Beyond Borders: Mastering Pesticide Maximum Residue Levels and Contaminant Limits in the Global Food Sector

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The Critical Role of Managing Pesticide MRLs and Contaminant Limits in the Food Industry

With an increasing spotlight on food safety and consumer health, producers and manufacturers in the food industry face a significant challenge: Navigating the complex and varied regulations surrounding pesticide maximum residue levels (MRLs) and contaminant limits. Maintaining compliance with regulations of target markets not only requires significant time and resources, but a deep understanding of the regulatory information available and how it applies to ingredients or products.

At FoodChain ID, it is our mission to help keep the food supply chain safe and transparent. We provide technology-enabled solutions and expertise to over 30,000 customers across the world.

This whitepaper will provide an overview of pesticide MRL and contaminant limit regulations, touching on key variances in regulatory frameworks. It reviews insights we have assembled from our team of regulatory experts and valued customers regarding the challenges of managing this complex landscape. Also provided are actionable strategies to enhance and streamline compliance management.

Understanding Pesticide MRLs and Contaminant Limits: Overview and Definitions

As defined by the European Food Safety Authority (EFSA) pesticide MRLs are the "maximum amount of a pesticide residue allowed in food."[1] Pesticide MRLs are set by national regulatory bodies or international organizations and are critical for ensuring that the use of pesticides in agriculture does not result in harmful concentrations of residues in food. MRLs vary depending on the type of food product, the pesticide used, and the country of regulation, making it a complex landscape for companies operating on a global scale.

The Food and Agriculture Organization (FAO) defines contaminants as "substances that have not been intentionally added to food."[2] Contaminants can be present because of the production, manufacturing, processing, preparation, treatment, packing, packaging, transport, or holding of food products. This category includes both chemical and biological substances, such as heavy metals and mycotoxins.

Contaminant limits are set to ensure that exposure to these substances through food remains at levels considered safe for consumption. These limits are crucial in preventing foodborne illnesses and in maintaining the overall quality and safety of food products.

Region/ Country	Pesticide MRLs	Contaminant Limits
United States	**Environmental Protection Agency** (EPA): Sets MRLs for pesticides in both human food and animal feed.	**Food and Drug Administration** (FDA): Responsible for setting maximum limits of contaminants in food. **United States Department of Agriculture** (USDA): Oversees meat, poultry, and egg products.
Canada	**Health Canada:** Sets standards and regulations for food and feed safety. **Health Canada's Pest Management Regulatory Agency** (PMRA): Sets MRLs for pesticides.	
South America	Varies by country. Notable examples include **Brazil's National Health Surveillance Agency** (ANVISA) and **Argentina's National Service of Agri-Food Health and Quality** (SENASA).	Varies by country. Notable examples include **Brazil's National Health Surveillance Agency** (ANVISA) and **Argentina's National Service of Agri-Food Health and Quality** (SENASA) and **National Drug, Food and Medical Technology Administration** (ANMAT).
Europe	**European Commission:** Sets MRLs for all member states. Implements laws on food safety and quality. **European Food Safety Authority** (EFSA): Conducts risk assessments for the establishment of MRLs and contaminant limits.	
Asia	Varies by country. Notable examples include **China's Ministry of Agriculture and Rural Affairs, South Korea's Ministry of Food and Drug Safety** (MFDS), and the **Food Safety and Standards Authority of India** (FSSAI).	Varies by country, but major players include **China's National Health Commission** (NHC), **South Korea's Ministry of Food and Drug Safety** (MFDS), and the **Food Safety and Standards Authority of India** (FSSAI).
Africa	Varies by country. Notable examples include **South Africa's Department of Health and Department of Agriculture, Land Reform, and Rural Development** (DALRRD), and **Zimbabwe's Ministry of Health and Child Care** (MOHCC).	Varies by country. Notable examples include **South Africa's Department of Health** and **Zimbabwe's Ministry of Health and Child Care** (MOHCC).

Challenges of Managing Varying Pesticide MRLs and Contaminant Limits

The lack of harmonization in pesticide MRLs and contaminant limits across different countries present several challenges for food industry professionals:

1. Updated regulations are published frequently and are difficult to track.
2. Regulations may be in different languages, making it difficult to understand applicable limits.
3. Each country has different pesticide and commodity terminologies, or worse, different crop group definitions that can be difficult to define and vary between countries.
4. Some countries rely on complex deferral paths that reference several different global standards (i.e. Codex or the EU) to determine the applicable MRL value.
5. National markets continue to establish new MRLs and contaminant limits, making the formula for compliance a complicated and evolving equation.

Frequency of Updates and Language Barriers

Some markets have a well-established framework with proposals and regulations that are updated frequently, which can be difficult to track. Most markets publish in the original language and translations are not publicly available, adding to the complexity of finding and reviewing the information.

- The European Union publishes several hundred regulatory updates annually.
- Contaminant limits are regulated in many areas. For example in the U.S., contaminant limits are published in many different sections of the Code of Federal Regulations (CFRs), while guidance levels and action levels are published in various Guidance for Industry documents and FDA Compliance Policy Guides (CPGs).
- Examples of markets that publish in their original language include Argentina, China, Costa Rica, Japan, Mexico, South Korea, and Switzerland.

Challenges of Managing Varying Pesticide MRLs and Contaminant Limits

Complex Deferral Process Considerations

Many countries establish and maintain their own national MRLs, including the U.S., EU, and Australia. However, some countries use decision trees to accept other MRL standards in place of their own. These are referred to as deferral paths and can range from simple to complex. For example, some countries will not establish national MRLs and instead defer directly to one international standard, such as Codex.

In other cases, the deferral policies in place are more complex. Markets such as Argentina and Singapore establish national MRLs, but also accept Codex MRLs where no national MRL has been established. Certain countries will compare MRL values between two different global standards, such as the EU and U.S., and then accept the highest or lowest value between the two authorities. There are also global examples like Chile and Peru, which have deferral paths involving multiple markets. Finally, further complicating matters, some markets apply different MRL policies for imported versus domestically produced food, such as South Africa and New Zealand.

Challenges of Managing Varying Pesticide MRLs and Contaminant Limits

Increase in Global MRLs for Compliance

The global landscape of pesticide MRL and contaminant limit regulations continues to grow in complexity. Numerous countries continue to increase the number of national MRLs established each year, which presents complex challenges for producers due to the lack of harmonization across global markets. For example, China issued its MRL standard GB 2763-2021 in March 2021, which established over 10,000 MRLs for pesticides in food. Furthermore, China's Ministry of Agriculture and Rural Affairs (MARA) has asserted that it intends to increase the number of established MRLs to 15,000 by 2025.

By establishing more national MRLs, some markets are consequently moving away from international harmonization. Great Britain previously deferred to European Union MRLs but started establishing its own national MRLs in 2021. Although Great Britain has adopted some Codex MRLs in this time, this effort has created a unique and developing set of MRLs which are based on EU MRLs, Codex MRLs, or neither, depending on the active ingredient and commodity. In addition, Uruguay previously accepted Codex MRLs but established a complex deferral path in 2022, which involves comparing Codex, Argentina, Brazil, Chile, U.S., EU, and a handful of national MRLs.

Due to this increase in established MRL standards, the range of MRLs for a single commodity and pesticide can vary significantly between markets. In the example below looking at one commodity and one pesticide, the MRLs range from 0.01 ppm to 5 ppm.[3] This lack of harmonization creates barriers in tracking regulations and ensuring compliance for companies that sell to multiple markets.

Table Grape MRL Variance for the Pesticide Pyriproxyfen

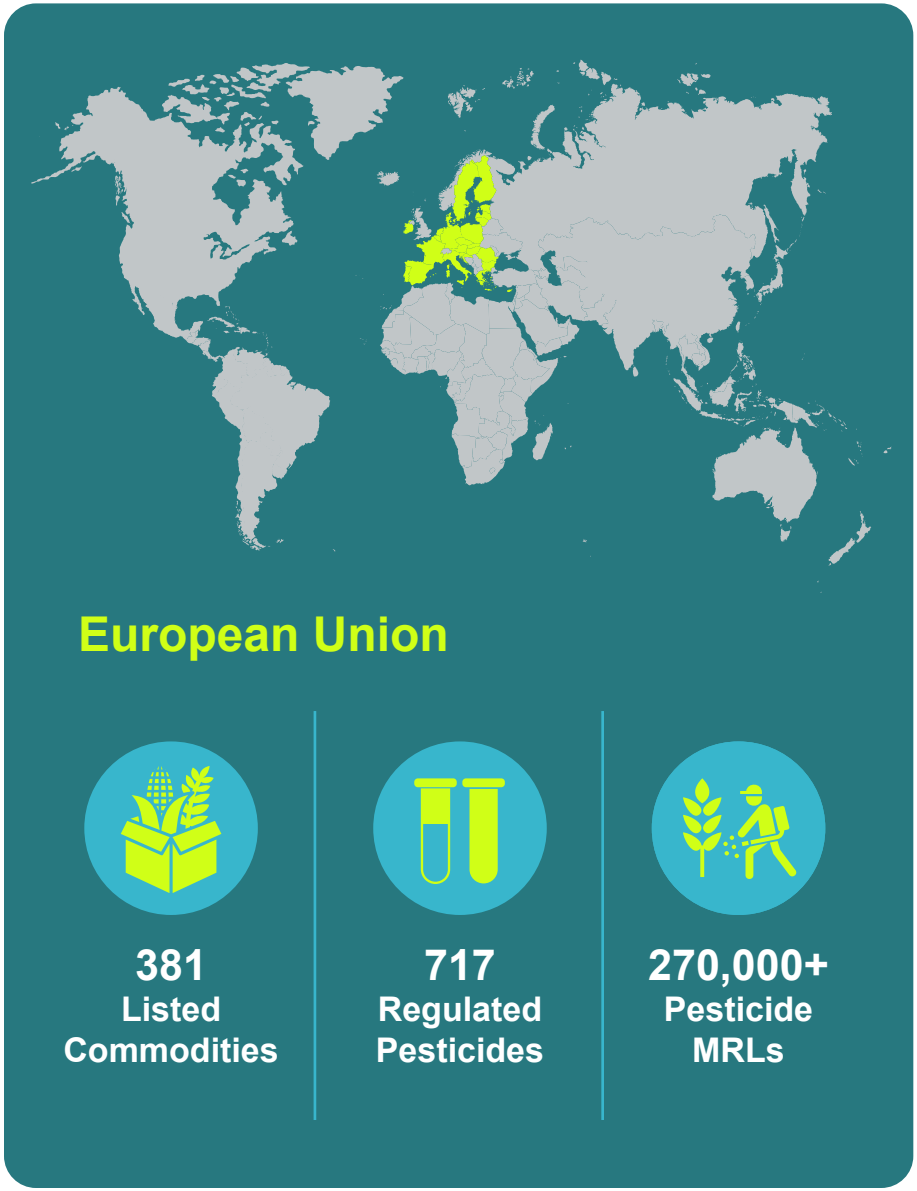
Market	United States	Brazil	Canada	Dominican Republic	European Union	India	Japan	South Africa (Domestic)	Taiwan
Market Commodity Name	Grape	Grape	Grapes	Grapes	Table Grapes	Default MRL	Grape	Grapes	Small Berries
MRL (ppm)	**2.5**	**5**	**3**	**2.5**	**0.01**	**0.01**	**0.05**	**0.05**	**0.05**

Challenges of Managing Varying Pesticide MRLs and Contaminant Limits

The Complex Formula for Compliance

The complexity of managing regulations builds with the number of markets and commodities, creating a formula for compliance that involves multiple variables. First, consider the number of countries you operate in. Then, multiply that by the number of commodities or ingredients used, whether they're in your products or sourced from suppliers. A constant influx of new pesticide regulations being added or changed adds further complexity to the equation.

Taking a single region as an example, the EU has 381 commodities listed and over 700 regulated pesticides, resulting in a possibility of over 270,000 MRLs to consider. Moreso, this only factors in MRLs currently in effect without considering proposed or pending MRLs. There are currently 12,000 proposed and 3,000 pending MRLs in the EU, and there were around 200 regulatory documents published and over 1,000 pesticide violations in the last year alone. When you crunch the numbers, it can become a challenging and labor-intensive task to ensure you're maintaining compliance with current regulations.



Consequences and Examples of Violations

Navigating the varied regulations and standards for MRLs and contaminants across different countries is not just a matter of regulatory compliance; it is integral to maintaining your supply chain resiliency, product safety, consumer trust, and market access.

Recent Examples of Violations

Lead and Chromium in Applesauce Pouches
Applesauce pouches produced in Ecuador were recalled in the U.S. after discovering the products had levels of lead and chromium at more than 200 times higher than the proposed action level. This became a nationwide story in the U.S. as frantic parents checked their fridges for the brands impacted by the recall.[5]

Ethylene Oxide in Sesame Seeds
Several products were recalled across the EU in 2020 after ethylene oxide was detected on sesame seeds from India. The recall affected a wide range of products from ice cream to instant noodles, and vegetable oils and involved popular products and brands.[6]

Aflatoxins in Peanut Butter
A South African company recently detected aflatoxins in certain batches of their peanut butter products during routine quality testing. This discovery led to recalls of multiple products by several retailers, including a large supermarket chain.[7]

The EU Alert and Cooperation Network reported that six of the top 10 recurrent RASFF* notifications were related to pesticides or contaminants.[4]

Failing to understand and comply can lead to severe consequences such as product recalls, financial losses, legal penalties, and damage to brand reputation. Additionally, non-compliance can create longer-term trade issues that could lead to market access barriers and supply chain disruptions. Many markets put products which receive a violation on a "red list," indicating that they will receive continual and heightened testing in the future before being permitted to enter the market.

What is RASFF?

RASFF is the **Rapid Alert System for Food and Feed**. It is a database created by the European Commission that reports food safety violations.

Strategies for Streamlining Compliance Management

With the array of barriers and risks in managing MRLs and contaminants, it is essential to have a comprehensive, strategic process with tools in place to track and monitor current and future regulations. The data should be kept up-to-date and accessible to stakeholders to mitigate risks of disruptions or errors.

Know your products and target markets:

Regulatory managers need to have a deep knowledge of all pesticide MRLs and contaminant limits applicable to their products in respect to the countries that are part of their global supply chain. It is important to understand where regulatory information is accessed for each country and to ensure the accuracy of the data. Regulatory managers should know which regulatory bodies set and enforce the limits, any deferral policies in place, and the enforcement and violation policies of each of their destination markets. In addition, when reviewing new possible target or supplier countries, regulatory managers also need to conduct a pesticide MRL and contaminant limit risk analysis for their products as a factor in their evaluation.

Know what's ahead:

Continual monitoring of announcements for proposed and pending regulations is necessary to prepare for changes. Regulatory managers should understand timeframes and implications and have a strategic plan in place for products that will be affected. This includes time to coordinate with supply chain partners or, if necessary, modify the locations of your supply chain partners. This might also include time to seek outside expertise for their global supply chain impact analyses, so that you can be informed and prepare each supply chain dependency to ensure they comply by the enforcement date.

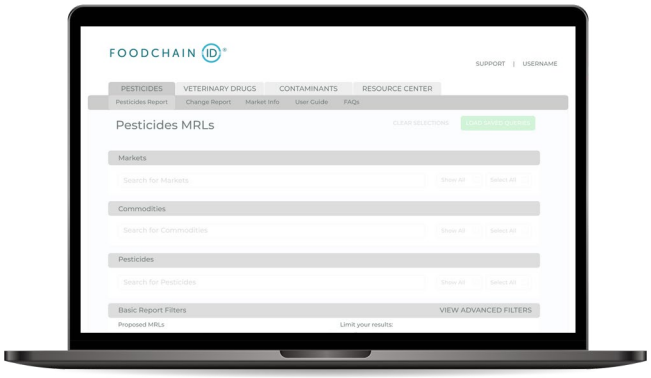
These strategies are vital for ensuring that all stakeholders in your global supply chain adhere to these standards to avoid disruptions and ultimately allow you to maintain brand integrity.

A Comprehensive Solution

The FoodChain ID Regulatory Limits suite of solutions is designed to address the challenges discussed in this white paper. These accurate and user-friendly tools allow for quick landscape analysis across different markets to easily determine export risks. The databases are backed by a team of global regulatory analysts, ensuring that regulatory changes are consistently monitored and available in the database almost immediately.

Regulatory Limits Key Features:

- Provides proposed, pending, and current regulatory values so users can see which limits apply today, and those that will or could apply in the future.
- MRL information is professionally translated and provided in English.
- Built with algorithms which automatically display the actual MRL faced at import into a country, taking into account market-specific deferral pathways.
- Standardized commodity terms for searching enables effortless comparison across markets, despite differing terms and crop group definitions.
- Our analysts understand food safety regulations and maintain a rigorous regulatory monitoring program covering nearly 1,000 government and international sources.
- Updated daily, with routine regulatory updates often available in the system as soon as the next business day.
- Includes a change report notification system that will email you when a change might affect your business, as well as information reports that provide full regulatory snapshots of each country.
- Top-of-the-line support provided by the same FoodChain ID regulatory analysts who monitor for and update Regulatory Limits, with a deep understanding of the regulations.



When it comes to managing pesticide MRL and contaminant limits, being equipped with the right tools and knowledge is not just a competitive advantage – it is a necessity for business survival. By reducing research time and ensuring products meet international standards, Regulatory Limits helps companies efficiently mitigate compliance risks, supports safe, global trade, and protects against the financial and reputational damages associated with non-compliance. With Regulatory Limits, companies can not only meet the challenges of today but also prepare for the evolving demands of tomorrow, ensuring the safety and quality of their products in the global marketplace.

Want to learn more?

Schedule a meeting with our experts.

Glossary

- **Current MRLs/Limits:** Officially established MRLs/limits that are in force.
- **Pending MRLs/Limits:** MRLs/limits which have been officially adopted and will enter into force on a specified future date.
- **Proposed MRLs/Limits:** Draft MRL/limit amendments, proposals, or petitions that are still under consideration in the regulatory process.
- **Default MRL:** Many markets maintain a default MRL that applies in cases where no other MRL is set.
- **Deferral Path:** Deferral paths are the decision trees used by some countries to determine acceptable MRLs when a national MRL is not established or does not apply in a certain circumstance.

1. https://www.efsa.europa.eu/en/glossary/mrl#:~:text=The%20maximum%20amount%20of%20a,expressed%20as%20milligrams%20per%20kilogram
2. https://www.fao.org/fao-who-codexalimentarius/thematic-areas/contaminants/en/
3. FoodChain ID's Regulatory Limits Database: https://www.foodchainid.com/products/regulatory-limits/
4. https://food.ec.europa.eu/document/download/bbad1a9c-9367-401c-92e0-2b93a7f1db09_en?filename=acn_report_2022_overview.pdf
5. https://www.foodsafetynews.com/2024/02/patient-count-continues-to-grow-in-outbreak-of-lead-poisoning-traced-to-applesauce/
6. https://timesofmalta.com/article/60-products-taken-off-shelves-in-widespread-food-recall.898930
7. https://timesofmalta.com/article/60-products-taken-off-shelves-in-widespread-food-recall.898930