THE MAGB HACCP GUIDE FOR MALTING.

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INDEX.

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THE MAGB HACCP GUIDE FOR MALTING

PART ONE

Part 1 Section 1 INTRODUCTION

1.1 Background and purpose.

This national document has been drawn up at the request of MAGB members, and by a work group of industry experts from several malting companies, appointed by the MAGB Technical Committee. The Guide carries no legal force, and its use is voluntary.

1.2 Regulatory framework.

Directive 93/43/EEC of 14 June 1993 stipulates in Article 3 " food business operators shall identify any step in their activities which is critical to ensure food safety and ensure that adequate safety procedures are identified, implemented, maintained and reviewed on the basis of the principles used to develop the system of HACCP (Hazard Analysis and Critical Control Point)". It should be noted that all maltings are classified as Food Businesses and should be registered as such, under the requirements of national legislation.

UK malting companies had each drawn up HACCP assessments for their malting sites, and their individual procedures have been in place for several years. In recent years customers have been auditing supplier product safety schemes, and maltsters have felt that the provision of an industry guide to the essential core elements of malting HACCP will underline their commitment to food and product safety.
It is intended that the pooling of expert knowledge of what can form a potential hazard in malt production and dispatch, and how it can be avoided, or detected, will ensure that an industry standard of good practice will be maintained.

1.3 The scope of the MAGB HACCP Guide for malting

This guide applies to the industrial production of barley malt from the intake and storage of barley for supply as malt to breweries and distilleries and food industries. It includes ale, lager and distilling malts (white malt) and also speciality malts (such as crystal and roasted malt) as well as unmalted roasted cereals. It also covers the production of cereal co-products of the malting process, for supply as animal feed.
It deals with operations from the intake of raw materials to the loading of malt at the maltings.
The risks considered are only those that relate to consumer health, and this includes malting co-products for feed to animals intended for the human food chain. Risks to drink and food quality that have no safety implications are not considered.

The purpose of this guide is to assist in the identification of biological, chemical and physical hazards that could occur in malting raw materials, malting processes and environments, which may cause the end product to be unsafe for human consumption.

It will identify critical points in the malting process where control can be applied to prevent, eliminate or reduce hazards to acceptable levels. The preventative measures to be implemented at these critical points are also identified.

It is intended that the Guide should provide an auditing framework for the industry.

The guide is written for the production of white malts and peated malts, with separate Annexes for variation in techniques for roasted and specialist malts.

It should be noted that all maltings co-products, intended for animal feed either, as direct feed or as compound ingredients should comply with all the requirements of the Feedingstuffs legislation. This guide is intended to assist compliance with that obligation.

Members of the team drawing up this guide were also involved with the production of the Euromalt EU HACCP guide for malting. The EU Guide is effectively a policy document, which has a restricted field of application, in terms of the scope of the operation, in sympathy with national practices. The MAGB Guide meets all the requirements of the Euromalt EU HACCP Guide for malting, but deals with malting from the intake of raw grain from farm, and gives specific control data.

Malt and Malting

1.4 Overview of the malting process

Malt is made from malting grade barley, by soaking it in water, and then allowing germination to take place under carefully controlled conditions. This first stage of the process is very similar to what occurs in nature when the grain is sown in the earth. However, when the changes inside the grain are to the maltsters' requirements, then the final stage in the malting process is the application of heat in a specially designed kiln, and the resultant product, malt, has a moisture content of below 6.5%. The kilning process imparts flavour and colour into the malted grain, and the low moisture content allows safe storage. The final malt superficially resembles the original barley in outward appearance, but is physically and bio-chemically much changed.

Malt intended for distilling use may have peat smoke introduced into the airflow through the malt kiln, to give the particular characteristics needed by the whisky to be made from it.

Coloured or roasted malts will have different heat application than white or peated malts.

1.5 Intended use of malt

Malt is used predominantly as the basic raw material for beer and malt whisky, with a much smaller quantity used in the food industry, (e.g. bread, biscuits, breakfast cereals and bedtime drinks.)
There are four product groups:

White malts.
Peated malts.
Coloured and speciality malts/ roasted malts
Roasted barley.

Malt is used predominantly as the basic raw material for beer and malt whisky. Some malt is also used in the manufacture of grain whisky. Brewing and distilling operations involve further processing, both of which include heating and filtration steps that will sterilise and filter the process stream. There is also a significant dilution effect (about 7 to 10 fold).

Malting is considered a low risk process, involving grain, water, heat and airflow. Malt has a long history as a product that has not caused harm to the end consumer. However, malt is not a sterile commodity. Potential hazards, which could affect consumer health, have been identified. These include product contamination, mycotoxins in raw grain, pesticides, nitrosamines and chloropropanols in highly coloured malts. General preventative measures can greatly reduce risk, and such measures include:

- Good manufacturing and good malting practices.
- The use of a formalised quality management system, with defined working procedures.
- Suitably trained personnel.
- Traceability of product from intake barley truck, through bulk to final customer delivery.

1.6 Definitions of terms.

A definition of all terms used in this guide is listed in Part 2 Section 1.3.

1.7 Layout of this Guide

This Guide is in two parts:

Part 1 Introduction and general principles of good maltings practice, which contribute to assurance of product quality and safety.

Part 2 The HACCP section, and the identification of critical control points for a typical UK malting site.

1.8 Exclusions

1.8.1 Construction materials

It is assumed that all construction materials used in a maltings, and in contact with product are fit for purpose.

1.8.2 Utilities

These are outside the scope of this guidance note.

1.9 Remedial action

This guide gives an indication of remedial action to be taken in the event of critical limits on a Critical Control Point being exceeded. The detail of remedial action will be dealt with by individual malting company quality assurance systems.

Part 1 Section 2 GENERAL PRINCIPLES OF GOOD MALTING PRACTICE: PRE-REQUISITE PROGRAMMES

Definition: 'Pre Requisite Programmes' = The measures that provide the basic environmental and operating conditions in a food operation that are necessary for the preparation of safe and wholesome food.

2.1 Establishment: design and facilities

2.1.1 Location

- The site must conform to any national legislation that specifies minimum distances from other facilities.

2.1.2 Premises

- Buildings should be fit for their purpose, adequately maintained and designed so as to be easy to clean and minimise risks of contamination.
- Good standards of cleanliness should be maintained across the site

2.1.3 Glass

- Every malting site should have a documented glass policy, which stipulates where glass or Perspex may not be used or taken into the plant. The possibility of contamination should be reduced by the use of safety bulbs or tight covers wherever possible.
- Any glass or Perspex sited in the plant in an area that could contaminate product should be detailed in a Glass Register, which should be reviewed and updated regularly. The glass policy should include a procedure for action on the discovery of broken glass, and the discovery and subsequent action taken should be documented.

2.1.4 Visitors

- A formal visitor reception procedure should be used, with controlled access to site.

2.1.5 Equipment

- All construction materials and machinery used in the maltings and in contact with the product should be fit for the purpose.
- Surfaces in processing areas should be easy to clean and resistant to abrasion

2.2 Establishment: maintenance and hygiene

2.2.1 Cleaning

- Good standards of housekeeping and cleanliness must be maintained.
- A fully documented system of process plant cleaning should be in place

2.2.2 Cleaning materials

- Cleaning and disinfection products must conform to any national legislation and company policies.
- They should be clearly labelled and stored appropriately, where there is no danger of them contaminating raw materials, process streams or finished product.
- Empty containers should not be re-used for other purposes.
- Records should be kept of the chemicals on site, together with relevant safety data sheets, as required under COSHH.

2.2.3 Silos

- Empty silos should be swept or vacuumed to remove residues, and may be fumigated or treated with suitable insecticides according to company policy.
- Only chemicals that conform to national legislation and are approved by the malting and brewing industry should be used.
- Operators using pesticides should be trained and registered according to national legislation.
- Records of chemical applications should be kept.

2.2.4. Equipment

- Equipment should be regularly maintained and records kept.

2.2.5 Pest control

A pest control programme should be in place.

ON SITE

- A suitably qualified pest control specialist (Approved according to any national legislation) should be appointed to control pests in all critical process, production and storage areas.
- Areas which should be addressed include materials used, infestation due to intake of materials, ingress of pests, waste accumulation and disposal, frequency of treatment and inspection and evaluation of pest control performance.
- Records should be kept of all treatments and inspections.
- All storage, process, packaging and dispatch areas should be protected against bird ingress. Doors and hatches etc should be kept closed when not in use.
- Waste materials that might encourage pests should be regularly cleared away and disposed of.
- Pest control performance should be evaluated on a determined time scale.

GRAIN IN STORE

- All personnel involved applying insecticides should be appropriately trained, in accordance with any national legislation. Records of all training should be kept.
- Insecticides or fumigants applied to grain, to stores or to equipment should be approved under national legislation and only BBPA approved agrochemicals are recognised as acceptable by the malting and brewing industries for the use intended.
- The dose applied should be controlled, and conform to national and industry limits. Records should be kept, to include, the chemical used, the dose and date of application and the person involved.
- All agrochemicals should be clearly labelled and should not be transferred to alternative packages. They should be stored in a secure place away from the production areas. Empty packages should not be reused for other materials.
- Records should be kept of all agrochemicals on site.
- Spraying equipment should be regularly maintained and calibrated. Records should be kept.

2.3 Establishment; personnel

2.3.1. Health status

Personnel working on the site should comply with any national guidelines for food handlers concerning fitness to work

2.3.2. Hygiene
Personnel should obey basic rules of hygiene

2.3.3. Facilities
Adequate sanitary facilities should be available for staff and conform to any national legislation

2.3.4. Eating, drinking and smoking
If allowed, these activities should only take place in designated areas.

2.3.5 Jewellery policy
The site should have a written procedure stipulating what jewellery, if any, can be worn on site, and what action is to be taken if jewellery is lost in a process area.

2.4 Control of Operations

2.4.1 Raw materials – cereals.

Definition: 'Due Diligence' = Certain contaminants may be only very infrequently encountered, very expensive to determine or are not uniformly distributed through a grain bulk. Frequent routine sampling becomes impractical. For several years the MAGB and its members have conducted ongoing surveys of barley and malt for various food safety analytes (e.g. heavy metals, mycotoxins. When the data are pooled the statistical probability and extent of the potential problem may be better determined and monitored. The data sets are updated regularly to ensure that there is no change to the probability or the level of potential hazard.

- **Assured grain.** The UK malting industry has been encouraging growers to be members of an approved Assured Grain Scheme, which ensures that good farming practice, and grain storage/movement has been carried out to an agreed and auditable standard. Assured grain must be clearly declared as such, at delivery to the maltings.
- The cereal used for UK malting is mainly barley, which this guide concentrates on, although a very small amount of wheat is also malted. Deliveries should conform to the maltster's specifications, which will take into account his customers' requirements and any regulatory limits (for example for mycotoxins, pesticides and heavy metals).
- Cereal raw material, if stored, must be managed in such a way as to minimise the risk from mycotoxins (see 2.4.2). Spot testing will be carried out by maltsters to ensure due diligence in this respect.
- Careful inspection and evaluation of all deliveries of raw grain will remove a significant potential of introducing risk to product, and ensure the correct barley is accepted. Visual inspection must take place for insects, foreign material and mould. The smell of the barley before intake will reveal if it has been stored in good condition. Any taint or "nose" will result in rejection of the load.
- A UKASTA Pesticide Passport must accompany every delivery of barley to a maltings, indicating whether or not a pesticide has been applied by the grower/seller post harvest. If pesticide has been applied the pesticide type and an assurance that good working practice has been followed must be declared. No

delivery will be accepted without an accompanying passport, and grain will be refused if the pesticide does not comply with the maltster's specifications for malting barley purchases. Spot testing will be carried out by maltsters to ensure due diligence in this respect.

- The maltster's terms of purchase for malting barley should state that the only agricultural chemicals that can be applied to malting barley during its growth, harvest and storage are those that are named on the British Beer and Pubs Association (BBPA) approved agricultural chemicals list. This covers herbicides, fungicides, insecticides, growth regulators, etc. The BBPA approved list is updated at least once a year.
- "Due diligence" testing will require sampling plans to be in place to check residues, (for example of pesticides, mycotoxins and heavy metals) for conformity to legal limits.

2.4.2 Storage of grain

- Grain should be stored in sound, dedicated stores and protected from water ingress. For long-term storage, grain should be dried down as quickly as possible to a moisture content of below 13% in order to ensure good germination characteristics (<13%) and to prevent grain spoilage from storage fungi (<14.5%), mites (<14.5%) and insects (temperature < 15deg C). All these recommended moisture figures, and in the paragraph below are based on a grain temperature of 15 degrees centigrade, unless stated otherwise.
- Ochratoxin A is the main mycotoxin associated with badly stored damp grain. However, due diligence monitoring has proven that the risks and frequency of such a problem with UK malting barley bulks, although real, are quite small. The risk of Ochratoxin A is greater with wet harvest conditions, but drying barley to less than 18% moisture content prevents the toxigenic storage fungus, *Penicillium verrucosum* from growing and from producing the toxin. 'Green' barley should not be stored for longer than 2 weeks over 18%. If the harvested barley is received at an elevated temperature of 20-25degC, this safe moisture limit can decrease by up to 0.5%. Given that temperature affects the equilibrium relative humidity (erh) of grain, cooling grain significantly reduces any moisture related spoilage risks.
- Spot testing for Ochratoxin A will be carried out by maltsters to verify the management of grain in store.
- Relevant Codes of practice for safe storage should be followed. The following documents provide good background information on best practice:
  HGCA The Grain Storage Guide, updated 2003
  HGCA Topic Sheet No 60, Ensuring Good Germination in Malting Barley

2.4.3 Removal of Metal

- Magnets should be positioned in barley, malt and co-product flows to remove any metal objects that find their way into the process line.
- Magnets should be cleaned on a regular basis, and the action documented

2.4.4 Water

- Water used in the malting process, for steeping and air humidification must be of a potable quality and suitable for human consumption as defined by the relevant EU and national legislation

- If water is drawn from a maltings' own bore hole or well, then it must be analysed regularly for potability, in particular for the absence of *E.coli.*
- Any non-potable water used on site must have its own service system, entirely separate from all water used in processing.
- Storage tanks should be covered and access should be regulated for security

2.4.5 Processing aids

- All processing aids used must be suitable for food use, should be clearly labelled and stored securely and at the appropriate temperature. There should be written application protocols and methods of use should conform to any relevant legislation.
- Customer specifications may permit, very small quantities of gibberellic acid to be applied during the process to enhance the modification of the grain.
- It is also common for sulphur dioxide to be used in kilning to control the formation of nitrosamines.
- Peat smoke, from burning peat may be introduced to the airflow through the kiln for the manufacture of malts for whisky distilling. This produces taste and aroma properties in the finished malt, to the customer's requirements

2.4.6 Air

- Intakes for air used in processing should be sited so as to avoid sources of pollution such as vehicle exhausts.
- In certain circumstances **ambient NOx** in the air can combine with hordein in the malt during the kilning process to produce elevated nitrosamines levels. The high NOx levels in combustion gases can result in elevated nitrosamines levels in direct-fired kilns, especially where natural gas is the fuel source. Nitrosamines (NDMA) formation can be controlled by the introduction of sulphur dioxide into the airflow through the malt being kilned
- Malt samples are regularly tested to ensure that delivered malt complies with the agreed maximum limit of 5 ppb of NDMA. (See 2.4.8)

2.4.7 Process control

- Process parameters such as temperature, time and moisture should be controlled within the limits required for the type of malt being made. Temperatures and moistures in excess of those required for modification should be avoided in order to limit the opportunity for mould growth.
- Registration in quality assurance schemes such as the ISO 9000 series is encouraged.

2.4.8 Due diligence testing on malt

- MAGB members randomly test their barley for pesticide residues and mycotoxin, on a risk- evaluated basis, and valid sampling plans for control activities are defined and managed in accordance with BS 6001:1972 and BS 6002:1979, as appropriate. The industry's analyses results are collated by the MAGB on an annual basis, to show due diligence. (See 2.4.1 and 2.4.2)
- NDMA test results on delivered malts are also collated by MAGB for each crop year, to record due diligence. (See 2.4.6)
- The MAGB arranges for a survey to be carried out every year on the barley crop, and malt produced from that crop year. The survey covers a wide range of food safety checks, including heavy metals and mycotoxins analyses, and any

substances that are deemed pertinent. . Its surveys to date show that both UK barley and malt are well below the maximum levels set by legislation for heavy metals.

2.4 9 Malt Storage

Malt should be stored in sound, dedicated stores and protected from moisture uptake.

2.4 10 Packaging

- Any packaging materials (e.g. plastic sacks or liners) should be suitable for food use and conform to any relevant EU legislation. They should be stored in a clean, dry place and protected against infestation.

2.5 Transport

2.5.1 Vehicles

- **Grain transport.** Transport of the grain from the farm to the maltings is a potential source of contamination, but to prevent this problem, maltsters require that vehicles comply with the UKASTA Code of Practice for Road Haulage. This specifies the need to clean trailers out thoroughly between loads, and details products that cannot be transported in vehicles that haul grain for food use.
- Co-products. The food safety requirements for the transport of grain into maltings equally apply for co-products from the maltings, for use as animal feed into the food chain.
- Malt transport as a minimum complies with the UKASTA Code of Practice for Road Haulage.

2.5.2 Inspections

- An inspection system for foreign material and odours should be in place.

2.5.3 Hauliers

- Hauliers shall fully comply with the UKASTA Code of Practice for Road Haulage.
- A list of company-approved hauliers should be maintained.

2.6 Training

2.6.1 General

Personnel should be adequately trained for the tasks they are carrying out.

2.6.2 Application of pesticides

Operators involved with the application of pesticides should have appropriate training, according to national requirement.

2.6.3 Records

Records of training should be kept

THE MAGB HACCP GUIDE FOR MALTING
PART TWO

Part 2 Section 1
1 HACCP Scheme protocol.

1.1 The CODEX HACCP approach to managing food safety risk.

HACCP (Hazard Analysis by Critical Control Points) is a system that allows identification and control of risks to food safety in a process, It involves identification of the potential hazards (of biological, chemical or physical nature), evaluation and prioritisation of risks and installation of systems by which those risks are monitored and controlled.

The principles of HACCP, as defined

i) Conduct hazard analysis.
ii) Determine critical control points.
iii) Establish control limits.
iv) Devise a system to monitor control.
v) Establish corrective action.
vi) Procedures for verification (that the system is working.)
vii) System documentation needed to support all the above.

The operation of a HACCP system is illustrated in flow chart format in section 4.

1.2 Prerequisite Programmes and Critical Control Points

Prerequisite Programmes (PRPs) must be developed, documented and implemented in order to control factors that may not be directly related to manufacturing (malting) controls, but which support the HACCP plan. PRPs generally deal with generic or "site-wide" issues and often reflect controls applied to raw materials down the supply chain.

The prerequisite programmes for malting are outlined in part 1, section 2, of this guide, and cover the environment (premises and personnel) and product (including raw material). Given their importance, a number of PRPs have been highlighted in the HACCP Scheme Protocol (part 2) and are included in the appropriate tables (from section 7).

In contrast, Critical Control Points (CCPs) are steps in the production process where control is applied to eliminate a particular hazard, or to reduce it to an acceptable level. Decision Trees (see section 3 for an example) can prove useful in the identification of CCPs by giving structure to the consideration, in turn, of each hazard at each process stage. Each CCP is assigned a critical control limit.

1.3 Terms used

Hazard. – a biological, chemical or physical impact on the production of malt, which may cause the finished product to be unsafe for human consumption, or for animals intended for the human food chain.

Risk – the likelihood that a hazard will occur.

Preventative measures – actions that can be taken, or factors that can control an identified hazard.

Critical Control Point (CCP) – a point, step or procedure in the malting process where control can be applied to prevent, eliminate or reduce a hazard to an acceptable level. Conversely, lack of control could result in the increased development of a hazard.

Prerequisite Programmes. The measures that provide the basic environmental and operating conditions in a food operation that are necessary for the production of safe and wholesome food.

CCP decision tree – the formalised protocol for assessing an identified hazard at each process step (see section 3)

Critical Limits – control limits (if measurable) that must be met for each preventative control in use at a CCP. They define the difference between safe and unsafe products.

Corrective action – procedures to be followed when deviation from the critical limits occurs, that is when the process or product goes out of control at a critical control point.

Monitoring – planned, recorded observations or measurements to assess if the process or product is under control.

Audit -.a cross check of all or part of the HACCP systems effectiveness, at a minimum of twice per year.

Flow Chart - A map showing the malting process from raw material intake to final product dispatch. (See section 6)

1.4 Potential Hazards

Hazards fall into three categories:

BIOLOGICAL CONTAMINATION Coded (B) in this guide

By organic materials present (e.g. animal/bird/insect remains), or from toxins produced from moulds and bacteria. Human contact with the product can cause bacterial contamination.

CHEMICAL CONTAMINATION Coded (C) in this guide

By chemicals introduced deliberately (e.g. pesticides), by accident (e.g. fuel), cleaning chemicals, or actually produced by the malting process (e.g. NDMA)

PHYSICAL CONTAMINATION Coded (P) in this guide

By physical objects present in the raw barley (e.g. stones, glass, metal), or picked up from the malting plant (e.g. metal components, glass), or accidentally dropped in by process operator/contractors (e.g. pens/tools). In the event of a nuclear catastrophe, cereals sourced in the outfall area could be radioactive

Part 2 Section 2

2 Using a HACCP system to identify and manage risks in malt production.

2.1 A generic flow chart of the operations taking place at a maltings is illustrated in section 6. The flow should be confirmed as appropriate for individual sites and amended if required. A co-products flow chart is in Section 9.

2.2 Potential hazards to the consumer of the end product have been identified and considered, in turn, for each process step. Control measures are given for all hazards (see sections 8). Due consideration has been given to the risk of sabotage.
This guide lists the types of hazard at section 7 for malting and section 10 for co-products, categorised as biological, chemical and biochemical and physical.

2.3 The hazards have been analysed by using a scale number for the impact of the risk, and another for the likelihood of its occurrence, and multiplying one by the other. That is: **Risk rating = Impact X Likelihood**. (See section 7)
The rating system is tabulated below:

Impact rating	Likely effect
1	Consumption of the hazard might cause consumer distaste, but will not have any adverse physical health effect
2	Consumption of the hazard might cause mild adverse physical health effect if the consumer was exposed to the hazard over a long period of time
3	Consumption of the hazard might cause severe physical health problems (possible hospitalisation/death) in some /all people.

Likelihood rating	Likely effect of no control being in operation
1	The hazard is present intermittently and if control of the product was absent at this point the hazard would be present in only part of one batch of product
2	The hazard is present intermittently and if control of the product was absent at this point the hazard would be present in the whole of one batch of product
3	The hazard is present continuously and if control of the product were absent at this point the hazard would affect several batches of product.

2.4 The expert committee evaluated all hazards noted in this guide against the CCP decision tree. The 'Decision Tree' (see section 3) was used to identify where hazards are eliminated or reduced to an acceptable level. The nodes of operation defined in this manner are termed the Critical Control Points and are indicated in section 8.

2.5 Critical limits for each CCP have been set, taking into account the degree of risk, the degree/severity of hazard and the likelihood of its occurrence (see section 8).

2.6 Where CCP's have been identified a system of monitoring is outlined in section 8, together with the relevant critical limits for that system of monitoring.
Similarly, corrective action for each CCP is outlined in section 9 in cases where deviations occur (as indicated by the monitoring system), such that the CCP is brought under control. Corrective action at site level will be as detailed by the Company for their site.

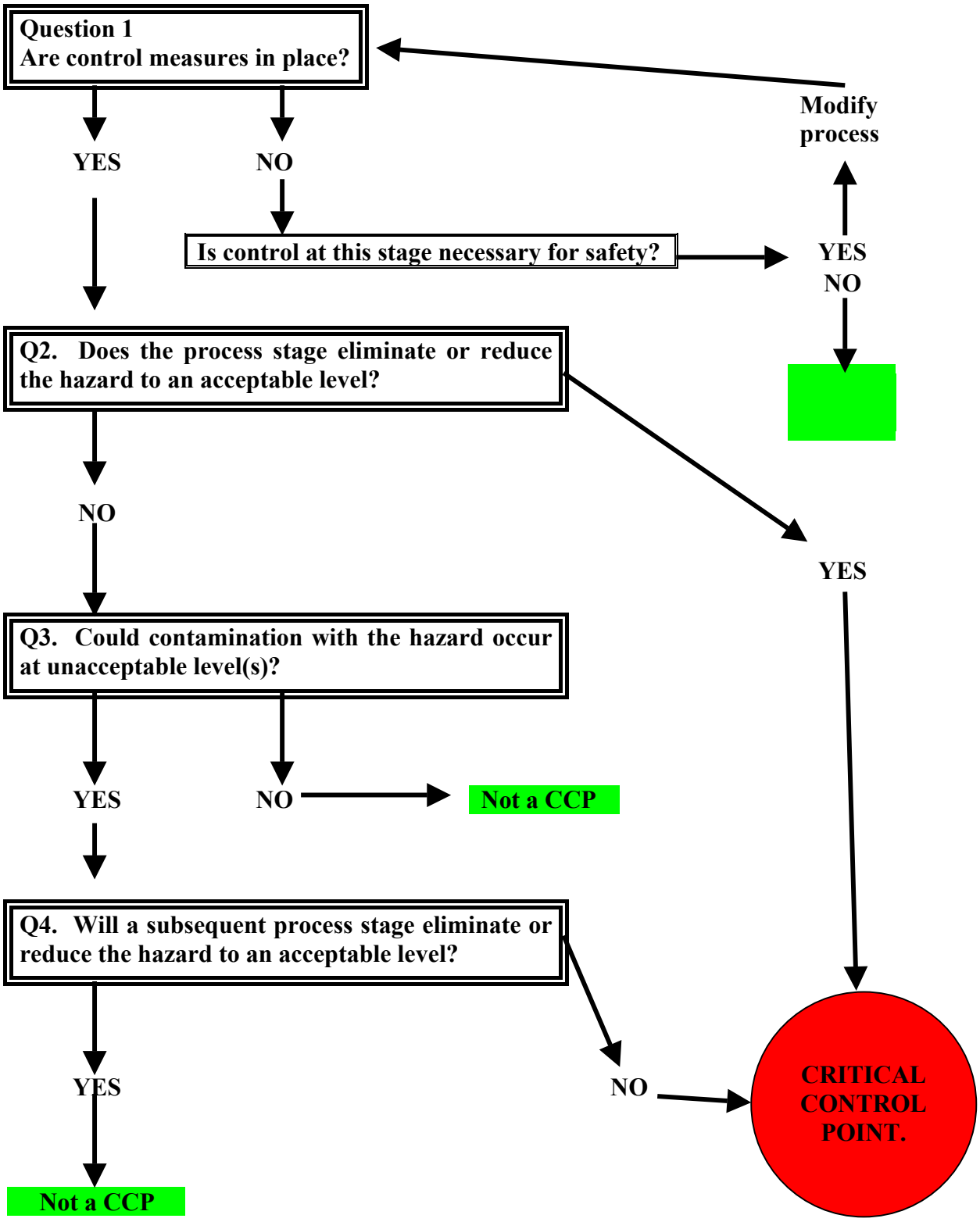
2.7 Appropriate verification activities are described in section 8 for each CCP. These procedures determine the effectiveness of the monitoring system at each CCP.
The CCP specific verification activities are complimented by a system of internal audits, which underwrite the operation of the HACCP system.

2.8 Co-products are handled as indicated by a generic flow chart in section 9, and the hazard analysis for co-products are shown in section 10.

2.9 Specialist malts are dealt with in Appendix 1.

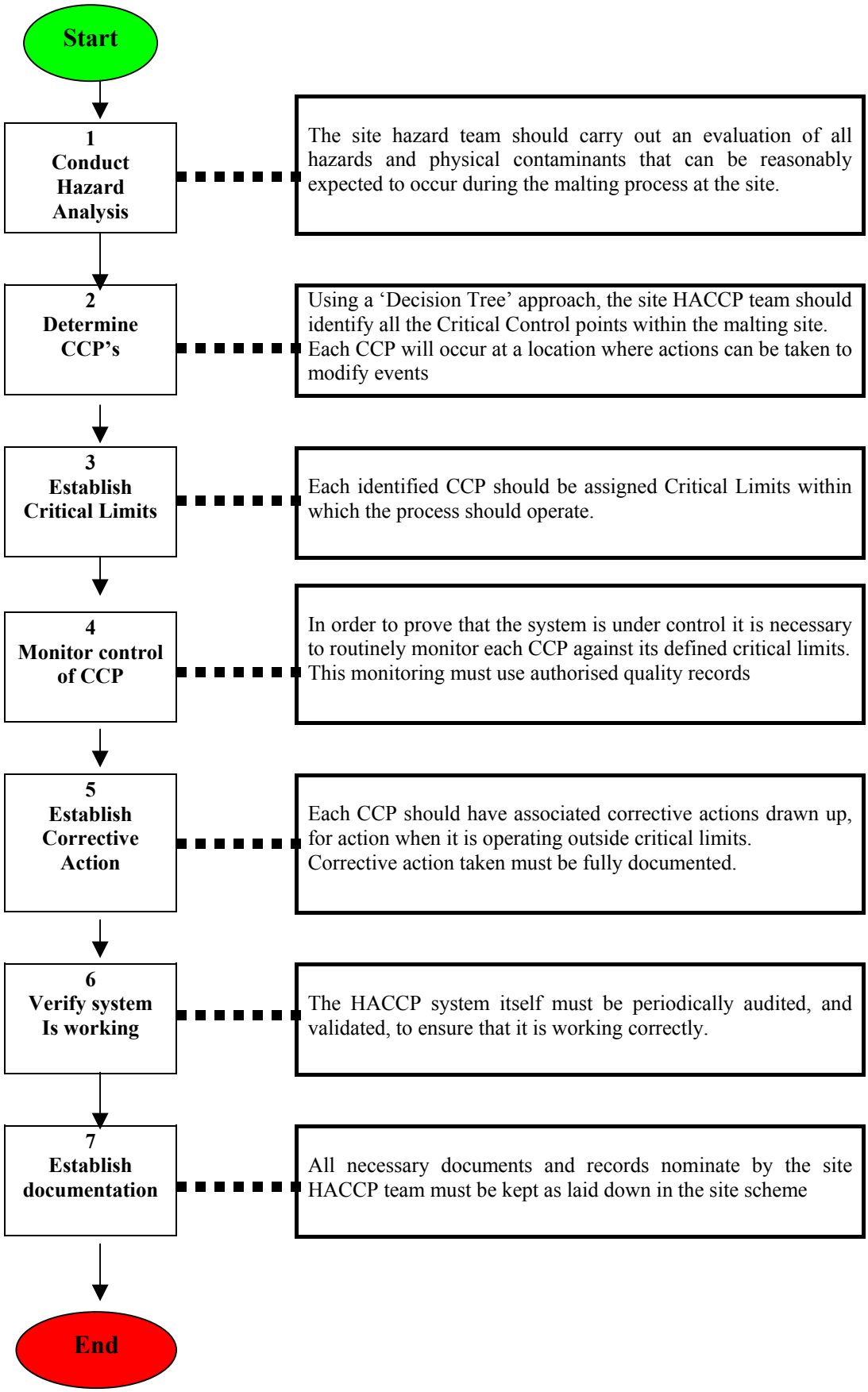
Part 2 Section 3 The 'Decision Tree' for CCP's

To use this protocol, answer each question in sequence at each process stage, for each hazard identified.



Part 2 Section 4 The HACCP protocol applied to malting.

The following chart can illustrate the HACCP approach to product safety:



Part 2 Section 5 CLASSIFICATION OF POTENTIAL MALTING HAZARDS

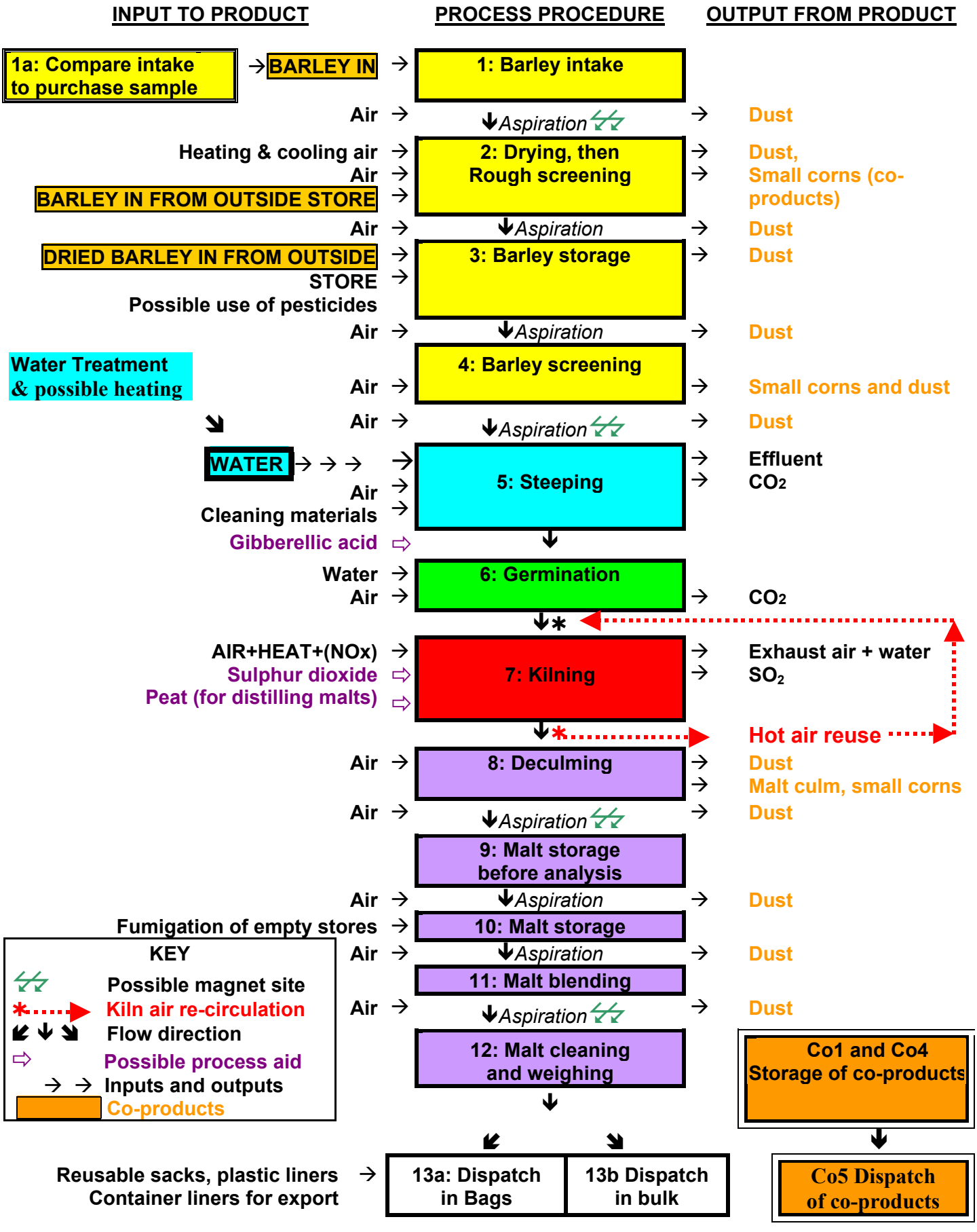
HAZARD TYPE	HAZARD	GUIDE CODE
BIOLOGICAL	Microbiological: (including human contact) Bacterial pathogens (e.g. E.coli, salmonella)	B1
	Microbiological: Fungi, and mould (e.g. Aspergillus, Penicillium, Ergot etc)	B2
	Insects, birds, rodents.	B3

HAZARD TYPE	HAZARD	GUIDE CODE
CHEMICAL & BIOCHEMICAL	Mycotoxins (e.g. Ochratoxin A)	C1
	Nitrosamines (e.g. NDMA)	C2
	Pest control residues (e.g. insecticides, rodenticides.)	C3
	Horticultural control residues, (e.g. herbicides, fungicides, growth regulators)	C4
	Glycosidic Nitriles (only in distilling)	C5
	Heavy metals, nitrates/nitrites, PCB's	C6
	Thermal transfer fluid, hydraulic oil, lubrication and fuel oil	C7
	3-Monochloropropanediol and/or acrylamide (only in high colour malts and roasted barley)	C8
	Cleaning chemicals or water treatment chemicals	C9
	Taint or odours from other than those listed above	C10

HAZARD TYPE	HAZARD	GUIDE CODE
PHYSICAL	Contamination by metal objects	P1
	Contamination by non metal objects (e.g. other seeds, cereals etc)	P2
	Contamination by radioactivity	P3

HACCP experts in the industry have identified these listed hazards. An indication of the potential risk that they pose, and where that risk occurs (i.e. the critical control point), is detailed in Part Two of this guide

Part 2 Section 6 UK GENERIC MALTING FLOW CHART



Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Inspection at intake 0f harvested grain	**1a.1**	Mycotoxin contamination derived from mould; ergot on grain.	B2 & C1	Serious contamination can be very toxic	3X3	Purchase conditions and intake procedures. Look, smell.	**YES**
	1a.2	Contamination from extraneous material ex farm/outside store.	P1 & P2	Can damage mills and cause explosions. Could cause injury in food and confectionary grade malt	2X1	Intake procedures UKASTA Code of Practice for Road Haulage operator. Intake grid, screening. Metal removal magnet.	NO
	1a.3	Taint and odour on the grain, a cross contamination issue	C10 C7	Could affect beer quality	1X1	Look and smell	NO
	1a.4	Insect contamination	B3	Can facilitate microbial infection. Mites secrete toxic substance	1X1	Purchase conditions and intake procedures.	NO
	1a.5	Contamination through use of non-approved pesticide, or excess application of agrochemical.	C3 & C4	Can be toxic to yeast and humans	3X2	Farm audits on assured grain. Purchase conditions to BBPA Guide. Passport declaration with each load	**YES**
Inspection at intake 0f stored grain	**1b.1**	Mycotoxin contamination derived from storage mould; ergot on grain.	B2 & C1	Serious contamination can be very toxic	3X3	Adoption of good storage practices as outlined in prerequisite programme allied with purchase conditions and intake procedures. Moisture, look, smell.	**YES PRP**
	1b.2	Contamination from extraneous material ex farm/outside store.	P1 & P2	Can damage mills and cause explosions. Could cause injury in food and confectionary grade malt	2X1	Intake procedures UKASTA Code of Practice for Road Haulage operator. Intake grid, screening. Metal removal magnet.	NO
	1b.3	Taint and odour on the grain, a cross contamination issue	C10 C7	Could affect beer quality	1X1	Look and smell	NO
	1b.4	Insect contamination	B3	Can facilitate microbial infection. Mites secrete toxic substance	1X1	Purchase conditions and intake procedures.	NO
	1b.5	Contamination through use of non-approved pesticide, or excess application of agrochemical.	C3 & C4	Can be toxic to yeast and humans	3X2	Adoption of working practices as outlined in prerequisite programme allied with store audits and compliance with the BBPA Guide. Passport declaration with each load	**YES PRP**

Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Intake of barley	**1.1**	Heavy metal contamination	C6	Can effect beer quality and have long-term effect on consumers. Could accumulate in co-products	2X1	Survey to monitor levels	NO
	1.2	Salmonella from bird droppings	B1 & B3	Can cause sickness in humans	2X1	Prevent bird ingress Pest control system	NO
	1.3	Hydraulic oil from burst hydraulic hose on delivery vehicle	C7	Unpleasant, but toxicity usually low. Downstream processing lowers risk	2X1	Operator vigilance	NO
Drying & rough screening	**2.1**	Mycotoxin formation due to extended pre-drying storage	C1	Serious contamination can be very toxic	2X1	Control pre drying storage time	NO
	2.2	Fuel leak or bad combustion on direct fired drier	C7	Unpleasant, but toxicity usually low. Downstream processing lowers risk	2X1	Planned maintenance and operator vigilance.	NO
Barley Storage	**3.1**	Mycotoxin from mould formed due to poor drying/storage conditions	C1	Serious contamination can be very toxic	3X2	Low moisture level in stored barley will prevent mycotoxin production.	**YES**
	3.2	Insect contamination	B3	Can facilitate microbial infection. Mites secrete toxic substance	1X2	Insect detection traps. Storage temperature checks	NO
	3.3	Salmonella contamination from vermin in storage area	B1	Can cause sickness in humans	2X1	Bird ingress prevention. Planned pest control system	NO
Barley screening	**4.1**	No hazards identified					

Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Steeping	**5.1**	Contaminated water supply, or incorrectly treated water.	B1 & C9	Water is not potable	2X1	Water Authority supply and Bore hole supply meets Regulations set. Analysis, training	NO
	5.2	Process aid application. a) incorrect chemical. b) contaminated chemical c) overdosing.		No risk from overdosing	2X1	Use only approved suppliers of process aids.	NO
	5.3	Glass from process lighting	P2	Could cause consumer injury	1X1	Glass policy in place.	NO
	5.4	Cleaning materials	C9	Not likely to cause health risk	1X1	Use food grade quality. Training, effective rinsing procedures	NO
	5.5	Glycosidic Nitriles formation in the finished malt for distilling.	C5	Can lead to elevated levels of ethyl carbamate in whisky.	3X2	Selection and use of appropriate barley variety	YES

Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Germination	**6.1**	Microbiological	B2 & C1	Serious contamination can be toxic	3X1	Correctly dried and stored barley Regular, documented plant cleaning	NO
	6.2	Glass from process lighting	P2	Could cause consumer injury	2X1	Glass policy in place.	NO
	6.3	Foreign objects dropping into germinating malt from plant or operators	P1 & P"	Not likely to cause consumer injury	1X1	Jewellery policy, magnets and malt screening	NO
	6.4	Cleaning materials	C9	Not likely to cause health risk	1X1	Assessment via COSHH Training	NO
Indirect fired Kilning	**7.1**	3-MCPD formation	C8	Possible carcinogen	2X1	Not formed during white or peated malt production, a product of very high temperature application during roasting operations	NO
	7.2	NDMA formation during kilning	C2	Can be toxic and carcinogenic	3X2	Analyse malt Low risks with indirect firing. SO2 can be added at a rate sufficient to control NDMA below critical level	YES
Direct fired Kilning	**7.3**	NDMA formation during kilning	C2	Can be toxic and carcinogenic	3X3	Analyse malt SO2 added at a rate sufficient to control NDMA below critical level	YES
	7.4	3/MCPD formation	C8	Possible carcinogen	2X1	Not formed during white or peated malt production, a product of very high temperature application during roasting operations	NO
	7.5	Fuel leak or bad combustion on direct fired kiln	C7	Unpleasant, but toxicity usually low. Downstream processing lowers risk	2X1	Planned maintenance and operator vigilance.	NO

Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Deculming	**8.1**	No hazards identified					
Malt storage	**9.1 and 10.1**	Microbiological, from mould growth on malt during storage	C1	Serious contamination can be very toxic	2X2	Stock rotation and records. Malt storage moisture much too low to create conditions for mycotoxin production	NO
	9.2 and 10.2	Pest/vermin contamination	B3	Bird faeces can carry Salmonella, rodents can carry Weils disease.	2X1	Planned pest control system	NO
	9.3 and 10.3	Contamination by rodenticide	C3	Toxic to humans	3X1	Trained operator or contractor, controlled bait procedures.	NO
Blending, Screening and Weighing	**11.1 and 12.1**	Foreign objects pick up	P1 P2	Can damage mills and cause explosions. Could cause injury in food and confectionary grade malt	2X1	Magnet metal removal Physical screening action Glass and Jewellery policy	NO
	11.2 and 12.2	Pest/vermin contamination	B3	Bird faeces can carry Salmonella, rodents can carry Weils disease.	2X1	Planned pest control system	NO
	11.3 and 12.3	Contamination by rodenticide	C3	Toxic to humans	3X1	Trained operator or contractor, controlled bait procedures.	NO

Part 2 Section 7 MALTING HAZARDS AND INDICATIVE RISK RATINGS.

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Malt dispatch in sack	**13a.1**	Unsuitable sacks, unclean or previously used for non-food products	B1	Tainted product	2X1	Approved haulage contractor and sack inspection regime.	NO
Malt dispatch in bulk	**13b.1**	Contamination from foreign bodies/water in delivery vehicle trailer	B1 P1 P2	Good product tainted or contaminated by dirty vehicle	2X1	Approved contractor, who complies with UKASTA Code of Practice for Road Haulage 1999.	NO

Part 2 Section 8 THE EIGHT CRITICAL CONTROL POINTS ACTION PLAN

Process stage	Ref	Hazard and potential causes	Critical limits	Monitoring system	Corrective action	Verification procedures
Inspection at intake of harvested barley	**1.a.1**	Mycotoxin contamination derived from mould; ergot on grain.	Absence of mould and/or ergot	Sensory evaluation	Rejection of load	Sampling of barley at intake for mycotoxin analysis
	1.a.5	Contamination through use of non-approved pesticide, or excess application of agrochemical	a) Correctly presented pesticide passport with each load. b) Pesticide application should declare that all instructions have been followed.	a) Check passport b) Ensure any pesticide declared meets BBPA approval for type.	Rejection of load	Sampling of barley at intake for pesticide residues analysis
Inspection at intake of stored barley	**1.b.1**	Mycotoxin contamination derived from storage mould on grain	a) Supplier to comply with prerequisite programme b) Absence of mould and/or ergot	a) Supplier approval system/audits b) Sensory evaluation	a) Withdrawal of approved status from supplier. Agreed corrective action b) Rejection of load	a) and b) analysis for mycotoxins
	1.b.5	Contamination through use of non-approved pesticide, or excess application of agrochemical	a) Correctly presented pesticide passport with each load. b) Pesticide application should declare that all instructions have been followed.	a) Check passport b) Ensure any pesticide declared meets BBPA approval for type.	Rejection of load	Analysis for pesticide residues

Part 2 Section 8 THE EIGHT CRITICAL CONTROL POINTS ACTION PLAN

Process stage	Ref	Hazard and potential causes	Critical limits	Monitoring system	Corrective action	Verification procedures
Barley Storage	**3.1**	Mycotoxin contamination derived from storage mould (*Penicillium verrucosum)*	Grain not to be stored at or above 18% moisture for more than 2 weeks.	Regular inspections of the grain during storage and test for moisture	Appropriate stock control For example re-drying, barley movement or earlier planned processing	Analysis for mycotoxins
Steeping	**5.5**	Glycosidic Nitriles formation in the finished malt for distilling	Selection of appropriate barley variety through consultation with customer	Stock records Customer specification Historic database of Glycosidic Nitriles residues in malt	Do not process incorrect variety	Analysis of final malt for Glycosidic Nitriles

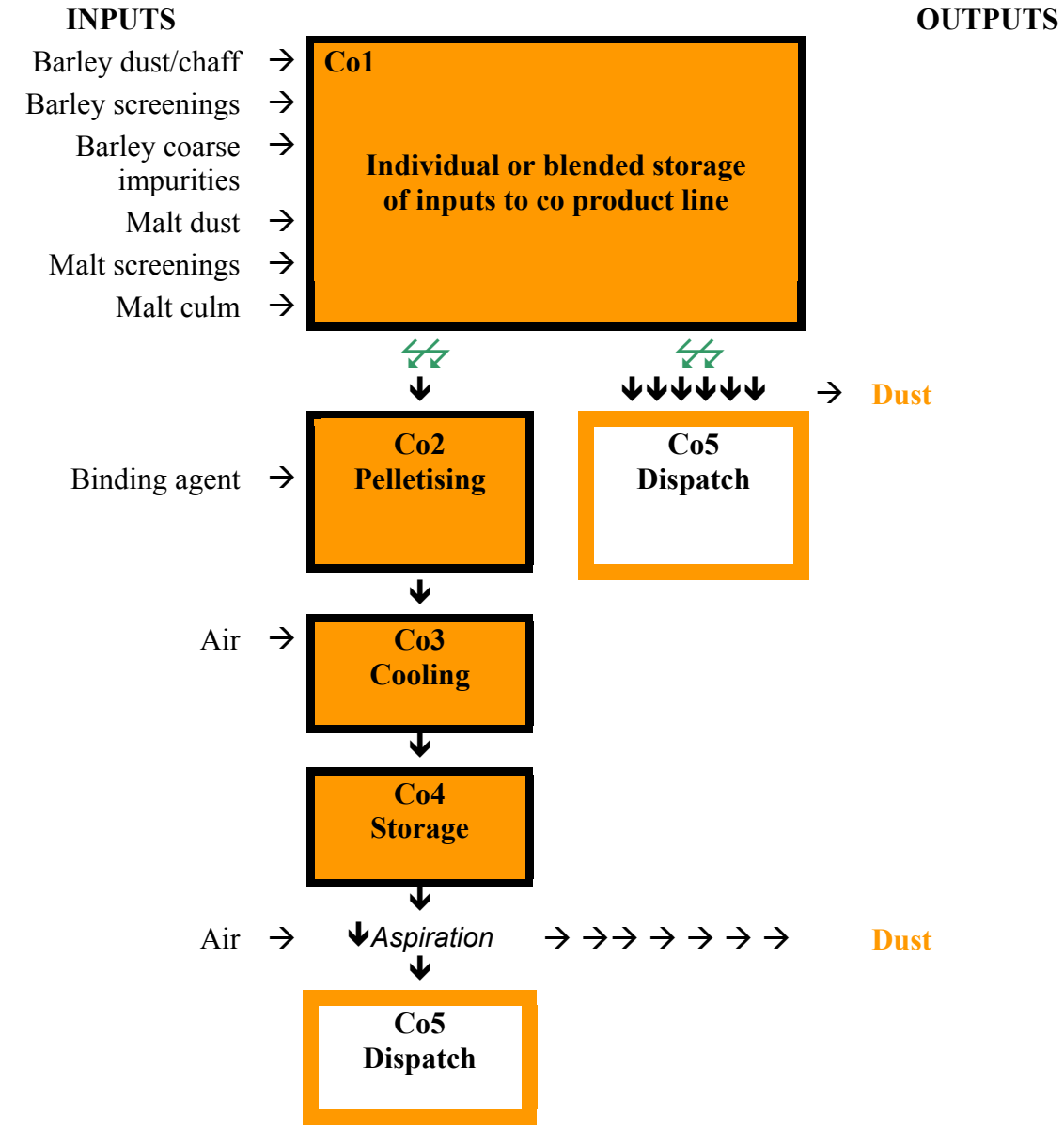
Part 2 Section 8 THE EIGHT CRITICAL CONTROL POINTS ACTION PLAN

Process stage	Ref	Hazard and potential causes	Critical limits	Monitoring system	Corrective action	Verification procedures
Kilning Direct firing	**7.2**	NDMA formation during kilning	a) The timing and burning of sulphur and the amount used is a function of local conditions and product** b) The industry agreed maximum standard of 5 ppb c) Low NOX burners	a) To ensure that all measured sulphur is burnt b) Plant maintained and operating in accordance with specified requirements c) Correctly selected plant maintained and operated in accordance with specified requirements	a) Isolate batch for testing if inadequate sulphur burnt b) and c) Isolate batch for testing if there are combustion problems	a) and b) Analysis of malt for NDMA. c) Analysis of malt for NDMA
Kilning Indirect firing	**7.3**	NDMA formation during kilning, mainly caused by ambient NOX	a) If sulphur is to be used, the timing and burning of sulphur and the amount used, is a function of local conditions ** b) Indirect firing of kiln. c) The industry agreed maximum standard of 5 ppb	a) If sulphur is scheduled to be burnt, check that it has been b) Correctly selected plant maintained and operated in accordance with specified requirements .	a) Isolate batch for testing if sulphur was scheduled for use, and inadequate sulphur was burnt. b) Isolate batch for testing if there are combustion problems	a) and c) Analysis of malt for NDMA. b) Analysis of malt for NDMA

** Alternatively SO2 may be injected into the kiln airflow

Part 2 Section 9 Flow chart for malt co-products

UK Generic co-products flow chart for malting



Part 2 Section 10 CO-PRODUCTS HAZARDS AND INDICATIVE RISK RATINGS

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Co -products Storage	**Co1.1**	Mould and potential mycotoxin formed due to poor storage conditions	B2 C1	Serious contamination can be very toxic	3X1	Low moisture level in stored barley will prevent mycotoxin production	NO
	Co1.2	Insect contamination	B3	Can facilitate microbial infection. Mites secrete toxic substance	1X2	Visual inspection	NO
	Co1.3	Salmonella contamination	B1	Can cause sickness	2X1	Planned pest control system	NO
Pelletising	**Co2.1**	No hazard identified as long as appropriate binding agent is used.					
Pellet Cooling	**Co3**	No hazard identified Properly cooled pellets should cause no condensation problem in store.					
Pellet storage	**Co4.1**	Mould and potential mycotoxin formed due to poor storage conditions	B2 C1	Serious contamination can be very toxic	2X2	Visual check to ensure no mould present, and the storage area has no moisture ingress	NO
	Co4.2	Pest/vermin contamination	B3	Bird faeces can carry Salmonella.	2X2	Planned pest control system	NO
	Co4.3	Contamination by rodenticide	C3	Toxic	2X2	Trained operator or contractor, controlled bait procedures.	NO

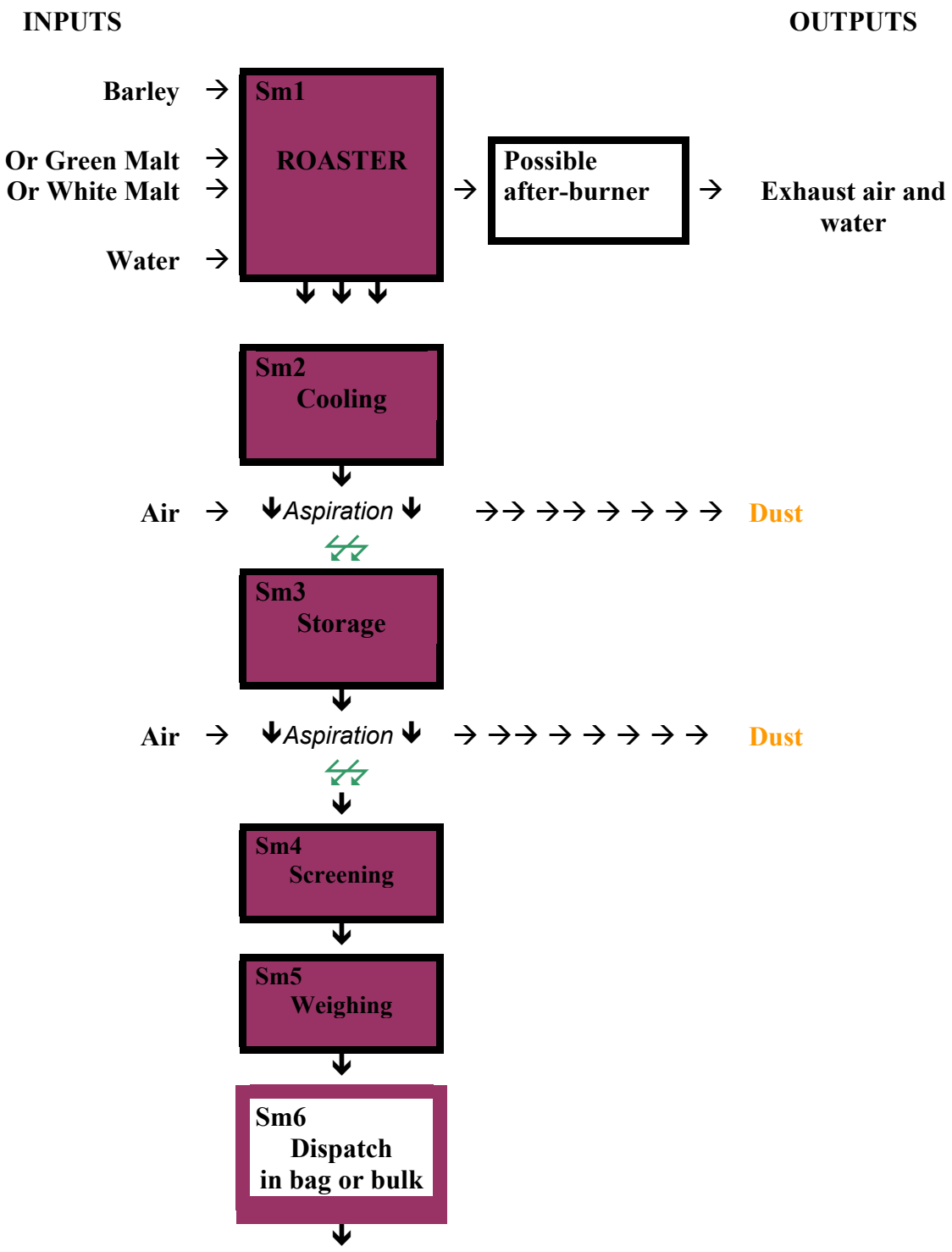
The reference numbers refer to the flow chart positions shown in Section 9

Part 2 Section 10 CO-PRODUCTS HAZARDS AND INDICATIVE RISK RATINGS

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Co-products dispatch in bulk	**Co5**	Unsuitable sacks, unclean or previously used for non-food products	B1	Tainted product	2X1	Approved haulage contractor and sack inspection regime.	NO
Co-products dispatch in sacks	**Co5**	Contamination from foreign bodies/water in delivery vehicle trailer	B1 P1 P2	Good product tainted or contaminated by dirty vehicle	2X1	Approved contractor, who complies with UKASTA Code of Practice for Road Haulage.	NO

PART TWO APPENDIX 1 SPECIALIST MALTS

GENERIC FLOW DIAGRAM FOR SPECIALIST MALTS



Magnet

PART 2 APPENDIX 1A SPECIALIST MALTS HAZARDS AND INDICATIVE RISK RATINGS

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Roaster	**Sm.1.1**	NDMA formation from combination of amines in malt with NOX in heated air	C2	Can be toxic and carcinogenic	3x1	The elevated temperatures used in specialist malt production overcome this effect. NDMA analyses are carried out to ensure this position is maintained.	NO
	Sm.1.2	3/MCPD formation	C8	Possible carcinogen	3X3	The final colour of specialist malts is directly linked to the 3-MCPD formed. At present the technology does not exist to prevent this natural occurrence. Malt producers and malt users realise that this is an unusual situation, where the risk produced by the process can only be rectified further down the user chain by using the dilution guidelines (Appendix 1C) devised & agreed by the industry.	**NO** **NOT AT THIS POINT BUT LATER IN THE CHAIN**
	Sm.1.3	Fuel leak or bad combustion on direct firing	C7	Unpleasant, but toxicity usually low. Downstream processing lowers risk	2X1	Planned maintenance and operator vigilance.	NO
Cooler	**Sm.2**	Foreign objects pick up	P1 P2	Can damage mills and cause explosions. Could cause injury in food and confectionary grade malt	2X1	Magnet metal removal Physical screening action Glass and jewellery policy	NO
Specialist Malts storage	**Sm.3.1**	Microbiological, from mould growth on malt during storage	C1	Serious contamination can be very toxic	2X2	Stock rotation and records. Malt storage moisture much too low to create conditions for mycotoxin production	NO
	Sm.3.2	Pest/vermin contamination	B3	Bird faeces can carry Salmonella, rodents can carry Weils disease.	2X1	Planned pest control system	NO
	Sm.3.3	Contamination by rodenticide	C3	Toxic to humans	3X1	Trained operator or contractor, controlled bait procedures.	NO

The reference number refers to the flow chart position as shown on Appendix 1

PART 2 APPENDIX 1A SPECIALIST MALTS HAZARDS AND INDICATIVE RISK RATINGS

Process stage	Ref	Hazard and potential causes	Hazard Type	Consequence	Risk rating	Control measures	CCP?
Specialist Malts Screening and Weighing	**Sm.4.1 and Sm.5.1**	Foreign objects pick up	P1 P2	Can damage mills and cause explosions. Could cause injury in food and confectionary grade malt	2X1	Magnet metal removal Physical screening action Glass and Jewellery policy	NO
	Sm.4.2 and Sm 5.2	Pest/vermin contamination	B3	Bird faeces can carry Salmonella, rodents can carry Weils disease.	2X1	Planned pest control system	NO
	Sm.4.3 and Sm.5.3	Contamination by rodenticide	C3	Toxic to humans	3X1	Trained operator or contractor, controlled bait procedures.	NO
Dispatch	**Sm.6**	Unsuitable or unclean sacks, Reusable sacks that have erroneously used for non-food products. Unclean delivery vehicle	B1	Tainted product	2X1	Approved haulage contractor, who complies with UKASTA Code of Practice for Road Haulage. Sack inspection regime	NO

The reference number refers to the flow chart position as shown on Appendix 1

The additional critical control issue for specialist malts is detailed in Appendix 1B

PART 2 APPENDIX 1B THE ADDITIONAL CRITICAL ISSUE ACTION PLAN FOR SPECIALIST MALTS

Process stage	Ref	Hazard and potential causes	Critical effect	Monitoring system	Corrective action	Verification procedures
Roasting	**Sm.1.2**	**3-MCPD formation during roasting.** The application of high temperature to cereals produces 3-MCPD. In malts this occurs when temperatures exceed kilning profiles, which is the whole range of roasting regimes used for specialist malts above 25 EBC colour and roasted barley.	The higher the final desired specialist malt colour, the higher the 3-MCPD in the finished malt	'Operator expertise' is the only monitoring system available during specialist malt production.	Avoid excessive application of high temperature. The corrective action can only be undertaken by the food producer who must undertake to use the product in their recipes in the dilution factor laid down in the industry guideline as shown below. **(See Appendix 1C below)**	The malting and brewing industry working together to ensure that the guidelines used for specialist malt inclusions in recipes, continue to minimise any food safety risk to an acceptable level.

PART 2 APPENDIX 1C THE BLRA/AMPM/MAGB GUIDELINES TO PREVENT 3-MCPD BECOMING A PROBLEM IN BEER AND OTHER FOOD

Material	Typical colour range (EBC Colour Units)	3-MCPD ppb (μg/kg)	Typical dilution in foodstuffs
'White' malted barley (lager, ale, mild ale, distilling malt)	<9	<10	1:10 (i.e. 1kg malt per 10 kg product)
Cara malt	20-50	<30	1:50
Crystal malt	50-600	<200	1:50
Amber malt	30-200	<200	1:100
Roasted malts (brown, chocolate, black)	300-1,400	<500	1:100
Roasted barley	900-1,400	<500	1:100

END