White Paper

Structured preload restriction data as the cornerstone of digital collaboration in liquid bulk logistics

A position statement by Loady on the further development of quality and cleaning processes.

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Executive Summary

The safe and efficient logistics of liquid products depends largely on the control of so-called preload restrictions – rules that define which substances may be transported in a tank or container before a specific product. Until now, these checks have been based on manually maintained lists and individual experience. This leads to high costs, inconsistent data, and avoidable incidents at factory gates and cleaning facilities.

With its solution for structured preload restriction data, Loady provides the first shared, digitally enabled database that standardizes this safety-related information and makes it verifiable and interoperable. It enables both manual pre-product checks—via a uniform user interface—and automated checks via API interfaces that can be integrated into transport or yard management systems.

This shared data foundation enables a new form of digital collaboration in liquid bulk logistics: it reduces manual inspection efforts, improves planning and cleaning decisions, and opens up prospects for further applications – such as integration into cleaning station software for printed or PDF-based cleaning certificates or into electronic cleaning certificate (eECD) providers such as ECLIC or Bulkvision. In all cases, validated proof of the pre-product check could be documented directly on the certificate.

Loady thus positions itself as an enabler for data-driven quality assurance in chemical and food logistics—today as a standalone solution, tomorrow as a central component of a networked digital ecosystem.

1. Introduction and objective

The logistics of liquid products—in the chemical, food, and feed industries—requires uncompromising control of product purity and quality. A central element of this control is the handling of preload restrictions, i.e., the rules that determine which substances may be transported in a tank, container, or compartment before a particular product can be loaded.

Chemical and food companies have their own sets of rules and employ product experts who continuously update these restrictions.

When transports involve precursor products for which no specific or reliably derivable restriction exist, these experts must make qualified decisions on a case-by-case basis – often when the truck is already at the gate or loading point. Their objective is consistent: ensuring product integrity, human safety, and operational reliability.

This responsibility is shared across the supply chain: freight forwarders, cleaning stations, and shippers must verify that equipment, cleaning procedures, and previous loads comply with the applicable specifications. Precisely because this responsibility is so high, current processes remain heavily manual.

Every release decision must rely on robust information. Incorrect approvals can lead to contamination, safety risks, production delays, costly deposals, or reprocessing.

This is he context in which structured preload restriction data becomes essential. With Loady, for the first time a central, digitally accessible and auditable database enables companies to manage these rules consistently and make them available to all stakeholders.

The purpose of this position paper is to describe the professional and technical logic of Loady's solution, outline its current application benefits, and present the perspective this creates for digital collaboration in European liquid bulk logistics.

2. Initial situation: Fragmented data and manual review processes

Current preload restriction processes are characterized by high complexity and heterogeneity.

- Each company maintains its own lists—often in Excel files, PDFs, isolated databases, or SharePoint lists.
- These lists frequently contain hundreds or thousands of entries per product.
- Structures are non-standardized, multilingual naming is inconsistent, and machine-readability is limited.

This leads to several challenges:

- Lack of transparency: Freight forwarders and cleaning companies must research and interpret disparate documents.
- Susceptibility to error: Different names, synonyms, or group classifications create inconsistencies.
- Process delays: Manual reconciliation along the supply chain causes queries and waiting times.
- Rejections and incidents: Up to 5% of tank transports are delayed or rejected at the gate due to incorrect precursor products, insufficient cleaning, or discrepancies in required documentation.

These inefficiencies impact product quality, compliance, capacity utilization, and CO_2 emissions through unnecessary waiting times and double cleaning.

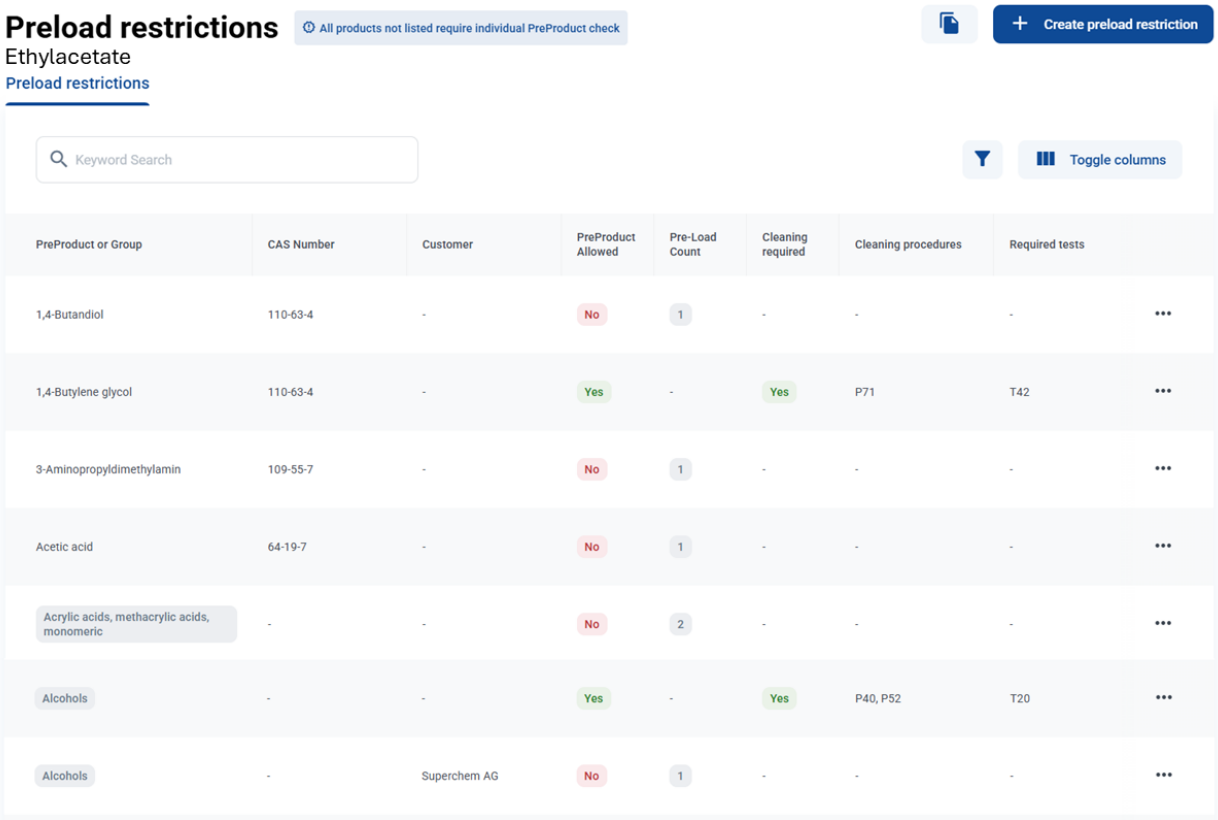
3. Loady as a central data and verification platform

a. Structure and logic of the data model

Loady structures preload restrictions within a multi-layered, chemically and logistically coherent data model.

Key principles include:

- Unique identification by trade names, chemical names, CAS/ EC numbers, synonyms, and multi-lingual variants.
- Multi-level classification enabling rules at substance or group level (e.g. "all acids excluded", "amines allowed after defined cleaning").
- Clear rule typing: allowed, not allowed or allowed after special cleaning, including associated cleaning codes.
- Chemical logic layers to detect equivalences or relationships, even across different naming conventions.
- Number of preloads. i.e., how many previous loads need to be checked and in how many previous loads the respective product is forbidden.
- Quality assurance through validation, release workflows, and duplicate detection.



I1: Product-specific preload restriction list in Loady

This standardization is essential for consistent manual and automated checks.

b. Maintaining and managing pre-loading restrictions

Companies maintain their restrictions directly in Loady. They may create data from scratch or import existing lists, which Loady helps structure and validate.

Key features include:

- Import and semi-automated structuring of existing lists
- Multilingual data handling
- Export and API functions to synchronize with ERP or QHSE systems
- Versioning, change tracking, and governance workflows (in planning)

This eliminates decentralized documentation and ensures all stakeholders work with consistent, up-to-date data.

4. Applications

a. Manual research on preload restrictions

Dispatchers, shippers, and cleaning companies can check preload restrictions via Loady's user interface.

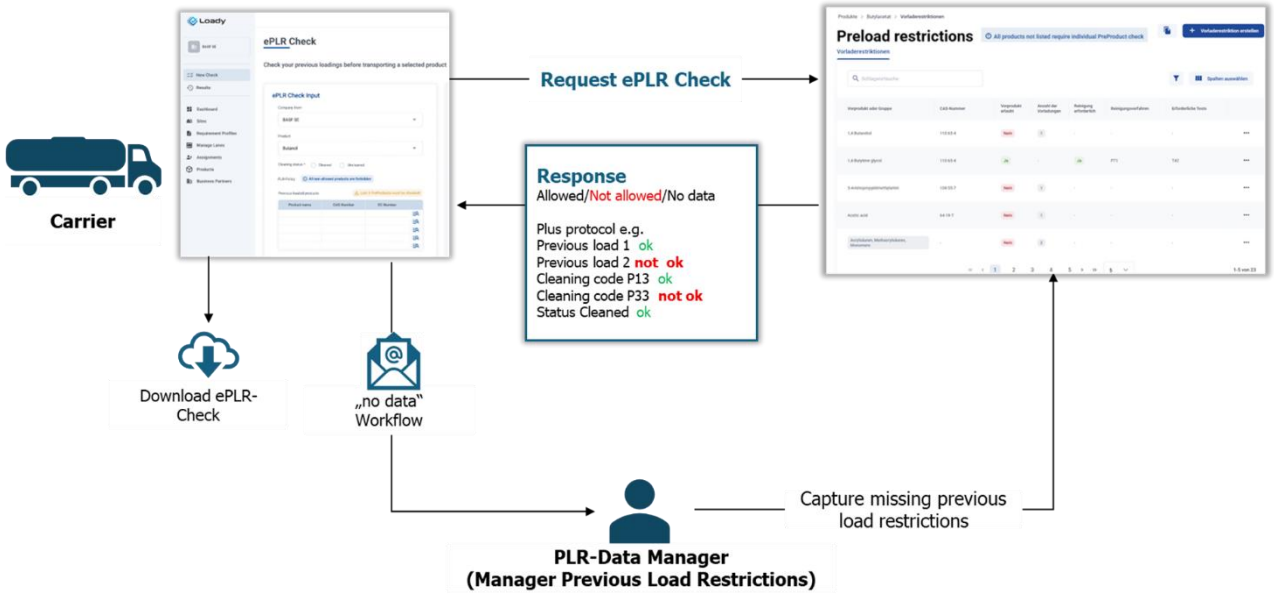
1. Select the product to be loaded in Loady or in the tab "Preload Restrictions" in the multilingual online view Loady2Share that shippers can provide via their freight order to dispatchers.
2. View the number of relevant preloads to be checked.
3. Enter previous loads and filter by products or product categories.
4. Retrieve results indicating permissibility, required cleaning procedures and customer-specific restrictions.

This replaces individual list checks and provides a transparent, auditable decision basis.

b. Manual ePLR-check

A manual Predictive Load Restrictions Check (ePLR) allows users to:

1. Select shipper and product.
2. Indicate the cleaning status and – if cleaned – the cleaning procedure.
3. Enter up to five previous loads. If no CAS number is known or stored, it is also possible to search for synonyms and names in other languages and filter by product families.
4. Receive the outcome: allowed / not allows / allowed under conditions.



I2: Manual ePLR-check in Loady incl. "no data" workflow

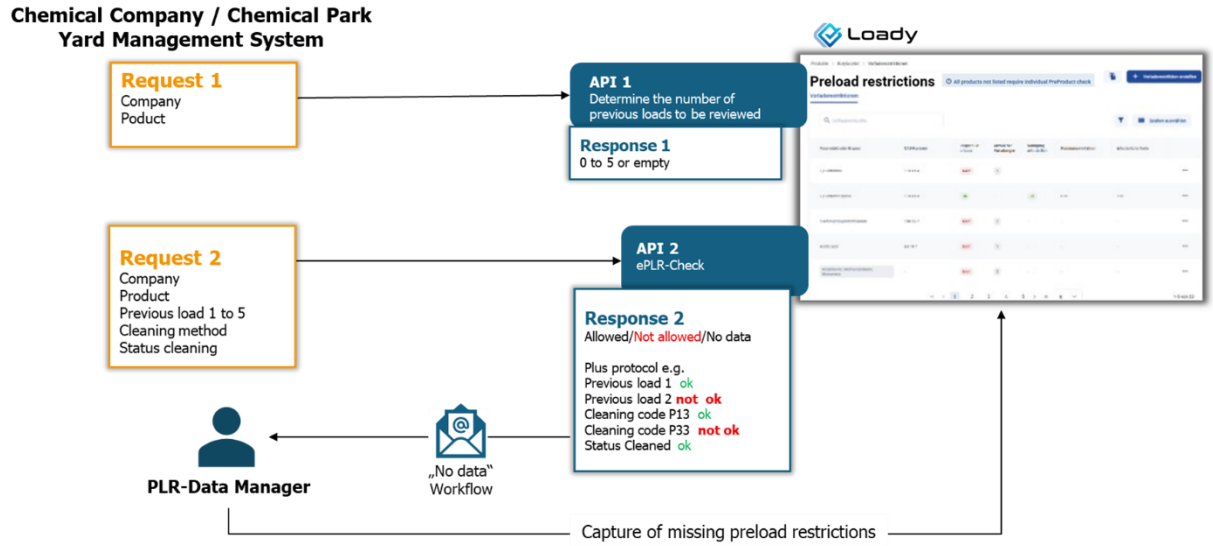
Application:

- Before scheduling, freight forwarders check whether tank/equipment and product combinations are permissible.
- Shippers carry out incoming inspections before loading.

The use of this single source of data replaces individual list checks. and creates a transparent, auditable basis for decision-making.

c. Automated ePLR-check via API

The ePLR logic can be integrated into transport or yard management systems. Several companies are piloting this integration to automatically trigger checks during scheduling or before gate release.



I3: Integrated ePLR-check with Loady API incl. "no data"-Workflow

Automated checks detect discrepancies early, reduce waiting times, and minimize rejections at gates or loading points.

5. Results and added value

The use of structured preload restriction data has a measurable impact on the efficiency and safety of processes:

- Reduction of manual verification effort by up to 80%
- Fewer gate rejections and rescheduled loading slots
- Transparent decision bases for freight forwarders, shippers and cleaning stations
- Improved data quality through continuous maintenance and governance
- Contribution to sustainability: fewer double trips and double cleaning, lower CO_2 emissions through optimized use of vehicles and equipment

6. Target image: ePLR Check as an integral part of cleaning certificates

Manual and automated preload checks already provide a reliable basis for scheduling and gate approvals.

A further evolutionary step is the integration of these checks into cleaning certificates.

Electronic cleaning certificates (eECD) such as those from ECLIC or Bulkvision already contain previous-product information and cleaning codes—but without validation against the shipper's preload restrictions.

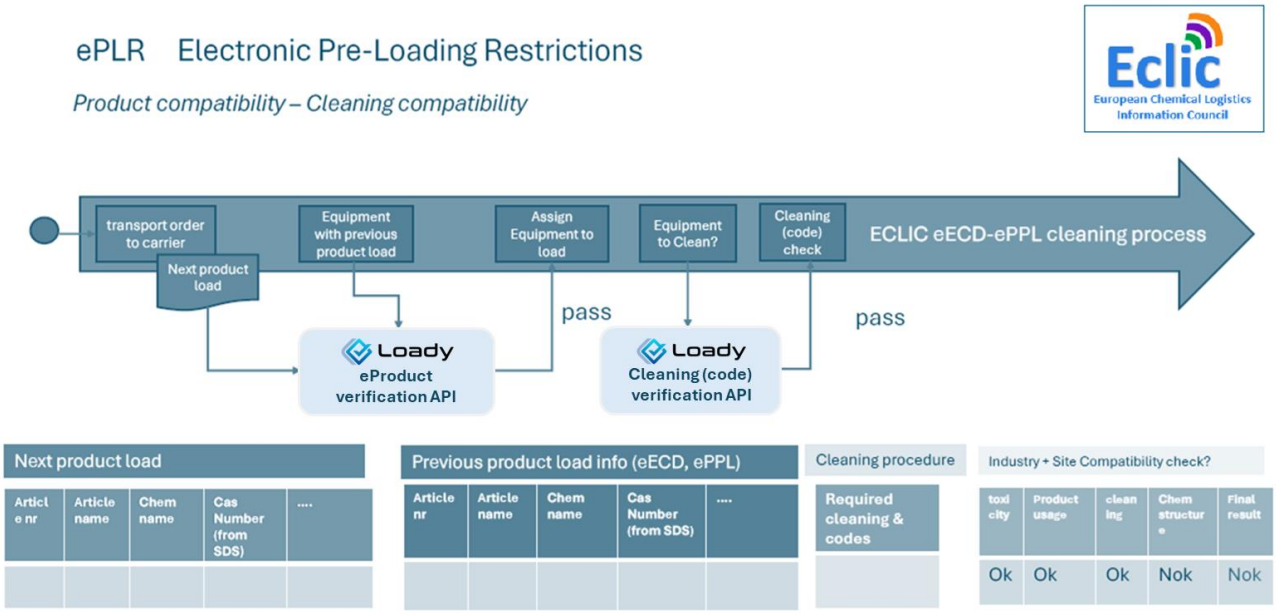
A Loady-based validation would close this gap.

Functional principle of an integrated Loady-validation

Applicable when cleaning is order-based and the intended product is known.

1. The cleaning station records previous product and cleaning code in the certificate (paper or electronic).
2. Its software triggers the Loady ePLR logic.
3. Loady validates the combination against applicable restrictions.
4. Loady returns the result (*OK, Note*, *Not allowed*).
5. The certificate includes a "Pre-Load-Check verified by Loady" entry (digital or PDF/ print)

If cleaning is done "for stock" (i.e., without a known next product), no check is required.



I4: Cleaning process with integrated ePLR-check with Loady API in eECD from ECLIC

Why integrated validation creates systemic value

The advantages of such validation come from the combination of two facts:

- The cleaning certificate documents *that* cleaning took place.
- Preload restrictions define *whether* the combination of the previous product and cleaning is sufficient.

Only the combination provides a complete safety and quality statement for shippers, cleaning stations, and carriers.

Benefits for industrial companies and shippers

- **Higher informational value of cleaning certificates**
  A certificate with reliable pre-product validation covers an additional safety-relevant step.
- **Fewer gate rejections through reliable validation**
  Tanks that have been checked with "OK" can be released without a new manual list check.
- **Improved decision-making in exceptional cases**
  When a new previous loaded product appears, Loady systematically triggers "No Data" – and the process is forwarded for professional evaluation and recording of new preload restrictions instead of being tacitly accepted.
- **Continuous improvement of preload-restriction data**
  The preload restrictions are continuously updated and the quality of the data increases.
- **Reduced risk of contamination and costly disposal/reprocessing**
  Fewer products are contaminated due to incorrect previous loads or inadequate cleaning.

Benefits for carriers and freight forwarders

- **Clear evidence for shippers**
  A "verified by Loady" note reduces queries and uncertainties when driving to the loading point.
- **Fewer additional cleaning cycles or trips**
  If the Loady check shows that the combination is permissible, extra cleaning processes and trips can be avoided.
- **Harmonized documentation, independent of shipper-specific lists**
  Carriers no longer must interpret different lists of shippers – validation is done centrally, according to the same rules.

Classification relative to ECLIC and Bulkvision

Embedding Loady validation in cleaning certificates would not replace current Loady functionalities.

It would be a logical next step in an increasingly digital industry.

- Loady remains fully usable as a standalone platform—manual checks, scheduling support, gate approvals, API integrations.
- ECLIC and Bulkvision are addressed as future but not required interfaces.
- With broader adoption of electronic cleaning certificates, integrated validation becomes an essential building block in digital cleaning and quality processes.

7. Conclusion and positioning

Structured preload restriction data represents a fundamental advance in the handling of quality and cleaning processes in liquid bulk logistics.

Loady enables reliable, data-based decisions across supply chain stakeholders and documentation formats.

Integrating Loady's ePLR logic into cleaning certificates—whether printed or electronic—would enhance these certificates into complete quality documents, closing a significant technical gap and paving the way for future interoperability in the sector.

Loady remains an independent and immediately applicable solution while creating the foundation for a digitally connected future in liquid bulk logistics.

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