

Solutions Designed for the World's Food Packaging

*Creating Safe, Sustainable Packaging Using
New Generation Memjet® Inks*



memjet®

Beautiful Precision, Simplicity, and Affordability.

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INTRODUCTION

Most labels and packages produced today are for food and beverage products. Anyone working — or expanding — in this growing market must understand how each component used in the packaging impacts the food inside. Each step in the supply chain should ensure their own regulatory responsibilities are met. In doing so, the company putting the product on the market can ultimately prove that the complete food package is compliant with all applicable regulations and safe for its intended end-use.

Failure to meet such regulations can lead to product recalls, sickness, or worse.



Is your business up to this task?

This White Paper takes a close look at the role of inks used in label and package print solutions. We will cover how the right inks help create high-performance, sustainable labels and packaging that do not negatively impact food, human health, the environment — or your wallet.

You'll learn how to choose inks that use safer ingredients than alternative technologies yet still create the high-quality, durable results needed to compete and differentiate in competitive food packaging markets, whether you use labels, flexible packaging, folding cartons, or corrugated materials.

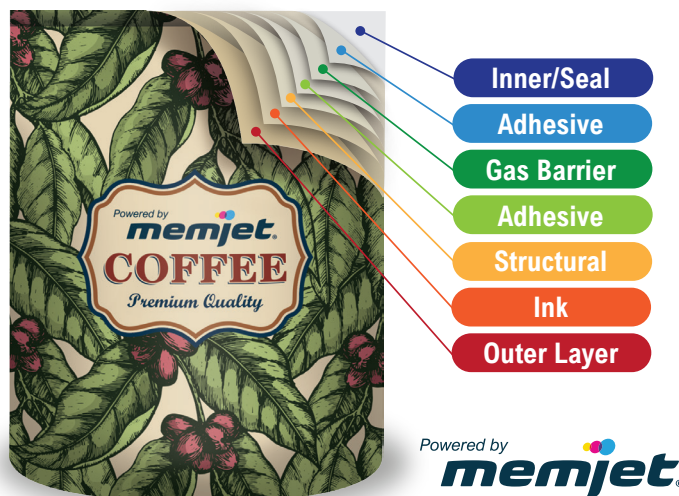
Finally, you'll understand how Memjet® inks and the *Powered by Memjet®* print solutions compete and differentiate in the ever-changing food packaging market while keeping employee and food safety a priority.

Creating Safe Food Labels and Packaging

Whether you are a seasoned professional in the field of packaging and label production, or just beginning, it is critical to have an in-depth understanding of the principles of **Food Contact Material (FCM)** regulations and compliance.

FCM compliance is about more than individual substances (or components) within each layer of a packaging article; it's about ensuring that ALL the layers together — commonly known as the packaging “sandwich” — covers, protects, and preserves the food, and is holistically in compliance.

Typical Packaging Layers



Whether you are printing a label for your packaging or printing on the packaging itself, these are the typical layers involved in the packaging sandwich.

The primary purpose of food packaging is to protect its contents from contamination or taint from the time it is put into the package until a consumer empties the package. A common method of contamination comes from the migration of substances from the packaging into the food. This migration can happen from any material layer within the packaging, including the substrate, label, adhesive, or ink.

The United States Food and Drug Administration (FDA) and European Food Safety Authority (EFSA) both regulate and evaluate the safety of most

substances used in FCMs. Remember each layer in the packaging article constitutes its own FCM. While these jurisdictions may maintain regulations on the substances used within FCMs, such as paper, adhesives, and plastics, they are not in the business of certifying or approving individual layers or a complete food contact article (FCA), although you can submit them for review. While ink is not meant to come into contact with food, there is no FDA or EU certification or even a harmonized regulation specific to ink.

Each step in the supply chain should ensure their own regulatory responsibilities are met so that the company putting the product on the market can ultimately prove that the complete food package is compliant with all applicable regulations and safe for its intended end-use.

Compositional Review and Migration

Understanding how each layer in the packaging sandwich supports the overall compliance of the entire package is crucial. These are some of the critical areas within the packaging sandwich to review:

Compositional Compliance

The composition of individual substances in each layer should first be assessed according to their corresponding material regulations in the jurisdiction(s) of interest. This may include maximum use limits or other specifications like food or temperature restrictions, extractive limitations, and specific migration limits.

Barrier/Structural

A functional barrier is any material or combination of materials that prevent the migration of components from any layer beyond the barrier layer into the food. Thicker packaging materials generally perform better as barriers but can be impacted by multiple factors and should be tested.

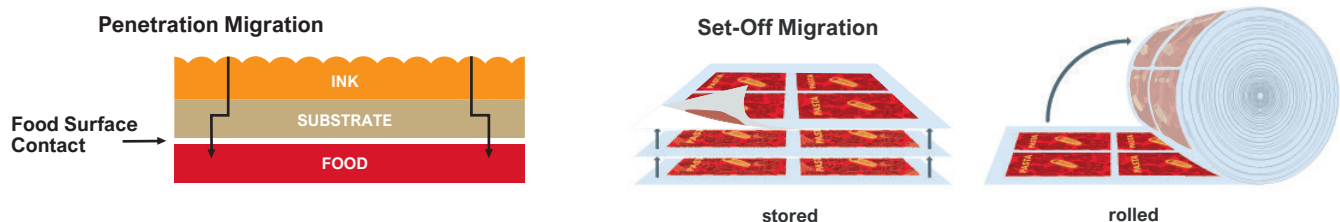
Properly tested inkjet media, with its fast dry time, can enhance water resistance properties, protect the food and improve the quality of the label and/or package.

Inks

Inks often get a greater amount of attention because they are a visible part of a packaging sandwich. Ink contributes to the communication of a brand's value — attracting customers to the product and letting them know what's inside. With the focus on branding, the critical role that ink plays in creating safe food packaging is often overlooked.

Ink migration is the transfer of ink components from or through a label or packaging. Here are two potential ways that migration can happen:

1. Penetration Migration is the migration of a substance from the printed side through the substrate onto the food.
2. Contact Migration or Set-off Migration can occur when a substance from the printed side migrates to the non-printed surface during manufacture or storage of the printed item in a stack or roll. One way to help limit ink set-off risk is to implement proper handling and drying methods.



Outer Layer — Lamination and Varnishes

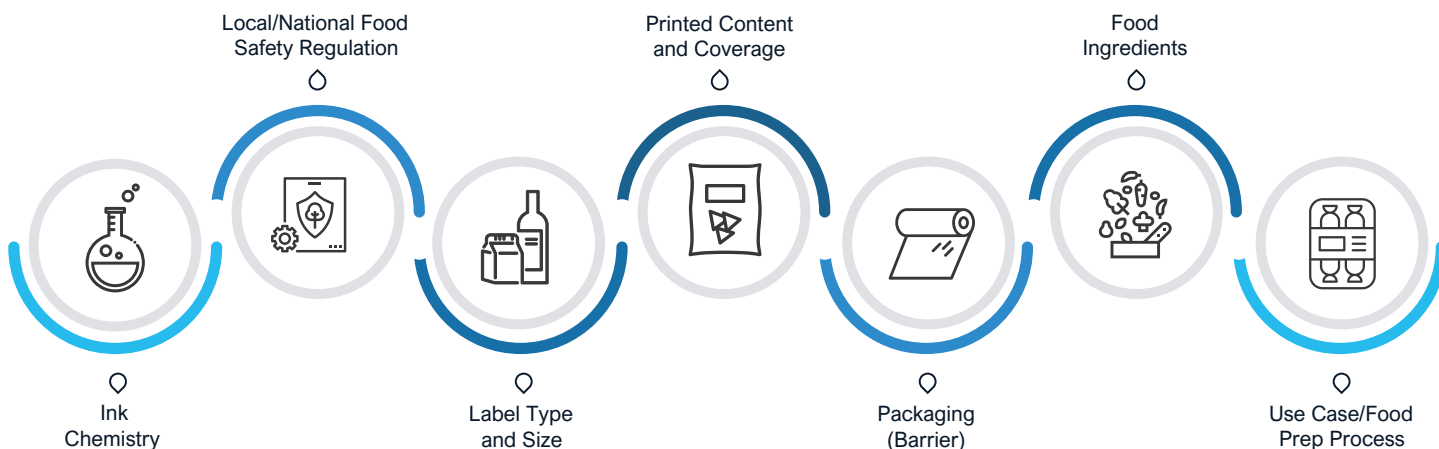
Outer lamination and varnishes (or overcoats) play a unique role in food labels and packaging. While they do not protect against potential ink migration through the backside of a label, they can help limit set-off, and protect what's printed on the label.

Complete Package Safety

After reviewing and evaluating any individual material regulation requirements, the complete package must then be assessed as a whole, including good manufacturing processes, organoleptic properties, and migration limits.

A best practice for migration testing is to consider the worst-case conditions, including food type and temperature while transported, stored, processed, and consumed. For example, fatty and acidic foods may induce a higher migration of some chemicals than dry foods. Foods stored in the refrigerator/freezer and/or used in the microwave will experience greater condensation or evaporation and therefore may require more substantial media, barrier and/or overcoat solutions.

Migration testing is your proof that the package is not releasing components into the food that might impact human health, the taste, or odor of the product.



There is no ink certification or FCM approval system. However, by using Memjet inks designed for food packaging, you can create effective, sustainable, and safe label and packaging solutions for food products.

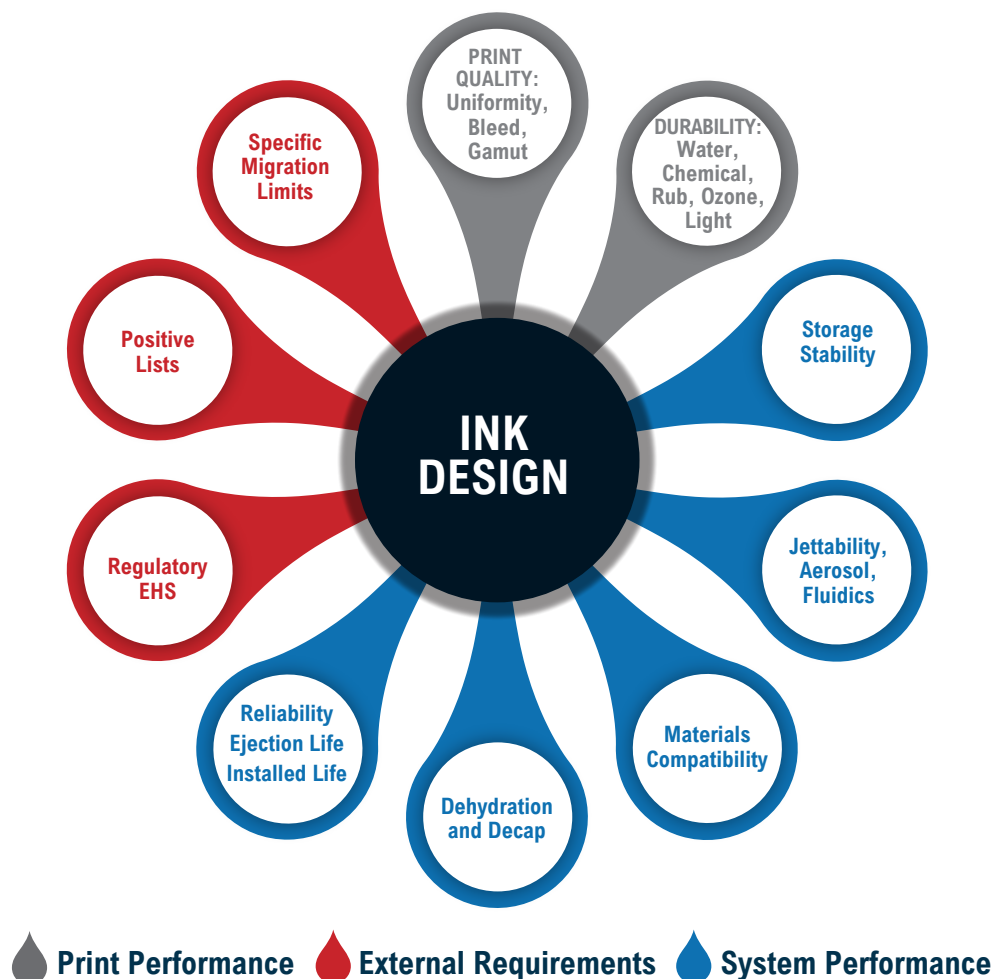
How Memjet Approaches Ink Formulation

Development Expertise

Memjet's team of chemists, scientists and engineers specialize in ink formulation, printhead development, and mechanical system design. Along with experts in regulatory compliance, these teams work together to actively monitor evolving regulations, standards, and customer demands to create inkjet technology solutions that are safe to use in packaging for the food and beverage market.

Our ink formulations and manufacturing processes are designed to meet the challenges of the physical and operating demands placed on inks in the printing environment. This ensures that printheads work effectively and unknown contaminants will not be present in your printed materials, labels, or packaging — from the first drop through the billionth.

Ink Design Considerations



Memjet's Inks are Different

Memjet has a fully water-based ink portfolio, making them safer for the earth and the people handling them. Building on that strong foundation, our focus on purity of ingredients, consistency in manufacturing, and rigorous quality control ensure high-performance and lifecycle reliability.

The new generation Memjet inks are carefully designed specifically for use in food packaging and other sensitive applications — an essential differentiator.

Water-Based



Water is the safest choice. Memjet's ink portfolio is all water-based – free from toxic and reactive chemistries – and do not negatively impact human health or the environment.

Pure Ingredients



Our chemists are always mindful of each ingredient's suitability for sensitive applications. The careful selection of highly pure raw materials ensures that there aren't unknown impurities, thus eliminating batch-to-batch variability.

Careful Composition



Memjet intentionally designs inks to enable safe use in food packaging while also optimizing the formulas for a variety of print performance and system requirements.

Testing



At each stage of development, testing for ink regulatory compliance, performance and stability are completed. Tests are performed both within the Memjet laboratory and by third-party laboratories, including BS5609 testing, which provides water resistance and abrasion performance data.

System Control



Memjet's inkjet system is inherently intolerant of change, impurities and variability. Optimal printhead functionality depends on tightly controlled ink formulations which provides reliability and consistent printing performance. This control requires a rigorous change management system, and also simplifies regulatory compliance compared to systems where inconsistencies, impurities, and contaminations are unrestricted.



































How Memjet Inks Stack Up

As a company focused on our own environmental impact, as well as that of our customers, we strive to achieve the safest inks possible without compromising performance.

Many companies make claims like sustainability, environmentally friendly, low migration, and recyclability. All too often, these claims are unsubstantiated. When it comes to these important topics, Memjet has the science and data to back up our ink chemistry claims.

The following safety and environmental factors table shows a comparison of Memjet inks designed for food packaging versus competitive technologies. Assessments are based on commercially available inks in each category. Rating does not represent every ink in that class but is expected to be typical for the class.

Competitive Overview of Safety & Environmental Factors

	Memjet Inks Designed for Food Packaging	Typical UV Ink	Typical Solvent Ink	Liquid Electrophotography Ink	Typical Eco- Solvent Ink
Odor					
VOCs					
Special Ventilation Required					
Ink Health Hazard					
Peripheral/Cleaning Fluids Hazard	N/A				
Transportation/ Flammability					
Waste/ Environmental Risk					

Low Migration

Some companies use claims of “low migration inks” without assessing both the components and migration. While a company can formulate their ink with higher molecular weight components that tend to migrate less than lower molecular weight components, this does not mean there is zero risk of migration and contamination of the food within packaging. It still needs to be proven with substantive data.

Sustainability

Environmental

Prompted by increased data, non-governmental organizations (NGOs), and customer demands, regulators around the world are tightening rules regarding the use of hazardous components often found in other ink technologies and their associated cleaning solutions. In addition, there are increasing social responsibility (ESG — Environmental, Social, and Corporate Governance) demands on labor safety within the supply chain.



When compared to other packaging ink technologies, Memjet's water-based inks contain less harmful components, are safer for the environment and human health, and can potentially cut your environmental costs (permits and disposal fees) in half.

Waste

In addition to inks, digital inkjet technology like that used in *Powered by Memjet* print solutions create key sustainability benefits by eliminating plate preparation and make-ready waste producing shorter runs to better match supply and demand. Waste from print overages or out-of-date materials is significantly reduced, as is the time and energy needed to print.

Memjet's modular design of its technology also provides capabilities to upgrade existing capital equipment, thus extending the life of the equipment and contributing to the overall circular economy.

Recyclability

The following substances are commonly used in other printing ink technologies and are of particular concern to recycling operations, municipalities, state and local regulators. Memjet inks intentionally do not contain any of these substances:

- Mineral oil saturated hydrocarbons (MOSH) / Mineral oil aromatic hydrocarbons (MOAH)
- Bisphenol-A
- Per- and polyfluoroalkyl substances (PFAS)
- Benzene, phthalate-esters, toluene, or xylene
- Heavy metals
- SVHCs
- Styrenes

Furthermore, the ability to deink printed substrates is also an important factor in the recycling process. Test data results obtained from CADEL DEINKING regarding the ability to recycle film substrates using standard conditions, provides confidence that Memjet's inks designed for food packaging can be adequately commercially deinked from a broad set of treated and untreated paper medias.



Figures 1,2 - BEFORE and AFTER the deinking test.

Part 3

Assurance of Food Packaging Safety

Creating safe food packaging is complex. Choosing the right partner is easy. To minimize risk, lower your cost of compliance and ensure your labels and food packaging are market-ready, start by considering these:

1 The Right Ink

Choosing the right inks up-front can help you to create high-performance, sustainable labels and packaging that do not negatively impact food, human health, the environment, or your wallet.

With high-quality, durable results and safer ingredients than alternative technologies, Memjet can help you differentiate in today's competitive food packaging market and other sensitive applications.

The purity of components, consistency in manufacturing, and rigorous quality control are backed by Memjet's team of experts. This team actively monitors evolving regulations, standards, and customer demands for any effects on ink formulation and, ultimately, the safety of the final packaging, so you don't have to.

2 The Right Ink + Technology

The combination of Memjet's thermal inkjet technology and water-based inks enable world-class print performance and environmental leadership. This combination significantly lowers costs of permits and waste.

Memjet's inkjet system is inherently intolerant of change, impurities and variability, simplifying regulatory compliance and ensuring lifecycle consistency.

3 The Right Partner

With so many considerations to keep in mind while designing a packaging solution, enlisting a partner like Memjet can simplify your path to FCM compliance. We can help you navigate:

- The complexities of Food Contact Materials (FCM) Compliance
- The creation of effective, budget friendly, and safe food packaging
- The requirements for migration testing to ensure you are 100% secure about the safety of your packaging solution
- Coordination with third-party laboratories to ensure individual food packaging solutions are tested properly

PACKAGING CONSIDERATIONS



To request more information from Memjet, or to find a Memjet partner with a *Powered by Memjet* printing solution designed for food packaging, visit www.memjet.com/markets/packaging

Part 4

Regulatory Compliance Statements for VersaPass® DN and DuraFlex® PZ Inks

As previously mentioned, there are no harmonized printing ink regulations. Instead, we look towards other safety regulations (e.g. Swiss Ordinance), positive lists and industry standards (e.g. Nestlé Guidance Note on Packaging Inks) for ensuring food packaging safety.

As noted in section three, Memjet inks intentionally do not contain any of these substances:

- Mineral oil saturated hydrocarbons (MOSH) / Mineral oil aromatic hydrocarbons (MOAH)
- Bisphenol-A
- Per- and polyfluoroalkyl substances (PFAS)
- Benzene, phthalate-esters, toluene, or xylene
- Heavy metals
- SVHCs
- Styrenes

Swiss Ordinance

Swiss Ordinance SR 817.023.21

- VersaPass DN CYM components are listed on the Swiss Ordinance Annex 10 and have been proven via migration testing to comply with the applicable SMLs under specific use conditions. One dye in DN K ink, although not classified nor on any negative list, was not approved for listing on the Swiss Ordinance. This dye is in the black ink (K) at ~1%.
- DuraFlex PZ 2 CYMK components are listed on the Swiss Ordinance Annex 10 and have been proven via migration testing to comply with the applicable SMLs under specific use conditions.

Nestlé Guidance

Nestlé Guidance Note on Packaging Inks October 2018

- VersaPass DN CYM inks are in compliance with Nestlé Guidance (VersaPass DN K is not in compliance; however, composite black can be used to ensure compliance).
- DuraFlex PZ 2 inks are compliant with Nestlé Guidance.

United States

California Proposition 65 (Prop 65)

VersaPass DN inks do not contain any Prop 65 listed substances above Safe Harbor limits. DuraFlex PZ inks do not contain any Prop 65 listed substances.

Food and Drug Administration (FDA)

The US FDA does not have a specific regulation or guidance for printing inks.

The Model Toxics in Packaging Legislation

Memjet's inks are in compliance with The Model Toxics in Packaging Legislation (formerly known as CONEG legislation) — lead, mercury, cadmium, or hexavalent chromium are not used in nor intentionally added to Memjet inks.

Asia

China Restriction on Hazardous Substances (China RoHS 2)

Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products (commonly referred to as China RoHS 2). Memjet inks do not use nor intentionally contain: cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB), or polybrominated diphenyl ethers (PBDE).

Japan Printing Ink Makers Association (JPIMA) May 2020 Negative List

Memjet inks do not contain any chemicals on the JPIMA May 2020 Negative List.

European Union

Regulation (EC) No. 1935/2004 as amended, commonly known as “The Framework Regulation”

The principles set out in Regulation (EC) No 1935/2004 require that materials do not release their constituents into food at levels harmful to human health and do not change food composition, taste, and odor in an unacceptable way. Memjet inks comply with its principles, and when printed on a substrate of sufficient efficacy or a functional barrier, Memjet ink will not alter the composition or organoleptic characteristics of food.

Regulation (EC) No. 2023/2006, known as the “GMP Regulation”

Memjet inks are manufactured according to GMP principles, but only packaging converters or those printing with Memjet’s ink can comply with the Annex of (EC) No 2023/2006 as it contains print handling and storage requirements.

European Union Registration, Evaluation, Authorisation and Restriction of Chemicals (EU REACH)

Memjet inks do not contain any REACH Authorized or Restricted substances.

European Chemical Association (ECHA) Substances of Very High Concern (SVHC) Candidate List – SVHC Substances

Memjet inks do not contain any chemicals on the SVHC Candidate List.

RoHS 3 Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU (RoHS 2) and EU 2015/863 (RoHS 3)

Memjet inks comply with RoHS 2 & 3 Directives, as the following substances are not used in nor intentionally added to Memjet inks: cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB), polybrominated diphenyl ethers (PBDE), bis(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBP), dibutyl phthalate (DBP), diisobutyl phthalate (DIBP).

Stay Tuned

Memjet DuraLink® PR2 Inks are currently being evaluated for use in food packaging applications.

A Regulatory Compliance Statement for these inks will be available when our evaluation is complete.