull down to the waterline.

**Stage 3** Complete Stages 1 and 2 plus slip the vessel and clean and disinfect the hull below the waterline. While travelling to the slip, the vessel must be routed to minimise contact with any fish farm site.

**Note:** Stage 3 may not be necessary when leaving a Surveillance Zone if a self-polishing type of antifouling paint is used on the hull and the hull is free of fouling.

On well-boats, a disinfection checklist (Appendix III) should be kept with the ship's log. The Skipper is responsible for overseeing all procedures and must sign the checklist on completion. Copies should be retained for inspection and audit purposes.

Approval must be obtained from FRS for the movement of all items of equipment liable to transmit infection to or from sites suspected or confirmed infected with a List I or List II notifiable disease of fish. The form given in Appendix IV may be used for applications seeking approval to move equipment.

### **5.3 Delicate Ancillary Equipment**

Electronic equipment (eg scales and thermometers) may be sprayed with alcohol and allowed to air dry, paying particular attention to manufacturer's instructions particularly in the initial removal of organic fouling.

### **5.4 Pallets**

Plastic pallets should be disinfected according to the procedure described in Section 4.3. Wooden pallets must not be circulated between sites as the absorbent nature of wood means it is difficult to ensure successful disinfection. Pallets returned to the distribution or holding yard, together with those which may have been contaminated in transit, must be kept in a designated dirty area for disinfection or disposal.

### **5.5 Nets**

Used nets should be transported in sealed containers. They should be tagged and logged on arrival at the designated dirty area of a net washing station to ensure they are kept separate from clean nets.

Nets should be immersed in sodium hypochlorite solution at a concentration of 1,000 mg/l for six hours (or an alternative equally effective disinfectant at the appropriate concentration) then rinsed with fresh water. The sodium hypochlorite solution must be agitated to ensure an even concentration of hypochlorite. 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 six hours. Commercially available kits are available for measuring free chlorine concentration.

Alternatively, clean nets can be heat treated by immersion in hot water so that the entire net is subjected to a temperature of more than 65 °C for at least ten minutes.

Nets may be destroyed by incineration, disposed of in an approved landfill site or buried.

**Note:** Iodine based disinfectants are not suitable for use on nets treated with copper based compounds. Iodine will render the antifouling process ineffective. Heat treatment of nylon nets above 71°C can significantly affect their breaking strain.

## 5.6 Cages and Moorings

All removable items, including cage nets, should be cleaned and disinfected according to the appropriate procedures. As a minimum, cages, barges etc should be scraped clean, using divers if necessary, and disinfected down to and including the waterline. The rest of the structure should be left fallow for at least four weeks.

In the event that a farm is infected with a List I or List II notifiable disease, the entire cage structure may be required to be cleaned and disinfected. Cages can be moved onshore for disinfection or wrapped in a tarpaulin at sea (SEPA authorisation for discharge may be required). If the cages are to be reused on the same farm it may be permissible for the cages to be left in situ for the required fallow period following the cleaning and disinfection of the cages down to and including the waterline. The minimum fallow period in such cases is normally 3-6 months.

Sub-surface moorings can be considered as part of the seabed and, as such, they can be left to fallow *in situ*. If moorings from a site infected with a List I or List II notifiable disease are required for use on another site, and the appropriate fallowing period has not been observed, they must be cleaned and disinfected prior to transfer.

## 5.7 Fish Farm Staff, Divers, Diving Gear and Site Visitors

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

Staff servicing sites with the same fish farm vessel should clean and disinfect the vessel to the waterline on leaving each site. Footbaths and brushes should be strategically placed for the disinfection of equipment where this is not site-specific. The site manager should take responsibility for ensuring good practice, including the maintenance of foot baths at an effective concentration.

Diving suits and equipment should be treated as follows:

**Step 1** Remove organic debris, clean with an appropriate detergent and rinse with clean water.

**Step 2** Immerse in fresh water containing iodophor (minimum 100 mg/l free iodine) or an equally effective disinfectant for 20 minutes. Alternatively, heat treat by immersing equipment in clean fresh water so that the gear is maintained at a minimum of 60°C for at least two minutes.

**Step 3** Rinse thoroughly with clean water.

## 5.8 Harvesting

Permission to move fish off sites subject to official controls for notifiable diseases must be sought from the Scottish Ministers prior to harvesting. The form given in Appendix V may be used for such applications. All movements of live fish for harvest should be recorded in the site movement records.

There is a high risk of spread of disease associated with the slaughter of farmed fish. Containment of fish and fish products, including blood, is recommended at all on-site slaughtering operations and is mandatory at sites within a Control or Surveillance Zone for a List I or List II notifiable disease. If necessary, tarpaulins should be placed beneath killing tables and any spillage collected and disinfected using sodium hypochlorite (1,000 mg/l for 10 minutes) or iodophor (1,000 ppm for 10 minutes). Care must be taken to ensure that there are no fish escapes and mortalities must be disposed of in an approved manner.

Harvest bins should be leak-proof, lined with polythene bags and have well fitting lids strapped on tightly. To prevent spillage of blood in transit the bins must not be over filled. Leaking bins or bins with broken straps or poorly fitting lids should not be used. All bins should be labelled for identification purposes and cleaned and disinfected between sites. Separate bins should be used in areas infected with a List I or List II disease.

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 should carry disinfectant and drivers should 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.

If a well-boat is used to transport fish, the valves must remain closed within 5 km or one tidal excursion (whichever is greater) of any fish farm or wild fishery. Fish must be transferred directly from the wells and not held in cages at the processing plant prior to harvest. Well water should either pass through the processing plant effluent treatment system prior to discharge or be discharged out with a tidal excursion or 5 km (whichever is greater) of any fish farm site. If

the processing plant itself is located more than two tidal excursions away from any fish farm site or significant wild fishery then the effluent may be discharged directly from the well, in the absence of blood or blood products.

## **5.9 Processing Plants and Ensiling**

Fish blood and viscera may be 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 recognise clinical signs of disease as fish showing clinical signs of disease are not permitted to be marketed for human consumption.

All drains should interconnect to the waste treatment plant to ensure containment of fish products and effluent discharges. Access should be restricted into the plant and between work areas.

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 footbaths. 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 VI useful.

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

### **5.9.1 Ensiling**

The process of ensiling inactivates ISA virus and many other fish pathogens, such as the causative agents of bacterial kidney disease and furunculosis. Mortalities and viscera may be ensiled by a process of blending the fish to a liquefied state and mixing with formic acid. Ensiling requires a minimum of 24 hours at pH < 4.0. Logs of pH measurements should be kept and made available for inspection.

**Note:** Ensiling does not inactivate Infectious Pancreatic Necrosis (IPN) virus. Consequently, ensiled waste should not be regarded as free from risk with respect to disease transmission.

### **5.9.2 Effluent treatment**

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, VHS and IHN-infected areas and strongly recommended for all fish processing plants. Approved treatments for disinfecting blood water include sodium hypochlorite, ozone and a combination of ozone and UV radiation. All these treatments are inactivated by organic material and it is important to remove as much of this as possible, for example by filtration, before treatment.

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 of sodium hypochlorite is sufficient. If the effluent treatment system includes a bacteriological digestion system or a high level of filtration the required concentration of hypochlorite can be reduced.

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 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 three minutes. If UV is to be used the dose must exceed 120 mJ/cm<sup>2</sup>. It is seldom used on its own, but has proved effective in plant systems employing a combination of ozone and secondary UV treatment. 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.

### **5.9.3 Neutralisation of sodium hypochlorite**

Sodium hypochlorite should be neutralised with sodium thiosulphate prior to discharge. Five moles of thiosulphate neutralise four moles of chlorine. The molecular proportions are the same for iodine (<http://www.oie.int>). Care must be taken to ensure adequate mixing, eg by aeration. Treated water must be disposed of through a SEPA-approved location. SEPA will advise on the use of such agents.

### **5.9.4 Movement of waste**

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.

## **5.10 Disinfection of Salmonid Ova**

Reference should be made to current OIE guidelines for the disinfection of ova ([http://www.oie.int/eng/normes/mcode/en\\_sommaire.htm](http://www.oie.int/eng/normes/mcode/en_sommaire.htm)). The following procedures are recommended to minimise the risk of extra-ovum transmission of fish pathogens from parent to progeny.

- Contamination of gametes with urine, faeces and blood should be avoided during stripping.
- Disinfection of pre-hardened eggs should take place as soon after fertilisation as possible, using buffered iodophor volume for volume in 0.9% isotonic saline solution to give a free iodine concentration of 100 ppm for 10 minutes. Thorough rinsing of disinfected, fertilised eggs should be carried out using clean isotonic saline followed by fresh water.
- Disinfection of eyed eggs should be carried out using iodophor solution to give a free iodine concentration of 100 ppm, prior to hatch or movement to another water supply.

## 6. DISPOSAL OF DEAD FISH

Subject to safe operating conditions, mortalities should be removed on a daily basis and should be disposed of by an approved method in accordance with Regulation (EC) 1774/2002. Local authorities have responsibility for waste disposal. A list of local authorities is provided in Appendix II.

## 7. PREVENT THE INTRODUCTION OF *GYRODACTYLUS SALARIS* INTO SCOTTISH WATERS

*Gyrodactylus salaris* is a parasite which infests the skin and fins of salmon, trout and some other types of fish in fresh water. It does not occur in UK rivers but our salmon, like those in Norway, are killed by the parasite. It is hardy and may inadvertently be introduced by fishermen, in damp conditions in bags, angling equipment and via dead fish, including bait. It reproduces very quickly, capable of starting an epidemic in a short time. Those responsible for fresh water fisheries should ensure good biosecurity measures are in place and that staff are aware of the risks.

If travelling from affected areas, ensure equipment is disinfected before fishing in UK waters.

Methods of disinfection

- Dry at 20 °C for two days
- Heat for at least 1 hour at > 60 °C
- Deep freeze > 24 hours
- Immerse in disinfectant for at least 10 minutes using either:

Virkon 1%  
Wescodyne 1%  
Sodium Chloride 3%  
Sodium Hydroxide 0.2%

Reference should be made to the leaflet “*Keep Fish Diseases Out – A guide to protecting freshwater fish stocks from gyrodactylosis and other serious fish diseases*” (<http://www.frs-scotland.gov.uk/Uploads/Documents/General%20Leaflet%20very%20latest!.pdf>).

## 8. FISHERIES

Biosecurity of a fishery is more difficult than in the farm situation. The risk of introduction and transmission of disease may be minimised by avoiding stock transfer between catchment areas, restricting the movement of personnel and equipment; developing and implementing contingency plans for disease outbreaks, prompt diagnosis of disease problems and staff training.

Moribund or dead fish and viscera (fish guts) should not be returned to ponds/the river. They should be disposed of by sealing in a polythene bag and placed in a waste bin destined for an approved landfill.

Sick or recently dead fish showing clinical signs of disease should be submitted to FRS Fish Health Inspectorate for diagnostic investigation (contact [fishhealth@marlab.ac.uk](mailto:fishhealth@marlab.ac.uk) or the Duty Inspector at 01224 295525). This may be co-ordinated via the local District Salmon Fishery Board or Fisheries Trust biologist, (contact [www.asfb.org.uk/asfb.html](http://www.asfb.org.uk/asfb.html)).

## 9. DISINFECTANT APPROVAL SCHEME

Under provisions of the Animal Health Act 1981, the Department for Environment, Food and Rural Affairs (Defra) maintains a list of disinfectants that are approved for use in the control of notifiable diseases of terrestrial animals and birds. At present, this system of approval does not extend to the notifiable diseases of fish and shellfish.

Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market specifies that all biocides should be demonstrably both efficacious and safe for their intended purpose before they can be marketed. Appropriate efficacy testing standards were not specified in the Directive and it will be some time before products that are currently in use are re-evaluated against the standard criteria.

Defra propose to introduce a voluntary listing system whereby companies can demonstrate to Defra that products are effective at inactivating a range of pathogens found in aquaculture. Products that pass appropriate test criteria can then be listed as being effective against the pathogens they have been tested against. This list should be useful, both to companies wishing to market disinfectants for use in aquaculture, as well as to health professionals and fish farmers wishing to select appropriate biocides.

## REFERENCES

- Ahne, W. 1982. Vergleichende Untersuchungen über die Stabilität von vier fischpathogenen Viren (VHSV, PFR, SVCV, IPNV). *Zbl. Vet. Med. B.*, **29**, 457-476.
- Dorson, M. and Michel, C. 1987. Evaluation de l'efficacité de cinq ammoniums quaternaires sur les principaux virus et bactéries pathogènes pour les salmonides. *Bull. Fr. Peche Piscic.*, **305**, 61-66.
- Elliott, D.G. and Amend, D.F. 1978. Efficacy of certain disinfectants against infectious pancreatic necrosis virus. *J. Fish Biol.*, **12**, 277-286.
- Frerichs, G.N., Tweedie, A., Starkey, W.G. and Richards, R.H. 2000. Temperature, pH and electrolyte sensitivity, and heat, UV and disinfectant inactivation of sea bass (*Dicentrarchus labrax*) neuropathy nodavirus. *Aquaculture*, **185**, 13-24.
- Liltved, H., Hektoen, H. and Efraimssen, H. 1995. Inactivation of Bacterial and Viral Fish Pathogens by Ozonation or UV Irradiation in Water of Different Salinity. *Aquaculture Engineering*, **14**, 107-122.
- Smail, D.A., Huntly, P.J. and Munro, A.L.S. 1993. Fate of four fish pathogens after exposure to fish silage containing fish farm mortalities and conditions for the inactivation of infectious pancreatic necrosis virus. *Aquaculture*, **113**, 173-181.

- Smail, D.A., Grant, R., Simpson, D., Bain, N. and Hastings, T.S. 2004. Disinfectants against cultured Infectious Salmon Anaemia (ISA) virus: the virucidal effect of three iodophors, chloramine T, chlorine dioxide and peracetic acid/hydrogen peroxide/acetic acid mixture. *Aquaculture*, **240**, 29-38.
- Torgersen, Y. 1998. Physical and chemical inactivation of the Infectious Salmon Anaemia (ISA) virus. In: Hastein, T. (ED), Workshop on ISA. New Brunswick, St Andrews, pp. 44-53. (Annex 5).
- Whipple, M.J. and Rohovec, J.S. 1994. The effect of heat and low pH on selected viral and bacterial fish pathogens. *Aquaculture*, **123**, 179-189.
- Scottish Quality Salmon, Scottish Executive and Fisheries Research Services. *Code of practice to Avoid and Minimise the Impact of Infectious Salmon Anaemia (ISA)*. Crown copyright (2000) The Crown Estate, 10 Charlotte Square, Edinburgh EH2 4DR. 16 pp.
- Scottish Executive and Fisheries Research Services. *Final Report of the Joint Government/Industry Working Group on Infectious Salmon Anaemia (ISA)*. Crown copyright (2000) 136 pp. (<http://www.frs-scotland.gov.uk>).
- Scottish Executive and DEFRA *Keep Fish Diseases Out – A guide to protecting freshwater fish stocks from gyrodactylosis and other serious fish diseases*. Crown copyright (2005) 2 pp. (<http://www.frs-scotland.gov.uk/Uploads/Documents/General%20Leaflet%20very%20latest!.pdf>)

## 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, 2 James Square, James Street, Stornoway, Isle of Lewis, HS1 2QN  
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

### Local Authority Contact Addresses for Further Information

#### **Aberdeen City**

Aberdeen City Council, Town House, Broad Street, Aberdeen, AB10 1FY  
TEL: 01224 522000 FAX: 01224 644346

#### **Aberdeenshire**

Aberdeenshire Council, Woodhill House, Westburn Road, Aberdeen AB16 5GB  
TEL: 01467 620981 FAX: 01224 665444

#### **Angus**

Angus Council, Council Headquarters, The Cross, Forfar, DD8 1BX  
TEL: 01307 461460 FAX: 01307 461874

#### **Argyll and Bute**

Argyll and Bute Council Headquarters, Kilmory Castle, Lochgilphead, Argyll, PA31 8RT TEL:  
01546 602127, FAX: 01546 604138

#### **Clackmannanshire**

Clackmannanshire Council, Greenfield, Alloa, FK10 2AD  
TEL: 01259 452002, FAX: 01259 452230

#### **Dumfries and Galloway**

Dumfries and Galloway Council, Council Offices, English Street, Dumfries, DG1 2DD TEL:  
01387 260000, FAX: 01387 260034

#### **Dundee City**

Dundee City Council, 21 City Square Dundee, DD1 3BY  
TEL: 01382 434201, FAX: 01382 434996

#### **East Ayrshire**

East Ayrshire Council Council Headquarters London Road Kilmarnock KA3 7BU  
TEL: 01563 576000 FAX: 01563 574062

#### **East Dunbartonshire**

Environmental Health, East Dunbartonshire Council, Tom Johnston House, Civic Way,  
Kirkintilloch, Glasgow, G66 4TJ  
TEL: 0141 761 4891, FAX: 0141 761 4888

#### **East Lothian**

East Lothian Council, Council Buildings, Court Street, Haddington,  
East Lothian EH41 3HA,  
TEL: 01620 827827, FAX: 01620 827888

#### **East Renfrewshire**

East Renfrewshire Council, Council Headquarters, Eastwood Park, Rouken Glen Road,  
Giffnock, East Renfrewshire, G46 6UG  
Tel. no. 0141-577 3009, Fax no. 0141-577 3890

**Edinburgh, City of**

City of Edinburgh Council, Council Headquarters, Wellington Court, 10 Waterloo Place,  
EDINBURGH, EH1 3EG  
TEL: 0131 200 2000, FAX: 0131 469 3010

**Eilean Siar, Comhairle nan (Previously known as Western Isles Council)**

Comhairle nan Eilean Siar, Council Offices, Sandwick Road, Stornoway, Isle of Lewis, HS1  
2BW  
TEL: 01851 703773, FAX: 01851 705349

**Falkirk**

Falkirk Council, Municipal Buildings, Falkirk, FK1 5RS  
TEL: 01324 506070, FAX: 01324 506071

**Fife**

Fife Council, Fife House, North Street, Glenrothes, Fife, KY7 5LT  
TEL: 01592 413998, FAX: 01592 413990

**Glasgow City**

Glasgow City Council, City Chambers, George Square, Glasgow, G2 1DU  
TEL: 0141 287 2000, FAX: 0141 287 5666

**Highland**

Highland Council, Glenurquhart Road, Inverness, IV3 5NX  
TEL: 01463 702000, FAX: 01463 702111

**Inverclyde**

Inverclyde Council, Clyde Square, Municipal Buildings, Greenock, PA15 1LY  
TEL: 01475 717101, FAX: 01475 712777

**Midlothian**

Midlothian Council, Midlothian House, Buccleuch Street, Dalkeith,  
Midlothian EH22 1DJ  
TEL: 0131270 7500, FAX: 0131 271 3050

**Moray**

Moray Council, Council Office, High Street, Elgin, Moray, IV30 1BX  
TEL: 01343 543451, FAX: 01343 540183

**North Ayrshire**

North Ayrshire Council, Cunninghame House, Friar's Croft, Irvine, KA12 8EE  
TEL: 01294 324100, FAX: 01294 324144

**North Lanarkshire**

North Lanarkshire Council, Civic Centre, Motherwell, ML1 1TW  
TEL: 01698 302222, FAX: 01698 275125

**Orkney Islands**

Orkney Islands Council, Council Offices, Kirkwall, Orkney, KW15 1NY  
TEL: 01856 873535, FAX: 01856 874615

**Perth & Kinross**

Perth & Kinross Council, PO Box 77, 1 High Street, Perth, PH1 5PH  
TEL: 01738 475000, FAX: 01738 635225

**Renfrewshire**

Renfrewshire Council, Council Headquarters, Cotton Street, Paisley, PA1 1WD  
TEL: 0141 840 3601, FAX: 0141 840 3349

**Scottish Borders**

Scottish Borders Council Headquarters, Newtown St Boswells, Melrose, TD6 0SA  
TEL: 01835 825055, FAX: 01835 825059

**Shetland Islands**

Shetland Islands Council, Town Hall, Lerwick, Shetland, ZE1 OHB  
TEL: 01595 744500, FAX: 01595 744509

**South Ayrshire**

South Ayrshire Council, County Buildings, Wellington Square, Ayr, KA7 1DR  
TEL: 01292 612170, FAX: 01292 612158

**South Lanarkshire**

South Lanarkshire Council, Council Offices, Almada Street, Hamilton, ML3 OAA  
TEL: 01698 454444, FAX: 01698 454275

**Stirling**

Stirling Council, Viewforth, Stirling, FK8 2ET  
TEL: 01786 443320, FAX: 01786 443474

**West Dunbartonshire**

West Dunbartonshire Council, Council Offices, Garshake Road, Dumbarton, G82 3PU TEL:  
01389 737702, FAX: 01389 737700

**West Lothian**

West Lothian Council, West Lothian House, Almondvale Boulevard, Livingston, West Lothian,  
EH54 6QG  
TEL: 01506 777141, FAX: 01506 777102

## APPENDIX III

### 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 Disinfection Guide with regard to ISA virus (Version II).			
Signed:		(Skipper)	(Witness)
Date:		Date:	

## APPENDIX IV

### 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 site subject to official controls. Fill in the details required and fax or post to: The Duty Inspector, FRS Marine Laboratory, PO Box 101, Victoria Road, Aberdeen, AB11 9DB

Fax no: 01224 295620

For Official Use only:			
Ref no:		Inspector:	
Site name:		Site no:	FS/
Business name:			
Contact name:		Tel:	
Contact address:		Fax:	
Equipment source:			
Equipment destination:			
Proposed date of movement:			
Equipment to be moved:			
Reason for movement:			
For Official Use only:			
Approved by:		Date:	

## APPENDIX V

### 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 official control notice in respect of a notifiable disease of fish. Fill in the details required and fax or post to: The Duty Inspector, FRS Marine Laboratory, PO Box 101, Victoria Road, Torry, Aberdeen, AB11 9DB

Fax no: 01224 295620.

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:			
For Official Use only:			
Approved by:		Date:	

## APPENDIX VI

### Check List for Processing Plants

Check	Tick
Notices restricting access posted at all entrances	<input type="checkbox"/>
Disinfectant foot baths with brushes provided at all entrances and exits with suitable notices	<input type="checkbox"/>
Disinfectant concentration checked and maintained at effective level	<input type="checkbox"/>
Vehicles entering and leaving the site pass through disinfection procedure	<input type="checkbox"/>
Transport of fish in sealed, clean and disinfected containers	<input type="checkbox"/>
On-site vehicles, forklift trucks routinely cleaned and disinfected	<input type="checkbox"/>
Drains connected to disinfection plant <i>via</i> filters	<input type="checkbox"/>
Yard clean and disinfected - no blood water evident	<input type="checkbox"/>
Foot baths in place between discrete work areas, e.g. yard, factory, chill, etc.	<input type="checkbox"/>
Protective clothing cleaned and disinfected (at least after every shift)	<input type="checkbox"/>
Processing equipment, utensils, etc. routinely cleaned and disinfected	<input type="checkbox"/>
System in place to prevent wind blown effluent when emptying fish bins	<input type="checkbox"/>
Fish-receiving hopper/tank designed to prevent spillage of fish and effluent	<input type="checkbox"/>
System in place to prevent access to carcasses by predators, e.g. birds	<input type="checkbox"/>
Cleaning and disinfection system in place for empty bins	<input type="checkbox"/>
Bins from ISA High Risk Areas kept separate from other bins	<input type="checkbox"/>
Eviscerated material pumped into ensilage system and fully contained	<input type="checkbox"/>
Log in place to monitor pH of silage (pH <4.0)	<input type="checkbox"/>
Filter in place to remove particulates from effluent before treatment	<input type="checkbox"/>
Log in place to monitor effluent treatment method (e.g. residual free chlorine level in effluent >5 PPM after 30 minutes)	<input type="checkbox"/>
pH and free chlorine logs kept for inspection by MLA	<input type="checkbox"/>
Inspected by: <input style="width: 150px;" type="text"/>	Date: <input style="width: 100px;" type="text"/>
Recommendations for improvements: <input style="width: 100px;" type="text"/>	Y / N <input style="width: 50px;" type="text"/>
Specify:          	