Fish and Shellfish Training in the Seafood Industry

An Introduction to HACCP in the Seafood Industry

Food hazards

A hazard can best be described as anything present in the food which could cause someone to become unwell, injure or kill them if they consumed that food.

There are three types of food hazard:
- physical;
- chemical; and
- biological.

Physical hazards

These can also be described as 'foreign bodies'.

Physical hazards are visible objects both large and small which are in the food. These could have been introduced in some way or they may be already part of that food eg bones. They pose a threat to the consumer of the food, who may cut their mouth, break teeth or choke on the object.

In a fish processing operation typical physical hazards to consider include:
- Metal, nails, staples, nuts, bolts.
- Glass, plastic, fabric, cardboard.
- Rust, flakes of paint.
- Hair, jewellery, buttons.
- Dead insects, rodent droppings.

Where do these physical hazards come from? In general they are:
- Brought in with the fish.
- Brought in by staff, visitors and contractors.
- Lying around the factory.

Chemical hazards

Chemical hazards are often not obvious to the naked eye, but small quantities can render food unsafe to eat. If a consumer were to eat chemically contaminated food, they could typically burn their mouth and throat and/or poison themselves causing vomiting or death.

In a fish processing operation typical chemical hazards to consider include:
- Cleaning chemicals – used onsite.
- Processing chemicals – eg sodium metabisulphite for prawn dipping.
- Maintenance chemicals – lubricants and greases.
- Contaminated water – from private supplies.
- Medication given to farmed fish.
- Diesel on/in fish from boats.
- Insecticides, pesticides and fungicides – used in pest control.

Biological hazards

Biological hazards are not obvious to the naked eye, and very small numbers can render food unsafe to eat. If a consumer were to eat biologically contaminated food, they would typically suffer from a nasty bought of sickness and diarrhoea. In the worst case scenario consumption of biologically contaminated food may lead to permanent disabilities such as blindness or even death.

In a fish processing operation biological hazards to consider include:

- pathogenic bacteria – these are commonly called food poisoning bacteria;
- moulds;
- yeasts; and
- food borne viruses.

Examples of food poisoning bacteria:

- Salmonella.
- Clostridium botulinum.
- E. coli.
- Staphylococcus aureus.
- Clostridium perfringens.
- Listeria.

How are these hazards controlled within a fish processing operation?

A system called 'Hazard Analysis' is used to **identify** these potential threats (hazards) to the food. Once the hazards have been identified, Hazard Analysis puts **controls** in place which will either:

1. prevent the hazard from occurring in the first place;
2. eliminate the hazard altogether; **or**
3. reduce the hazard to a safe level.

The hazard analysis system is very **flexible** and can be adapted to many different circumstances. For example, it can be used on individual products or processes or parts of the operation common to many different products or processes. Hazard analysis is a systematic, methodical approach which ensures attention to detail and guarantees you produce a safe product every time.

Is hazard analysis the same for all businesses?

If you are a primary processor handling raw material and filleting and packing it, the number of hazards will be limited. Therefore the number of controls will be fewer than a secondary processor who is hot smoking their fish ready for direct consumption. In the latter case you will need to look in more detail at the process as there will be more control points.

What is the next step?

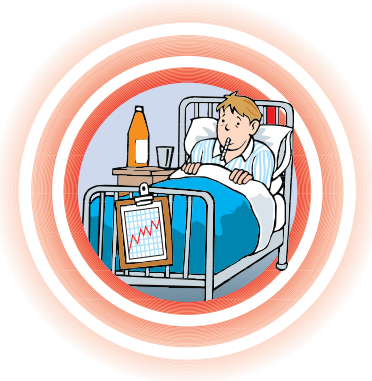
The hazard analysis of your operation is the first step in putting a full **Food Safety System** in place. The full system is called Hazard Analysis Critical Control Point or **HACCP** for short.

What is HACCP and where did it come from?

HACCP originated in the 1960's in the USA from a joint collaboration between NASA, The Pilsbury Corporation and US Army Laboratories who were trying to produce completely safe food for the astronauts to eat on space missions. They realised they couldn't do this from end product testing alone, so developed a system which enabled them to ascertain which controls were critical for food safety. This then guaranteed the food would be safe for the astronauts to eat. This was the first development of a preventative Quality Assurance approach.

What is food safety?

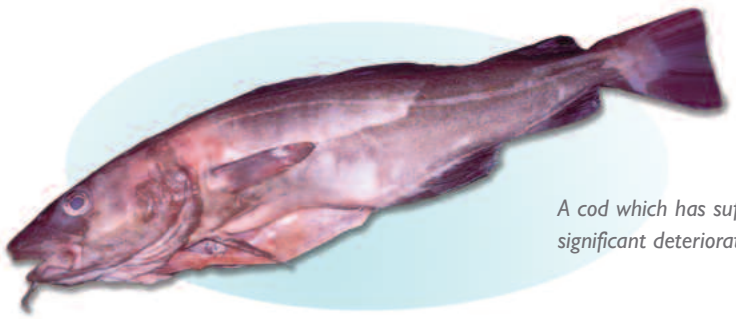
Issues of food safety are of great concern. If a food contains any of the physical, chemical or biological hazards discussed previously, then the person who eats that food is likely to become unwell, be injured or perhaps die.



The food may contain:

- High levels of pathogenic bacteria which can lead to food poisoning.
- Dangerous foreign bodies which could cause someone to choke.
- Dangerous chemicals which could burn someone's mouth and throat.

This is different to **food quality** issues, where the food has merely **deteriorated** and started to spoil causing off odours and flavours. Even if this food was eaten, the consumer would not become unwell or be injured as a result. They would not enjoy the eating experience, but there would be no danger to them.



A cod which has suffered significant deterioration.

Low risk and high risk foods

Low risk foods include:

- Any food which will be cooked before it is eaten which will kill bacteria present - eg raw seafood.
- Any food which will not support bacteria – eg dried foods, ambient stable foods, foods with high levels of sugar or salt.

High risk foods include:

- Those which do not require further processing, re-heating or cooking before being eaten – eg hot smoked mackerel, dressed crab.
- Those which will support food poisoning bacteria – eg dairy foods, pâtés, sandwich spreads.

Benefits of operating HACCP

HACCP is a proactive system which means it **predicts** in advance what might be a food safety problem, and puts some form of control measure in place to cancel out the problem. This means it is very cost effective as fewer problems actually occur, product losses are reduced and resources in terms of time, staff and money become focused on critical areas.

All food companies are now required by law to have HACCP in place.

Legal requirements

Due diligence

This is the only line of defence available under the **1990 Food Safety Act**, for those who are taken to court as a result of harming someone with the food they sold.

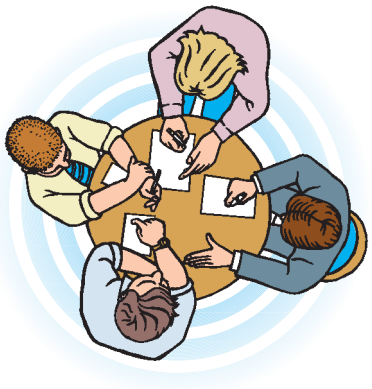
If using this defence, proof must be provided that **'all reasonable precautions'** were taken to prevent the incident from occurring. In order to prove this, a fully documented **food safety system** is vital.
Documentation required:

- HACCP documentation.
- Hygiene regimes – cleaning schedule, records and analysis of cleaning.
- Staff training records.
- Working practices, and company policies on pest control, glass, wood, knives, etc.
- Control measures and monitoring records of the critical controls.

All these records must be complete, accurate and up to date going back for at least two years.

Team working

In order to firstly develop and secondly implement a successful food safety system (HACCP), working in a **team** and **involving people** in the company is the **best** way to go about it.



Company staff have the best information and have a varied product and process knowledge which is more in depth than any consultant's. Using in-house staff makes them feel valued and involved in the process leading to an all important 'buy in' essential to the ultimate success of operating the new system.

The more in-house staff involved in the process the better. A cascading of information through the workforce about the HACCP study: what it's for, how it works; means staff understand why there is a need for it and are more likely to adhere to company regulations as they understand what purpose they serve. Those involved in carrying out monitoring are more likely to do so accurately and efficiently for the same reason.

HACCP Team

Forming a small team to develop the HACCP plan is the first step in producing a food safety system. Criteria to consider when forming this team include:

- Being realistic in size – four to six members are ideal, however this number will be reduced for smaller companies.
- Selecting members according to their role, experience, ability, knowledge and time available. Ideally representatives from **production, technical,** and **engineering** departments should be on the team. For high risk foods, a microbiologist would ideally be included.
- Do the team members need to be trained in HACCP?
- Are they the sort of people who will keep other staff informed – leading to this important 'buy in' from the workforce.
- Are they available to attend regular meetings, and could one member be responsible for making records of decisions and progress – ie a Technical Secretary.

The seven principles of HACCP

Principle one

Conduct a hazard analysis.

Prepare a flow diagram of the steps in the process. Identify and list the hazards and specify the control measures.

In working through principle one, there are several stages to be undertaken.

Stage one:
Define terms of reference:
- What product or process is the study going to be carried out on?
- A statement that food safety is being considered in relation to physical, chemical and biological hazards.
- Whether the product is being judged safe at the point of consumption, or at the point of manufacture with clear storage and use instructions.

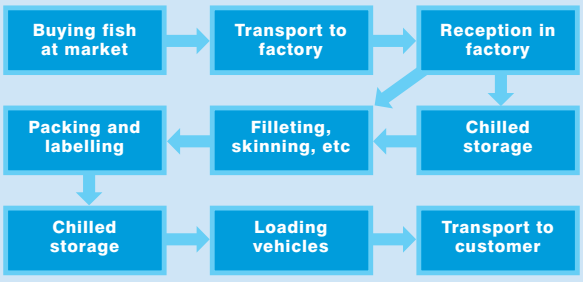
The terms of reference should be kept simple and generally take up less than one A4 page.

Stage two:
Select the HACCP team, bearing in mind the criteria detailed previously.

Stage three:
Describe the product being studied. The description should include:
- product composition;
- product structure;
- processing;
- packaging;
- storage and distribution conditions;
- shelf life; and
- instructions for use.

Stage four:
Identify the intended use of the product by the customer or consumer.

Stage five:
Construct a flow diagram. This is an **important stage** as the rest of the HACCP study will be based around this diagram. Each step in the process should be clearly outlined in sequence. All raw materials, packaging, waste and processes should be detailed. Any product recycle or rework loops should be included.



Stage six:
On-site confirmation of the flow diagram.
This is where the HACCP team take the flow diagram to the factory floor and walk through each stage to confirm it is accurate. The flow diagram should be amended to take account of any differences found.

Stage seven:
List all potential hazards associated with each process step, conduct a hazard analysis and consider any measures to control the identified hazards.

The HACCP team should list all potential hazards – physical, chemical and biological – that may **reasonably** occur at each process step. This is where having a good in-depth knowledge of the product and it's history is invaluable. The team must determine which hazards are of such a nature that their elimination or reduction to acceptable levels is **essential** to the production of a **safe** food.

The HACCP team must then consider what control measures, if any, exist which can be applied for each hazard. Control measures are actions or activities that are required to prevent or eliminate hazards or reduce their occurrence to a safe level. Control measures need to be underpinned by detailed specifications and procedures to ensure their effective implementation.

Control measures

Identified physical hazard		Control measure
Glass.		Glass policy.
Dead Insects.		Pest control policy / cleaning schedule.
Splinters of wood.		Wood policy.
Pieces of jewellery.		Staff hygiene regulations / staff training.
Hair.		Staff hygiene regulations.
Splinters of metal.		Metal detection / maintenance plans.
Cigarette ends.		Staff hygiene regulations.

Identified chemical hazard		Control measure
Diesel in fish.		Staff training / purchase specification.
Cleaning chemicals in fish.		Cleaning Schedule / staff training / correct storage of cleaning chemicals.
Lubricants used in the factory.		Purchase of food safe chemicals / staff training.
Over concentration of process chemicals.		Process specification / staff training.

Identified biological hazard		Control measure
Introduction from poor personal hygiene.		Staff hygiene regulations / staff training.
Introduction from pests.		Pest control policy / cleaning schedule.
Introduction from dirty equipment and surfaces.		Cleaning schedule / staff training.
Multiplication from poor time and temperature control.		Chilled storage / product specification / staff training.
Cross contamination from raw to cooked food.		Strict separation of raw and cooked foods and processes / staff training.

Principle two

Determine Critical Control Points (CCPs).

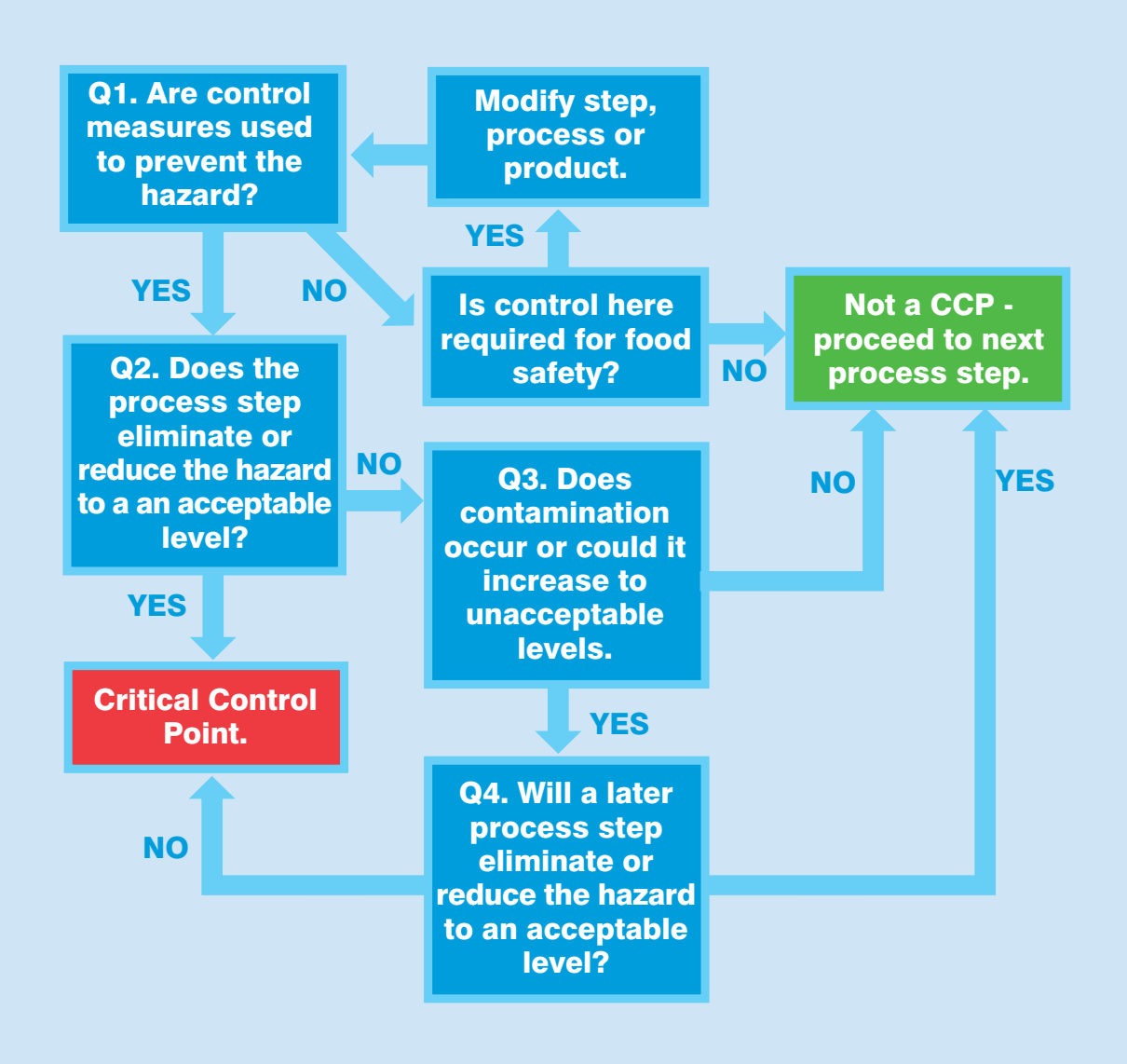
Critical control points

This is **any step** in the food process which **when controlled** will either eliminate or prevent the hazard from occurring, or reduce it to a safe level. This process of deciding if a point is a critical control point is often done using an aid called a '**decision tree**'.

Decision Tree

A decision tree is a sequence of questions which are applied to each process step where a potential hazard has been identified. The answers to the questions will establish whether any process steps are critical control points.

Example of a Decision Tree:



Principle three

Establish critical limits

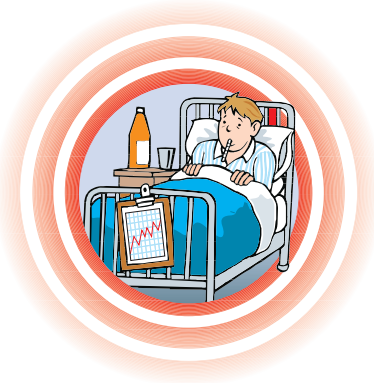
Critical limits are established and set for each critical control point (CCP). A critical limit is a calculated maximum or minimum figure that, dependant upon what is being measured, must be either exceeded or not exceeded to keep the food safe. Limits need to be set in order to ensure that the control measure for the CCP is working as it should and keeping the food safe.

Critical limits must be clearly defined and usually consist of things which are easy to measure. Some examples of measurements include:

- temperatures;
- bacterial loads;
- cooking times;
- salt percentages; and
- bone lengths.

Within each critical limit there will be a **target** which is the **'ideal'** figure at which the control measure should be operating. For example, if there is a CCP on temperature control of fresh fish, the ideal figure or optimum temperature the fish should be held at would be 0˚C. This would be the target within the critical limits.

However it is unlikely that fish could be held at 0˚C without the temperature fluctuating, so a **tolerance** is built in to accommodate these fluctuations. For example -1˚C to +4˚C would be the tolerance within the critical limits. Even if the fish deviated from 0˚C, as long as it is within the tolerance set, it will still be safe to eat. The upper limit of tolerance +4˚C is the critical limit and in this case must not be exceeded.



Sometimes the target and tolerance are the same figures, as there is no safe level of a particular hazard contained within the food. Very often the critical limit will be zero or complete absence. For example, this would be case when considering glass contamination, or some forms of chemical contamination.

If the tolerances are **breached**, the critical limits will have been **exceeded** and the food will be deemed **unsafe** to eat. It is therefore important to think carefully when setting the critical limits. If they are too tight, then it is likely they will be continually breached, and are therefore unworkable. If they are set too loose, they become meaningless and may not ensure the safety of the food. The critical limits can be reviewed and adjusted at any time, particularly when the HACCP system is reviewed, or if there has been some kind of food poisoning incident linked to the product.

Principle four

Establish monitoring procedures

Monitoring procedures are required for each CCP to ensure that the critical limits are not being breached, and therefore the control measure is working as it should, keeping the food safe.

When establishing how the control measure will be monitored, it is important to think of:

- Who will carry out the monitoring – Online staff? Quality staff? Engineers? Note this in the procedure.
- Frequency of the monitoring – How often does the monitoring need to be carried out? Do you need to know the situation 24 hours a day, seven days a week, or are less frequent checks sufficient? Note this in the procedure.
- What will be done? Is it a temperature check, a metal check, a hygiene swab, a bone check? Note this in the procedure.

Monitoring will also help to identify the possibility of the CCP going out of control. If the monitoring shows the figures creeping towards the outer limits of the tolerances then it could be an indication of the CCP going out of control, especially if this is unusual. The experience of the monitoring staff together with their training would enable them to raise an alert, and avert a potential breach of the CCP.

Monitoring documentation forms a vital part of the HACCP system. It goes without saying that these documents should be completed accurately and timeously, by a trained CCP monitor. They are essential when investigating breakdowns in hygiene, including customer complaints and food poisoning. They also play a vital role in a successful due diligence defence.

Principle five

Establish corrective actions

Corrective actions are the sequence of events which must be carried out when the monitoring shows that the critical limits have been breached. At this point the food will be deemed unsafe to eat, and therefore must be removed from production/stock and may have to be destroyed. Corrective actions will restore control.

In order to establish what corrective actions must be undertaken, thought needs to be given to what to do immediately. Follow up actions are also required in order to prevent the likelihood of this type of incident occurring again.

Immediate actions could include:

- Stopping production.
- Quarantining affected product.
- Cleaning the affected area.
- Removing equipment from the area.
- Icing product.
- Informing management.

Follow up actions could include:

- Rechecking additional batches of product.
- Retraining or disciplining staff.
- Reviewing procedures.
- Repairing equipment.
- Disposing or downgrading of product.

It is important that all staff are made aware of the existence of corrective actions, particularly if they are working in a CCP area. They will then know what to do in the event of the critical limits being breached, and won't have to come up with their own plan.

Each time a corrective action is implemented, it should be recorded and signed off by management. These records will provide vital information when the HACCP system is reviewed, and show whether or not the critical limits set are too tight, too loose or just right.

Principle six

Establish a detailed documentation and recording system

A fully documented system is now required by the law. Comprehensive documentation of the HACCP system, and all its supporting systems, specifications, procedures, work instructions, monitoring records, corrective action notes, training records etc will need to be established. These documents should relate to raw materials, processing equipment, cleaning and disinfection, pest control, customer complaints, storage and distribution, as well as the HACCP system itself.

Ideally document masters should be coded, dated and authorised before going into the system. This way, when the system changes and new documents are issued, old ones can easily be removed from the system, and everyone works with the correct document only (see example below).

Example of Document Coding:

COMPANY NAME
DAILY CALIBRATION CHECK SHEET

Date: …… QA Signature: …… Countersignature: ……

Time	Equipment	Calibration Check	Result	Comments
	Intake Scales Serial No:	10kg		
	Whole Fish Grading Weighhead	200g		
	Filleting Line Weighing Scales 1 Serial No:	200g		
	Filleting Line Weighing Scales 2 Serial No:	200g		
	Frozen Fish Grading Weighhead	200g		
	QA Scales 1 Serial No:	200g		
	QA Scales 2 Serial No:	200g		
	QA Temperature ID No:	0˚C / 100˚C		

Document No: Issue No: Issued By: Date:

All documentation must be clearly written, legible, up to date and easily accessed. The whole system should be **user-friendly** as it is first and foremost to be used by all staff within the food production process. It isn't purely for the benefit of auditors and visitors.

Records from monitoring must be kept on file for a minimum of two years, or for at least the life of the product if it exceeds two years.

Principle seven

Verify and review the system

Verification

Verification of the system is extremely important. It involves reviewing the whole HACCP system and records to ensure the system is working correctly and that monitoring is effective.

The method of verification to be undertaken should be written into the system.

Verification methods include:

- Checking records and the accuracy of monitoring.
- Observing staff and operations at critical control points.
- Obtaining microbiological samples.
- Special studies such as challenge testing.

Verification of the system is normally undertaken in-house and can be done by the HACCP team or independent staff members who have been suitably trained in HACCP and internal auditing. Consultants can be brought in if required.

Verification of the HACCP system will also be undertaken by your customers during audits, Environmental Health Officers and third party auditors undertaking an accreditation audit such as BRC or the Seafish Quality Processor Award. Effectively these audits should be used as a backup means of verification to the internal company verification. Any comments made about the system will be useful when the review process is undertaken.

Review

The HACCP system should be reviewed as a **minimum** on an **annual** basis even if nothing has changed. If however there is any **element of change** within the operation, a review should be carried out at that point.

Examples of change in the operation could include:

- Introducing new equipment.
- Introducing new raw materials.
- Changes in the process.
- Changes in the recipe or specification.
- Changes in cleaning schedule.
- Changes in staffing levels.
- Changes in packaging method.
- Changes in storage or distribution.
- Introducing new product lines.

Review would also be necessary if there had been a food poisoning incident traced to the food produced onsite, or from significant trends emerging from customer complaints.

Successful implementation of HACCP

Even the best prepared HACCP plan will not work if the workforce have not bought in to the system, or have not been suitably trained in it. Key points for successful implementation of HACCP are:

- **Full management commitment.**
- **Suitable training for all staff – this doesn't necessarily mean a formal course for everyone. Verbal on the job instructions with visual reminders at CCP points may be all that is required.**
- **Quick handover from HACCP team to all staff once system is established.**
- **Regular reviews of the system.**

Contact Details

Sea Fish Industry Authority

Humber Seafood Institute

Grimsby
DN39 9TZ
Tel:01472 252300
Email:training@seafish.co.uk
Website: www.seafish.org