Chapter 4 – The Carriage of Genetically Modified (GM) Crops

The term GMO (genetically modified organism) refers to any organism whose genetic makeup has been altered using genetic engineering. In the context of marine cargoes, they are usually seed from GM plant varieties that have characteristics that are different from those of varieties that have been developed through traditional plant breeding techniques. GM crops are not readily detectable by visual inspection.

Figure 4.1: GM cargoes are usually comprised of seed from GM plant varieties.

GM crop varieties have been developed to meet different breeding aims including:

- Herbicide resistance – crops that show minimum damage following herbicide spraying regimes that are designed to eliminate weeds
- disease – crops that are less prone to be damaged by fungal, bacterial or viral diseases
- pest resistance – crops that are less attractive to natural predators such as insects
- stress resistance – crops that are more tolerant to various environmental stresses such as drought, salinity and extreme temperatures
- varieties with altered composition – crops that show improved nutritional values, eg 'golden rice' with an increased level of vitamin A
- use in bioremediation to eliminate pollutants – crops that have the ability to decontaminate land by assimilating hazardous pollutants and toxic compounds. These plants can then be harvested and forwarded for industrial use or incinerated
- pharming (biopharming/molecular farming for the production of pharmaceuticals, enzymes, etc) – crops that produce increased yields of desirable compounds for industrial and pharmaceutical use, eg starch, fuel, antibodies, hormones, etc.

The first GM seeds were planted for commercial use in the USA in 1996. By 2006, the total acreage had increased to 102 million hectares, and today it is estimated that 180 million hectares globally are being cultivated with GM crops (2014 figures). The USA is leading in the cultivation of GM crops with approximately half of the world acreage (73 million hectares in 2014), followed by Argentina, Brazil and Canada. China is rapidly expanding cultivation of GM crops.

Today, a total of 28 countries use genetic engineering commercially. Soya beans, maize, oilseed rape (canola) and cotton account for almost all commercial GM crop production. Other GM crops under cultivation include sugar beet, potatoes, rice and sugar cane. GM ornamental products include roses and carnations.

Figure 4.2: GM crops on board a vessel.

4.1 Conventional Hazards

GM crops present no greater hazard during shipping than that already identified for their conventional counterparts. Similarly, the loading, precautions during carriage, ventilation and discharge operations of GM crops do not differ from those of conventional crops.

Figure 4.3: The loading of GM crops.

4.2 Carriage of GM Crops

When carrying GM crops:

- Cargoes of soya beans, maize, oilseed rape and cotton that are loaded in the USA, Argentina, Paraguay, Uruguay, Brazil or Canada come with an increased likelihood of being genetically modified. It is therefore recommended that these specific cargoes from the above locations are analysed prior to loading. The GM or non-GM nature of the cargo should be certified based on the analysis carried out
- the B/L should clearly state the unique identifier, species and the variety, which, if the cargo is GM, should be on the list of GMOs authorised in the EU (Reference 5)
- it is recommended that any GMO qualitative and quantitative tests carried out at the load port follow the protocols set out by the National Reference Laboratory of the destination country. In this way, the danger of variable results due to laboratory discrepancies is minimised. A list of National Reference laboratories that can carry out analyses of GM material and work under the auspices of the European Central Reference Laboratory (CRL) can be found at https://tinyurl.com/y8w66vpz (Reference 6)
- enquire whether the testing laboratory at the port of origin is accredited to carry out sampling specifically for GM material
- establish whether the import country is a party to the Cartagena Protocol on Biosafety (CBP) through the Biosafety Clearing-House (http://bch.biodiv.org) (Reference 7). The EU is a party
- establish whether the import country has any additional regulations on GM shipments for FFP (food or feed, or for processing), as in the case of the EU Members who accept only previously EU-authorised GM crops
- the International Grade Trade Coalition recommends that the commercial invoice contains the contact information of the last exporter prior to the transboundary movement and the first importer after that movement.

4.3 Carriage of Non-GM Crops with Low Level Presence (LLP) of Adventitious/Chance Contaminants

In conventional cargoes that are found to contain low levels of chance contaminants of GM origin, the fate of the cargo depends on the nature of the GM contaminant and the sampling and testing procedures that are conducted.

4.3.1 Sampling

Correct sampling intensity and good sampling techniques are crucial to minimising the error and inaccurate measurement of LLP involved with sampling. GM contaminations in large shipments are not necessarily random and any sampling methods used should take this into account. Currently, there are two appropriate testing guidelines:

- European recommendation 2004/787/EC. This also specifies the ISO method that should be used for the collection of the material (see Table 4.1) (Reference 8)
- ISO DIS 21568 (Reference 9).

Commodity to be sampled	ISO method to be used
Free-flowing commodities	6644/13690
Oilseeds	542
Pre-packaged food and feed products	2859
Material larger than grains (eg potatoes, fruits, rhizomes)	2859

Table 4.1: ISO methods used for the collection of material for the detection of GMOs.

Material for testing should be collected in intermittent sampling periods, which may be calculated by dividing the estimated total offloading time by the total number of increments. Table 4.2 shows the recommended number of increments, which varies according to the lot size.

Lot size in tonnes	Size of bulk sample in kg	Number of increments
≤50	5	10
100	10	20
250	25	50
≥500	50	100

Table 4.2: Size of bulk samples (kg) and number of increments to be collected for testing for GMOs in cargoes.

4.3.2 Testing

It is recommended that any qualitative and quantitative tests of GM crops that are carried out at the load port follow the protocols set out by the EU or national reference laboratory of the destination European country. In this way, the danger of variable

results due to laboratory discrepancies is minimised. A list of national reference laboratories that can carry out analyses of GM material and that work under the auspices of the European Central Reference Laboratory (CRL) can be found at https://tinyurl.com/y8w66vpz (Reference 6).

The analytical steps of cargo testing for the low level presence of GM material are shown in Figure 4.4.

Following a negative result of the screened material, the cargo will be released. However, a positive test to GM material will prompt further investigation for the identification of the exact GMO. If the identified GMO has been authorised to be used as food or feed in the European country of discharge, a quantitative test will be required to determine the level of contamination.

The maximum permitted amount of approved GMO in a non-GM cargo is 0.9%. Above this, the cargo will be labelled as GM cargo. If the GMO has not been previously authorised under EU regulations, the cargo will be deemed illegal and it will be rejected irrespective of the level of contamination (there is a zero threshold for non-approved GMOs in the EU).

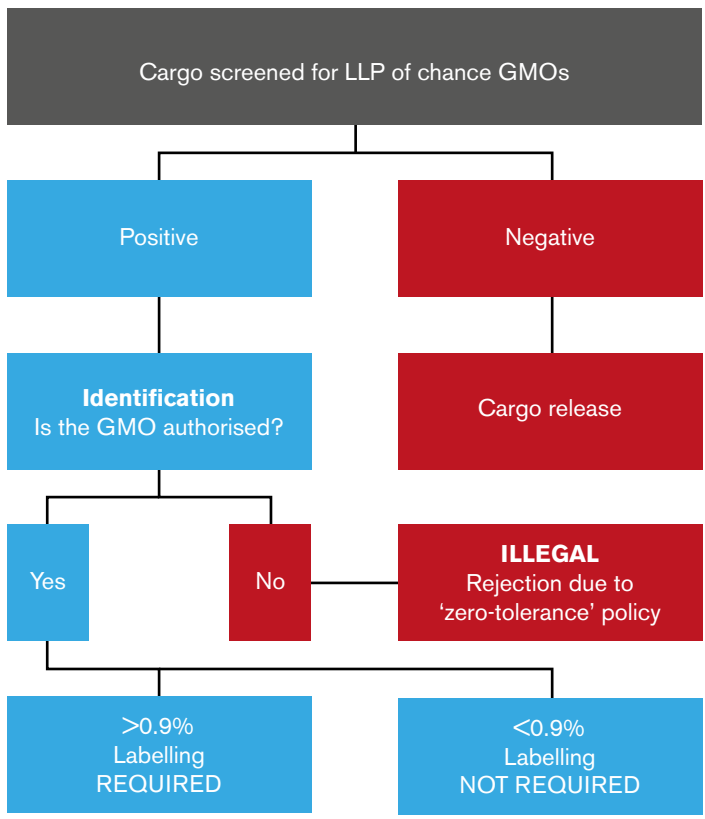


Figure 4.4: Cargo screening for the low level presence (LLP) of GM material.

Products that require labelling
Food that is a genetically modified organism (GMO) or that consists of GMOs (eg canned sweetcorn, approved but not available in the EU).
Food ingredients or additives that are produced from GMOs (eg oil from GM rapeseed or soya beans, starch from GM maize, and sugar from GM sugar beet).
Food ingredients or additives that contain genetically modified organisms (eg beer with GM yeast, blue cheese with GM moulds, yoghurt with GM lactobacilli). NOTE: No GM yeast/bacteria/fungi have been approved for use in food in the EU.

Products that do not require labelling
Food containing GMOs up to a threshold of 0.9% • The producer/importer of a product needs to supply evidence that the presence of such material is either adventitious or technically unavoidable and that every possible step to minimise the presence of such material has been taken • the GMO in question has already been classified as safe and has received an EU authorisation. NOTE: The threshold of unauthorised GMOs is 0% (zero tolerance).
Food that is produced with the aid of genetically modified organisms (eg meat, eggs or dairy products produced from animals fed on GM feed, also additives, flavours and vitamins produced with the help of GM microorganisms such as artificial sweeteners, flavour enhancers and thickening agents)
Substances that are not required to be declared on the list of ingredients • Enzymes used in food processing (eg chymosin used in cheese production and pectinases used to degrade cell membranes in juice or wine) • substrates (growth media) for microorganisms (eg baker's yeast cultured on a medium containing GM corn, and vitamin C produced by microorganisms raised using glucose derived from GM corn starch) • carrier substances; substances used to prolong shelf life, facilitate transportation, etc (eg starch/glucose/dextrin-derived).
Honey containing pollen or nectar from genetically modified plants

Table 4.3: Labelling requirements of GMO-related products.

4.4 The Legal Framework of GMO Importation

4.4.1 The European Regulations

Three laws govern the authorisation and release of genetically modified organisms in the EU:

Regulation 1829/2003 in effect since 19th April 2004 (Reference 10)
(Replaces directive 258/97)

This regulation defines the use of food and feed that has been produced from or contains GM plants. The regulation is set out in 49 Articles which give the detailed requirements for a GMO food or feed that need to be demonstrated in order for authorisation to be granted. It specifies the application for authorisation and the authorisation process, including modifications, revocations, suspensions and renewals of these.

Directive 2001/18/EC in effect since 17th April 2001 (Reference 11)
(Replaces directive 90/220/EC)

This directive contains 38 Articles which define the commercial use of genetically modified plants and their deliberate release into the environment. These have been compiled with the objective of protecting human health and the environment by controlling the risk of the deliberate release of GMOs. It clarifies the obligations, including the notification procedure, consultation with the public, and exchange of information prior to the release, as well as the monitoring and handling of any modifications following the release.

In addition to these two main directives, there is a further regulation concerning the traceability and labelling of GMOs, and a recommendation that encourages the inclusion of GM crops in European farming.

Directive (EU) 2015/412 in effect since 11th March 2015 (Reference 12)
(Amended directive 2001/18/EC)

This directive is an amendment that allows for member States to restrict or prohibit the cultivation of GMOs in their territory or in specific geographical areas.

Regulation 1830/2003 (Reference 13)
This regulation (13 Articles) determines the stages involved in the traceability and labelling of approved GMOs and the traceability of food and feed products produced from these GMOs prior to being placed on the market. It covers the labelling provisions of all GM food or feed that consists of, contains or is produced from GMOs. For any products comprising mixtures of GMOs, a list of the unique identifiers of all GMO components should be made available. Labelling of pre-packaged and non-pre-packaged products consisting of or containing GMOs should include the following statement on the label:

"This product contains genetically modified organisms" or *"This product contains genetically modified [name of organism(s)]."*

Recommendation 2003/556/EC (Reference 14)
This recommendation states that no form of agriculture should be excluded in the EU and includes guidelines to be used by member States for the development of measures for the coexistence of GMO crops and crops developed through conventional breeding. Strategies should be developed on the basis of the best available scientific evidence. The recommendation distinguishes between assessment of the environmental and health aspects, already covered by Directive 2001/18/EC, and the economic aspects still to be assessed. It also emphasises the need for monitoring and evaluation of coexistence and encourages the improvement of the existing segregation measures.

4.4.2 The Cartagena Protocol on Biosafety (CBP) and GMO Trade to the EU

In addition to the EU legal framework, there are regulations that have been agreed in the context of the Cartagena Protocol on Biosafety (CBP, Reference 15), which came into force in 2003. The CBP was designed to promote transparency and control in the international GMO trade, and up to the end of 2021 it had been ratified by 173 countries, excluding the three main GMO producers – USA, Argentina and Canada.

The CBP is an international regulatory framework put in place to reconcile the safety of the biodiversity with the use of products of modern biotechnology. A major component of the CBP was the establishment of the Biosafety Clearing-House (BCH) which was set up to *"facilitate the exchange of information on Living Modified Organisms (LMOs) and assist the Parties to better comply with their obligations under the Protocol".* (Reference 7).

The intentional and unintentional movements of products of modern biotechnology and their handling are described in Articles 6, 11, 17 and 18. It should be noted that the CBP refers to living modified organisms (LMOs). LMOs include genetically modified crops and other GMOs.

Under the protocol, exporters are obliged to provide more information on GM products before the shipment, and it is then up to the receiving country to decide whether or not to accept the shipment or to seek more information. Member States may reject such imports without quantitative justification or scientific evidence but must provide reasons, which may include (for example) potential danger to traditional crops, impacts on local culture or potential impacts on the value of biodiversity.

Figure 4.5: A shipment of GM goods.

CBP – Article 6 – Transit and Contained Use
Article 6 of the CBP exempts material destined for contained use or material in transit from the provisions of the protocol.

CBP – Article 11 – Procedure for Living Modified Organisms Intended for Direct Use as Food or Feed, or for Processing (LMO-FFPs)
Article 11 of the CBP describes the special measures required for LMOs that are intended for direct use as food or feed, or for processing (FFP), including the requirement for accurate information sharing via the BCH.

CBP – Article 17 – Unintentional Transboundary Movements and Emergency Measures
The presence of GM material found in non-GM cargoes is covered in Article 17. According to this Article, the duties of Parties involved in unintentional transboundary movements are:

- To notify affected or potentially affected States, the BCH and, where relevant, international organisations
- to provide the name, identity and details of the characteristics/traits of the LMO
- to provide information on the estimated quantities involved, the date of release, the use of the LMO at origin and any other relevant circumstances
- to inform on the possible adverse effects of the LMO on biodiversity, any risks to human health, and to provide possible risk management measures
- to provide a point of contact for further information and clarifications.

CBP – Article 18 – Handling, Transport, Packaging and Identification
Article 18 describes the requirements for handling, transport, packaging and identification of intentional transboundary movements of LMOs for direct use as FFP (Article 18.2a), for contained use (Article 18.2b) and for intentional introduction into the environment (Article 18.2c).

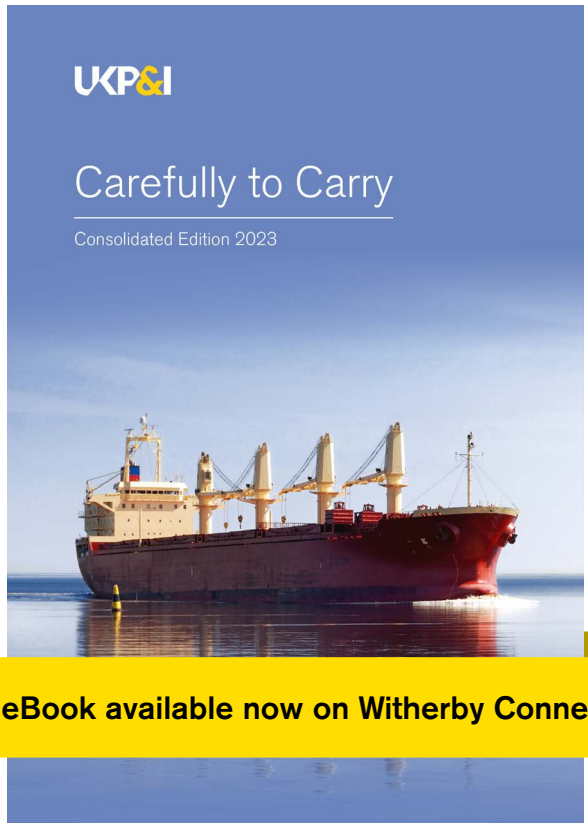
Central to the requirements of Article 18.2a is that the documentation that accompanies cargoes of LMO-FFPs clearly states that it 'may contain' LMOs. To this effect, the International Grain Trade Coalition (IGTC) recommends that the commercial invoice contains the following or a similar meaning declaration:

"*Cartagena Protocol Provision: This shipment may contain living modified organisms intended for direct use as food or feed, or for processing, that are not intended for intentional introduction into the environment*."

The European Union goes beyond the Cartagena provisions, with strict rules on the importation of GMOs, based on demanding but clearly set out principles. Following the cessation of the *de facto* moratorium on GMO imports in 2004, Regulation 1829/2003 came into force specifying the labelling provisions for food and feed produced from GMOs (as described under Regulation 1830/2003).

Carefully to Carry

Consolidated Edition 2023



Full eBook available now on Witherby Connect

Price: £95

This comprehensive publication, compiled by the UK P&I Club, details best practice for the carriage, loading and storage requirements of a wide range of cargoes. It also contains essential information on draught surveys and preparing cargo plans.

Outlining and expanding on all major international cargo regulations and guidelines, it also includes detailed checklists, information on draught surveys and guides to preparing cargo plans. Cargoes covered include timber, gas, grain, steel and other metals, bulk goods and refrigerated goods.