The first cork company in the world to have HACCP certification

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1. History of HACCP – Food Safety

Concern with taking steps to ensure food safety began with the discovery that destroying the micro-organisms in food allowed them to be kept safely. Louis Pasteur and Clarence Birdseye were pioneers in food processing technology. In the 1920's, two American dairy product associations established the first food processing control rules.

As the population shifted from the country to the cities, the need arose for industrial scale processing, packaging and transport of foods, with a simultaneous need for specific regulations concerning these aspects.

In the 1950's, the *National Aeronautics and Space Administration* (NASA) gave a major impetus to food safety work since it had 3 reasons for wanting special foods for space journeys:

1. In NASA spacecraft there was no room to prepare (kitchen) or preserve (refrigerator or freezer) foods;
2. Micro-organisms could not be introduced into space;
3. NASA astronauts had to be well fed and there had to be no risk of them becoming ill or weak through food poisoning.

The previous methodology of effecting control by analysing lots after manufacture had also been driven by space programmes and resulted in what came to be known as the ISO 9000 series.

In the **1960's** NASA started to demand the preparation of food safety control plans (for the *Gemini* and *Apollo* flights). The company hired for this purpose (Pillsbury) developed a system for the analysis and control of the critical points in the food manufacturing processes. In summary, the system involved making a systematic assessment of the ingredients, the environment and the process used, identifying the areas of potential risk, and then determining the points that the manufacturer had to control in order to guarantee the safety and integrity of the products.

In **1960**, largely as the result of an Austrian initiative, a United Nations commission was created to prepare a regional food code, called the *Codex Alimentarius Europaeus*.

In **1961** it was considered necessary to extend this globally. This step was formalised in **1963**, with the setting up of the *Codex Alimentarius Commission* by the *WHO* (World

Health Organisation) and the *FAO* (Food and Agriculture Organisation of the United Nations), for the study and publishing of food safety guidelines and standards.

In **1967** the *American Food and Drug Administration* (FDA) and industry initiated a self-regulating process for all food processing.

In **1988** the reports of the *International Commission on Microbiological Specifications for Food* (ICMSF) were published, and in **1991** the Guidelines for the application of the HACCP system, prepared by the *Codex Alimentarius Commission* (CAC), were brought out. These Guidelines were revised in **1993** and **1999**.

In **1993** the *European Union Council* published Directive 93/43/EC on food product hygiene (self-control). This was obligatorily transposed into the national law of each member state (in Portugal, this was done by Decree-Law 67/98 of 18 March **1998**).

In **1998** the Danish standard DS3027 on achieving Food Safety through the HACCP (Hazard Analysis and Critical Control Points) system was published. This set out the requisites for food producing companies and their suppliers.

2. The cork stopper in the food industry

In the production of wines and other drinks, packing is one of the process phases that, in accordance with the *Codex Alimentarius* and European Union Directive 93/43/EC, is the responsibility of the bottler. The legal obligation to fulfil this provision was established in Portugal with the publication of Decree-Law 67/98.

The importance of the cork stopper as a packaging material is thus seen as being more and more important, with all the provisions that were previously regulated under the *General Directive on Materials Intended To Come in Contact With Foodstuffs* (76/893/EEC, 89/109/EEC) having to be met. The cork stopper should also be produced under hygiene and safety conditions that meet the regulatory provisions of the food industry.

Cork has been used since the 17th Century for sealing drinks (with different levels of alcohol content) with no adverse effects on human health. The introduction of chemical processes in agriculture and in the processing and industrial finishing of cork materials and cork stoppers (washing, marking, treatment, packing), has made it necessary to consider the existence of possible health risks and, consequently, the need to guarantee the safety of these products in food-related terms.

In 1997, the *European Cork Confederation C.E. Liège* published the *International Code of Cork Stopper Manufacturing Practices*. This was widely recognised and

implemented (Systecode) throughout the cork industry and includes several parameters concerning food safety.

3. Implementation of the system

3.1. Phase 1: Compilation and analysis of base reference documents

3.1.1. Codex Alimentarius CAC/RCP-1-1969, Rev3-1997Amd(1999)

www.codexalimentarius.net/ ftp.fao.org/codex/standard/

The HACCP system has 7 principles:

1. **Hazard analysis**. Listing of all potential hazards associated with each step in the process and considering of any preventive measures to control identified hazards.
2. **Determination of Critical Control Points CCP** (Figure 1). Pest control is one of the obligatory critical control points.
3. Establish **critical limits** for the preventive measures associated with each identified CCP determined.
4. Establish **monitoring requirements and systems**. Establish procedures to use the results in order to adjust and monitor the process.
5. Establish **corrective actions** to be taken when the monitoring indicates that there is a deviation from the established critical limit.
6. Establish an effective records control procedure in order to **document** the HACCP system.
7. Establish procedures to **verify** that the HACCP system is working correctly.

The **ISO 9000** quality assurance / management system is an excellent framework on which to introduce the HACCP principles.

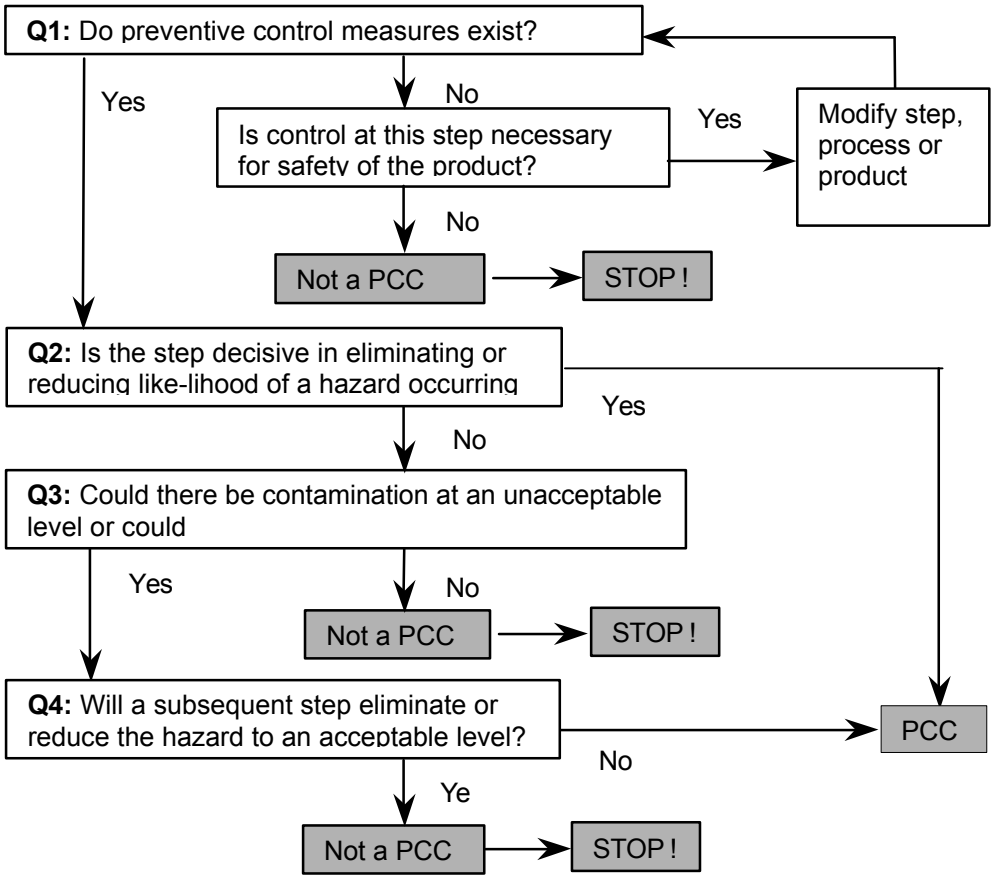


Figure 1. Decision tree to identify critical control points, CCP,
from *Codex Alimentarius CAC/RCP 1-1969, Rev3 (1997), Amd. (1999)*.

3.1.2. International Code of Cork Stopper Manufacturing Practices

The rules of good practices in the sector have been published by C.E. Liège and are available online at www.corkmasters.com/

This document refers to compliance with the directives related to materials in contact with foodstuffs (76/893/EEC, 89/109/EEC).

3.1.3. Directive 93/43/EEC of the European Council

Directive regarding food hygiene (rules for good hygiene practices) (available for online consultation at the European Union Law website www.europa.eu.int/eur-lex).

3.1.4. Standard DS3027E: 1998

Food safety standard with HACCP Requirements to be met by food industry companies and their subcontractors (available through certificating body APCER on www.apcer.pt)

3.2. Phase 2: Diagnosis/Preparation of the company

The prerequisites were the identification, characterisation and assessment of the different sections of the company in relation to the degree of hygiene necessary and the control of the existing sources of contamination / dirt (Figure 2).

For each section, cleaning charts were prepared showing expected sources of contamination, indications regarding personal hygiene, and instructions for cleaning the installations and equipment, including the specification of who should do the cleaning and with what frequency.

All possible corrective measures were then identified and the implementation and action validation plan was established.

Table 1. Summary of the problems and the solutions implemented in the diagnostic phase.

Problem detected	Solution implemented
Cement floor difficult to clean.	Re-covering of floor in production installations with ceramic floor covering.
High temperature variations in storage and finishing zone	Fitting of false ceilings, industrial heaters, and insulating tape between sections.
Water for industrial use with moderate level of microbiological contamination.	Water treatment by ultra-violet ionisation with pre-filtering through activated carbon.
High suspended microbe content in manufacturing zone – Need to separate cork / stoppers physically.	Immediate extraction of waste (most contaminated) from section. Stoppers moved immediately to pre-drying silos before rectification.
Need to ensure higher levels of hygiene in branding / treatment section.	Section insulated from production. Operators with special equipment (overalls, cap, shoes, gloves). Access reserved and subject to restrictions.
Control of natural sources of contamination	Rodents, insects, allergens and toxins.

Table 2. Summary of Phase 2.

Start	Re-structuring work (floors, ceilings, heating systems, insulation between sections); Acquisition and setting up of personal hygiene systems (dispensers, disposable overalls, caps, gloves, shoes); Acquisition of industrial hygiene systems (washing machine, water disinfecting system, control of rodents and insects).
Finish	Cleaning Plan. Manual with compilation of assessment, classification of degree of hygiene necessary in the various sections, characterisation of sources of contamination and instructions for personnel and industrial hygiene.
Duration	6 months

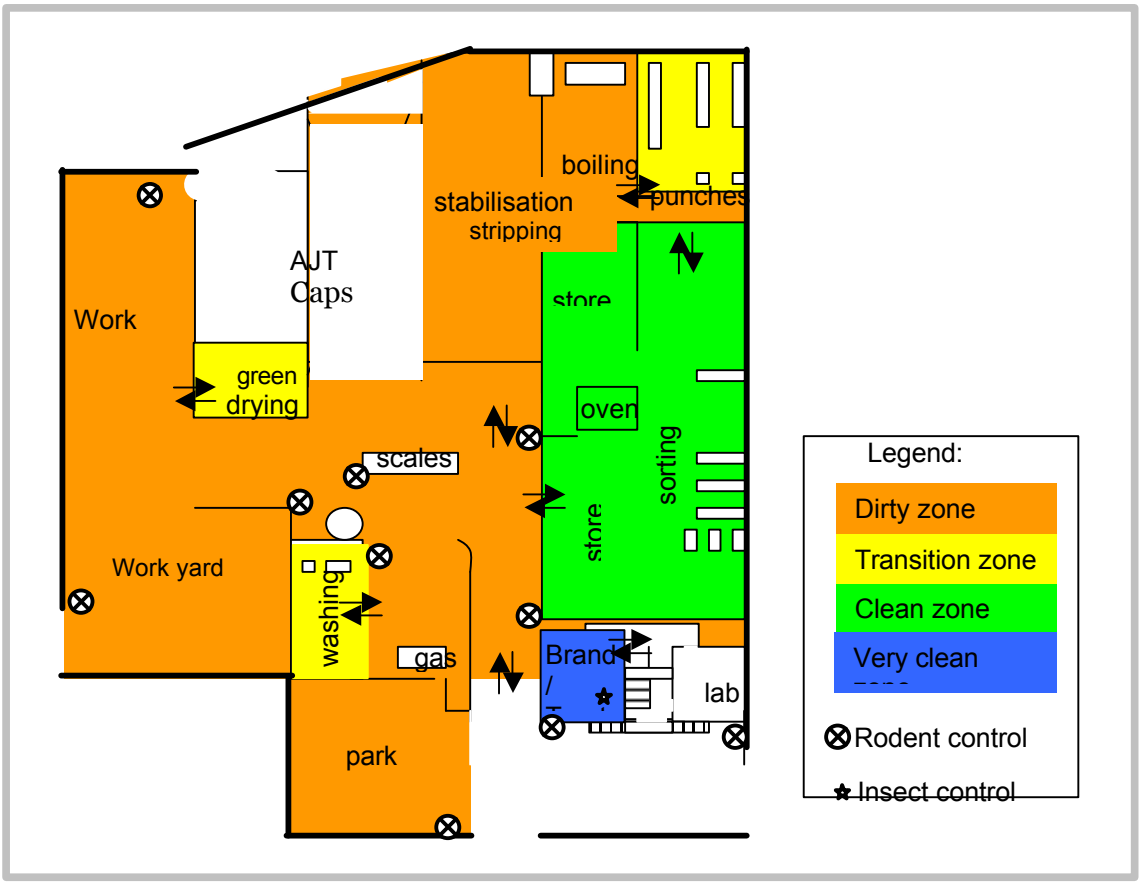


Figure 2. Classification of production area according to function.

3.3. Phase 3: Preparation of Personnel

People are of fundamental importance in a HACCP system since, in addition to being operators, they are also sources of contamination that have to be controlled.

3.3.1. The HACCP Team

This is a multi-disciplinary group of company employees that has the objective of developing, establishing and maintaining the implemented system. The team is made up of general management staff and those employees responsible for the commercial, production and quality areas.

3.3.2. HACCP Leader

The HACCP leader is the team member with the authority and responsibility to ensure the implementation and maintenance of the system and the organisation of the team work. The HACCP leader combines these duties with those of Quality Manager.

3.3.3. Training

All company employees have received training with regard to HACCP. This training was done at three levels, depending on the job carried out by the respective employee.

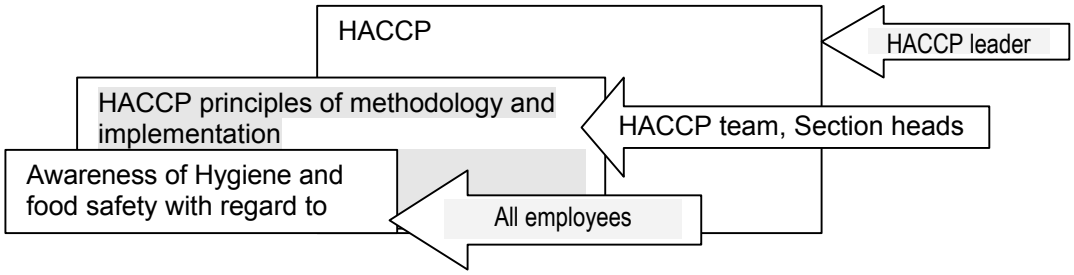


Table 3. Summary of Phase 3.

Start	Analysis of all employees' jobs Survey of training needs
Finish	HACCP team and leader Training of all employees
Duration	3 months

3.4. Phase 4: Hazard identification and risk analysis

3.4.1. Product description

Cork is characterised by suberised cells of the outer surface of certain trees and roots that are produced by the meristematic tissue (definition “Plants, Animals, and the Environment", WCB Glossary/McGraw-Hill). Cork is the bark of the cork oak (*Quercus suber L.*) and is made up of cells, which are filled with a gas with a composition close to that of air.

Whenever the cell walls are subjected to pressure, the air inside is compressed. The compressed air never escapes and the material is never permanently distended. This is one of the features that makes cork an ideal material for stoppers.

The chemical composition of cork is as follows:

- 45% Suberin,
- 27% Lignin,
- 12% Cellulose and polysaccharides,
- 6% Tannins,
- 5% Ceroids,
- 5% Ashes and other substances.

The presence of suberin at the levels indicated and the fact that the cells are polyhedral with a gaseous interior makes cork impermeable to liquids and gases and extremely compressible with very rapid elastic recovery. Cork is light, having a very low density of 0,12 to 0,22.

The terminology and definitions of cork stoppers are to be found in Standards NP1705, NP237, and ISO633. Cork stoppers are made by cutting previously prepared cork planks. Natural cork stoppers are manufactured by mechanically cutting cork. The “colmation” finishing is done by sealing the bottle stopper surface with a mixture of cork powder and rubber-based glues.

The stoppers are washed and disinfected using aqueous redox systems, with treatment by hydrogen peroxide solution in alkaline conditions with caustic soda and sodium silicate, being followed by neutralisation using sodium bisulphate solutions.

After drying, the stoppers are coated with emulsions of acrylic resins or natural rubber that leave a polymer layer on the bottle stopper surface. Finishing is then done in such a way as to enable the stoppers to more easily inserted into / extracted from the bottles. For this, paraffins (in aqueous or solid emulsion) and silicones (oils or elastomers) are used.

Cork stoppers are used for the sealing of glass bottles containing alcoholic drinks for human consumption and they come in direct contact with the drink. The alcohol content of the drinks may vary between 8% and 90% (light wines, liqueurs and spirits).

Cork stoppers that are ready to be used should be stored in an odour-free locale, at a temperature of between 15ºC and 25ºC and an atmospheric humidity of between 40% and 70% for no longer than approximately four months due to potential changes in the treated surfaces and the insulation of the packaging.

3.4.2. Hazards and risk analysis

The potential hazards involved with the manufacturing of natural cork stoppers are

- chemical (pesticides, heavy metals, toxins, allergens, toxic organic compounds)

The analysis of potential hazards is done using a cause-effect diagram to determine the sources of potential hazards in accordance with a detailed manufacturing flow-chart validated "in situ" and with working instructions.

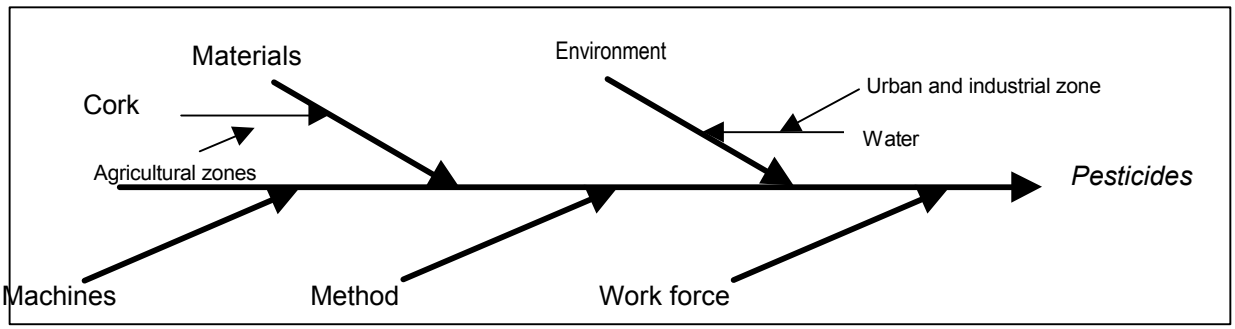


Figure 4. Cause-effect diagram for analysing sources of contamination for the potential hazard of pesticides in the stoppers.

The assessment of the risk depends on the product: Aggressiveness (A), Frequency (F), Detection ability (D). Control measures must be determined for all hazards in order to prevent, eliminate or reduce risk.

The determination of critical control points (CCP) is done using the *Codex Alimentarius* decision tree questions (figure 1). Then, for each CCP, ways of monitoring, critical limits and control measures are established.

The resulting HACCP plan identifies the CCP, the parameter to control, its limit, the way in which this is inspected or measured, the frequency with which this is done, who carries this out, who is responsible and the associated record-keeping.

As with the Inspection and Testing Plan, the HACCP plan has included corrective measures to be taken in the case of values being found that are outside the critical limits.

3.5. Phase 5: System Operation

The system operation is done through record controls, the control of non-conforming products, the control of measuring, inspection and testing equipment, and the notification and recall of products.

This last feature is the major difference between this system and a quality system since, should a critical control point be found to have values outside the limits, it is obligatory to recall all stoppers delivered during the relevant period. This means it must be either possible to trace the products or the monitoring should be carried out in a short processing interval so that, should a non-conforming product case occur, the respective product will still be on-site in the company's installations.

Table 4. Summary of Phase 5.

Start	Raw material, water for industrial use, and equipment for inspection and testing
Finish	Internal and external records
Duration	Continuous

3.6. Phase 6: System Maintenance

Communication with the HACCP team regarding clients' comments, analysis of changes in legislation, discussion of alterations or changes to the installations, processes or employees, hygiene and food safety policy and revision of the system.

Verification: HACCP audits and validation of the plan in order to verify that all elements are appropriate for the relevant risks.

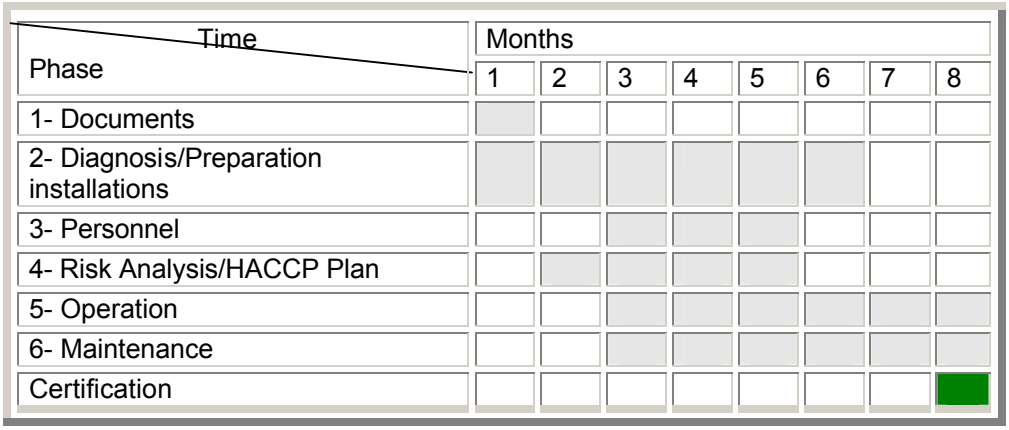
Table 5. Summary of Phase 6 and Certification.

Start	Internal and external (APCER) audits
Finish	Internal and external records
Duration	Continuous

4. Linkage with the ISO 9000 Quality System

The standard DS3027E:1998 fits in perfectly with ISO9000 Quality Systems. In the case of AJT, the fact that the company already had a certified system in place led to the process being implemented very much quicker than would have been the case otherwise.

Gantt chart of the process phases



5. Advantages for the company

1. Demonstration that the company's cork is worked in hygiene conditions that meet food industry requirements. The investment made is clearly worthwhile in terms of demonstrating this fact.

2. Improvement of general working conditions and the organisation of production processes. Improvement was noted in the organisation in terms of ISO9000.

3. Focus on the identification and prevention of contamination.

4. The fact that AJT is the first cork company in the world to obtain HACCP certification has had a very positive impact on the company's employees, clients and suppliers, showing that AJT is a different, innovative company, that can be expected to take new, bold attitudes to improve stoppers in the constant pursuit of its final objective: perfect sealing.

(Iso-thermal)

Figure 5. Vehicles used for distributing corks to bottlers.

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