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ADR COMPLIANCE CHECKING

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ABSTRACT

Today, the conformity verifications mandated by official regulations, when transporting dangerous goods are far too often executed using a manual or internal process (e.g., by filling paper forms). Unfortunately, our observation from the ground reveals that this process is time-consuming, and often results in errors—a rather alarming observation given the dangerous nature of the transported products.

Our contribution is **QuickADR**, a digital application that automates this process. *QuickADR* provides the following main benefits: (i) it has been designed to work in every country, i.e., also to comply with their local regulations; (ii) it can support international routes that must comply with different—and sometimes inconsistent—national regulations (iii) it supports a large part of the chemical products, and we are currently finalizing support for class 7—Type A and excepted package; (iii) it keeps logs of every step in the conformity checking process to allow backward tracking; (iv) it ensures data privacy and confidentiality.

So far, 50 clients are using daily *QuickADR*. Their feedback is in line with their expectations: they avoid errors and misplaced paper checklists. Moreover, they spend less time doing the checking process.

INTRODUCTION

In the last decades, we observed a massive shift towards automation through digitalization (e.g., in the banking or airline system). However, as Safety Advisers for the transport of dangerous goods, we notice that the compliance checks for conformity, a process that should be performed prior to any transportation of dangerous good, is outmoded. It still relies on a manual process with predefined checklists. It involves several people with different backgrounds. It requires complying between many combinations of complex international (e.g., [1,2]) and national regulations (e.g., [3,4]). However, the process faces inconsistencies between the regulations of the different countries. From our experience, we may affirm that this manual process is time-consuming and produces many errors which can have dramatic consequences, given the dangerous nature of the transported products.

As Safety Advisers, we also observe several errors inherent to the verification process. Hereby, a few examples of issues that we meet regularly:

Type of error #1: Incorrect Vehicle equipment checklist

When using a partial exemption [5] or total application of ADR, the compliance equipment of a vehicle varies significantly - e.g., incorrect number of fire extinguishers which are also different from one vehicle to another.

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Type of error #2: Incorrect labeling and marking checklist

Some exemptions change the rules of labeling and marking of packages. And so, people preparing complete ADR checklists on the loading dock, have no time to access to the right checklist.

Type of error #3: Incomplete checklist

When carrying waste, an additional country-specific check is mandatory [4]. Most of the time that add on is not implemented in the standard checklists.

The Special provisions [6] products are very often by-passed when loading.

Type of error #4: Incorrect vehicle marking and placarding checklist

In using (for instance) a checklist for a package instead of a tank— A significant issue, due to the great safety and security rules, e.g., differences for the marking and placarding rules.

Type of error #5: Loosing and/or un-traceability of the checklist

Occasionally, the hardcopy checklist can be found lying on the loading dock floor, i.e., while several members are required to repeat the same control: checklist tracking is not efficient.

These various situations make regulatory checks before loading blurred or inaccurate. That is the reason why we design a multi-user digital tool for any road transport situation.

DESIGN

QuickADR is a web application which supports all kinds of devices. No IT architecture is needed to be set up for or by the user. The application is hosted by a host that offers a safe environment and guarantees the retention of data regardless of potential incidents (hacking, massive power outage, disaster, etc.). Its architecture notably revolves around the integration of a robust rule's engine, which allows *QuickADR* to be fully compliant with the ADR [1] regulation. Moreover, this application takes into account an intuitive user interface that allows optimal and efficient use for all types of users.

It is also important to mention that this application can communicate with the outside world through secure and documented APIs. This facilitates connections with other components of a company's information system: ERP, TMS, CRM, WMS, and other APS.

FIRST VERSION IN PRODUCTION

QuickADR is the result of two years' development and in production since end 2021. That premium version was especially designed for the French market. It is focused for road transport. It is fully operational for—(i) Most of Class 2 to 9 products, (Class 7 and Class 1 are on-going)—(ii) Packages: only the authorized one are proposed, and the number of packing instructions appear as notifications— (iii) Portable and ADR tanks, only when authorized—(iv) The rules of about thirty special provisions applicable for certain articles or substances are integrated. Kind reminders are used for the other one —(v) Limited [7] and Excepted Quantities [8] can also be checked.

That first version demonstrates the flexibility of *QuickADR*. We can add or remove some specific controls, or remarks, without interfering with the global and common rules. Staying compliant in each loading situation was a great challenge, and the feedback of this first version was highly positive.

DEVELOPMENT FOR CLASS 7 – RADIOACTIVE MATERIAL

Transport of radioactive material needs specific rules. That complementary development considers Excepted (UN 2908 to UN 2911) and Type A (UN 2915 and UN 3332) packages. A production version

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is imminent in both English and French language. This is the most common type of radioactive material transported.

We are implementing the necessary dose rate measurements and required thresholds, as well as the determination of the Transport Index (TI) and required labeling (I-WHITE, II-YELLOW, or III-YELLOW) [9,10] before loading. The vehicle and package marking rules are also different from standard cases and need to be updated for radioactive transport [9,10,11].

Based on the same robust rule's engine, tests are on-going in order to check each loading situation. This development demonstrates the flexibility of our application that can adapt to specific requirements or situations.

USING QuickADR

QuickADR was designed to be a simple, efficient, and practical tool especially developed for checking compliance of Transport of Dangerous Goods by Road.

FIRST STEP: You select a checking.

First at all, it takes a short time to get the right checking list. This step can be done or completed directly on the loading dock by the controller, at the factory gate or before by safety responsible etc. Just connect at your computer, your phone, or your tablet, open a token, and select your audit, the main information, type of vehicle and loading (packages, tank or bulk), type of transport – **Figure 1**.

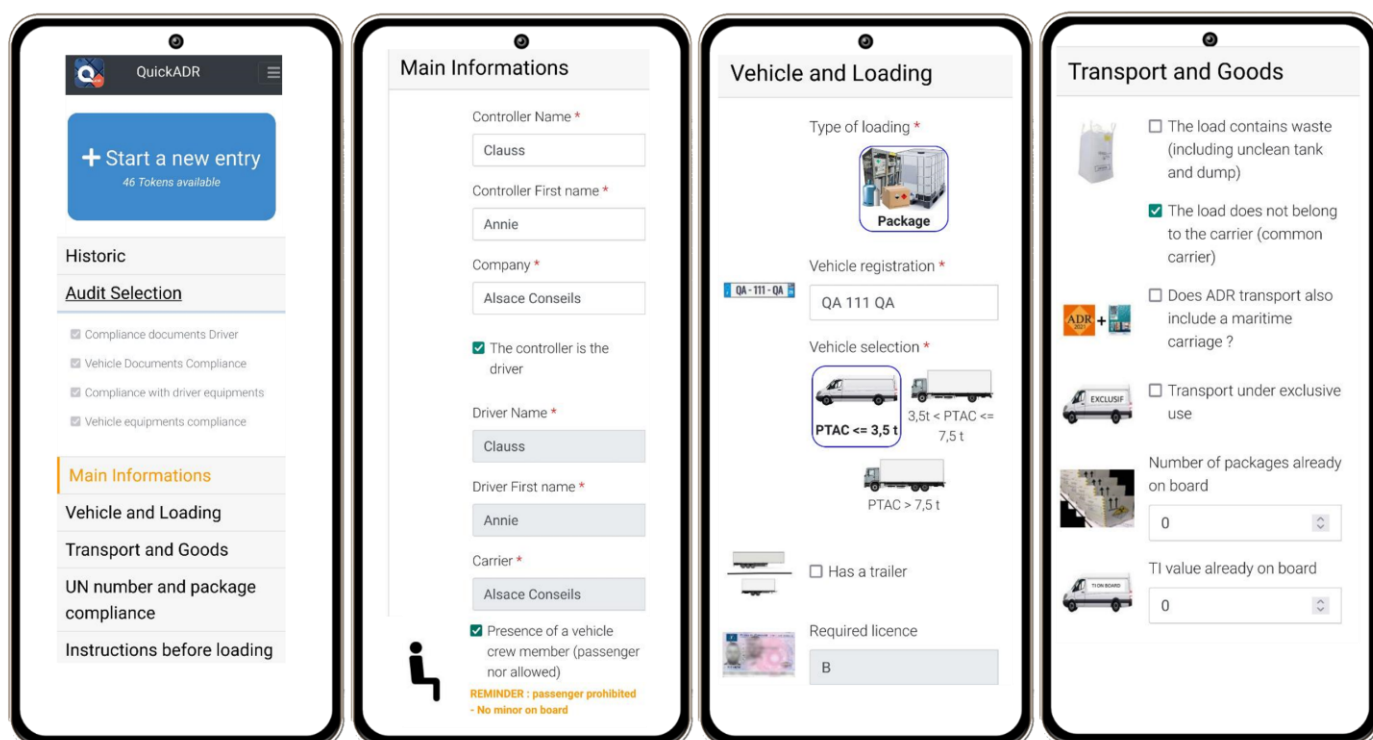


Figure 1. Select information to get the correct checklist.

Completing step by step will directly update the checklist. For next steps demonstration, we selected "Package" and Complete ADR situation. Of course, you get another control if you select tanks or bulk containers. You can also select exemptions, including ADR 1.1.3.6 [5] exemption to calculate your authorized value of quantities on board.

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SECOND STEP: You identify the products, and you start the checking.

Adding ADR identification with the UN number(s) and the Packing Group (if existing) of your Dangerous Good(s). Now, you can check the exact labeling and marking, and the correct packaging. – **Figure 2.** – The important Special Provisions are appearing most of the time in “before” and “after loading” parts which are also updated. They are implemented as a remark or as a check (depends on the importance of the special provision in terms of safety).

Also, agreement can be partially checked for most chemical products, or tanks when authorized (portable or ADR tanks are differentiated). If the dangerous good is considered as “high consequence dangerous good” and therefore has an obligation of security plan, the conductor's knowing part is checked etc.

Especially for Class 7, Type A or excepted packages, the measure of the relevant dose rate is proposed also in order to automatically calculate the Transport Index (TI) and therefore to control the I-WHITE, II-YELLOW or III-YELLOW labeling of the package [9,10]. These measurements allow the different irradiation thresholds controls (package, vehicle).

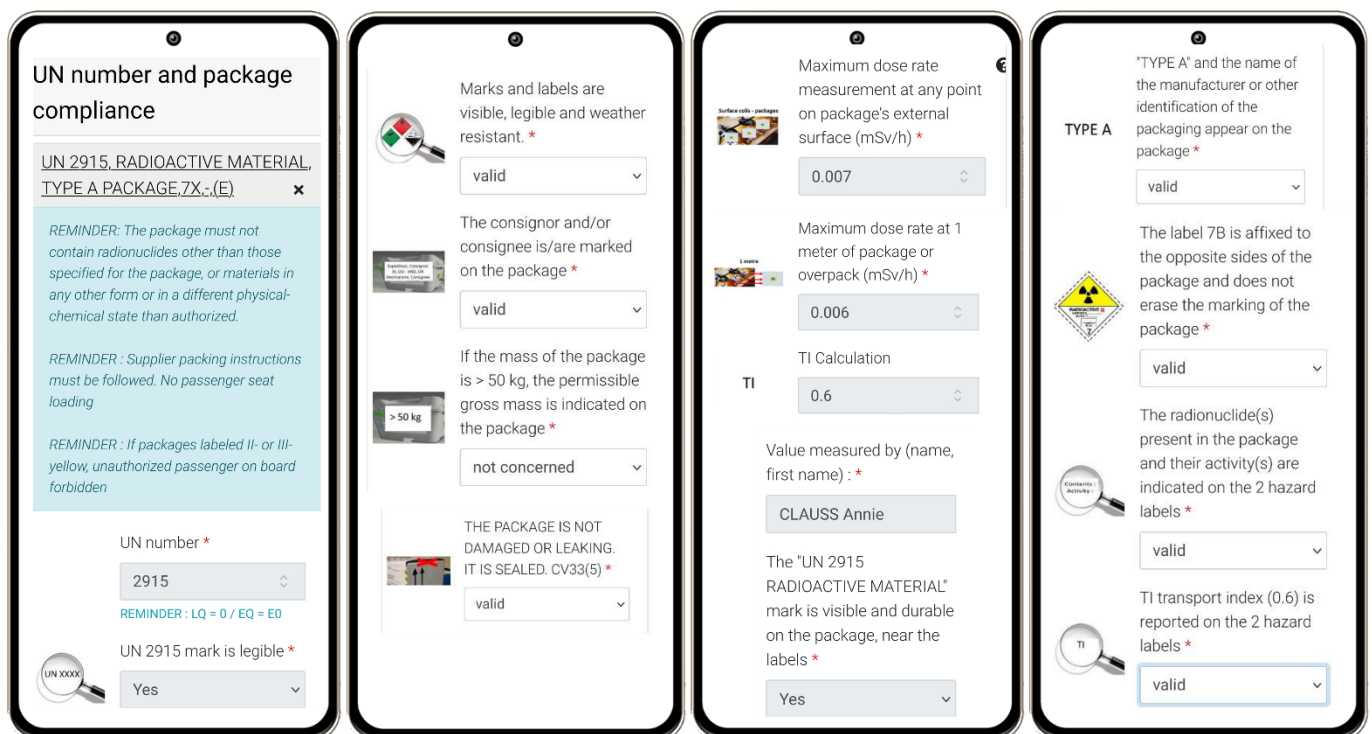


Figure 2. Compliance of packages

Your loading is reported a day later, will it be done by your co-worker? Just save your token to transfer it: your initial data are blocked and tracked. You want to modify the data later? Just save it.

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STEP THREE: Please, read the instructions before loading.

Loading is now imminent, open again your token, have a look and/or check the general and specific instructions before loading. – **Figure 3.**

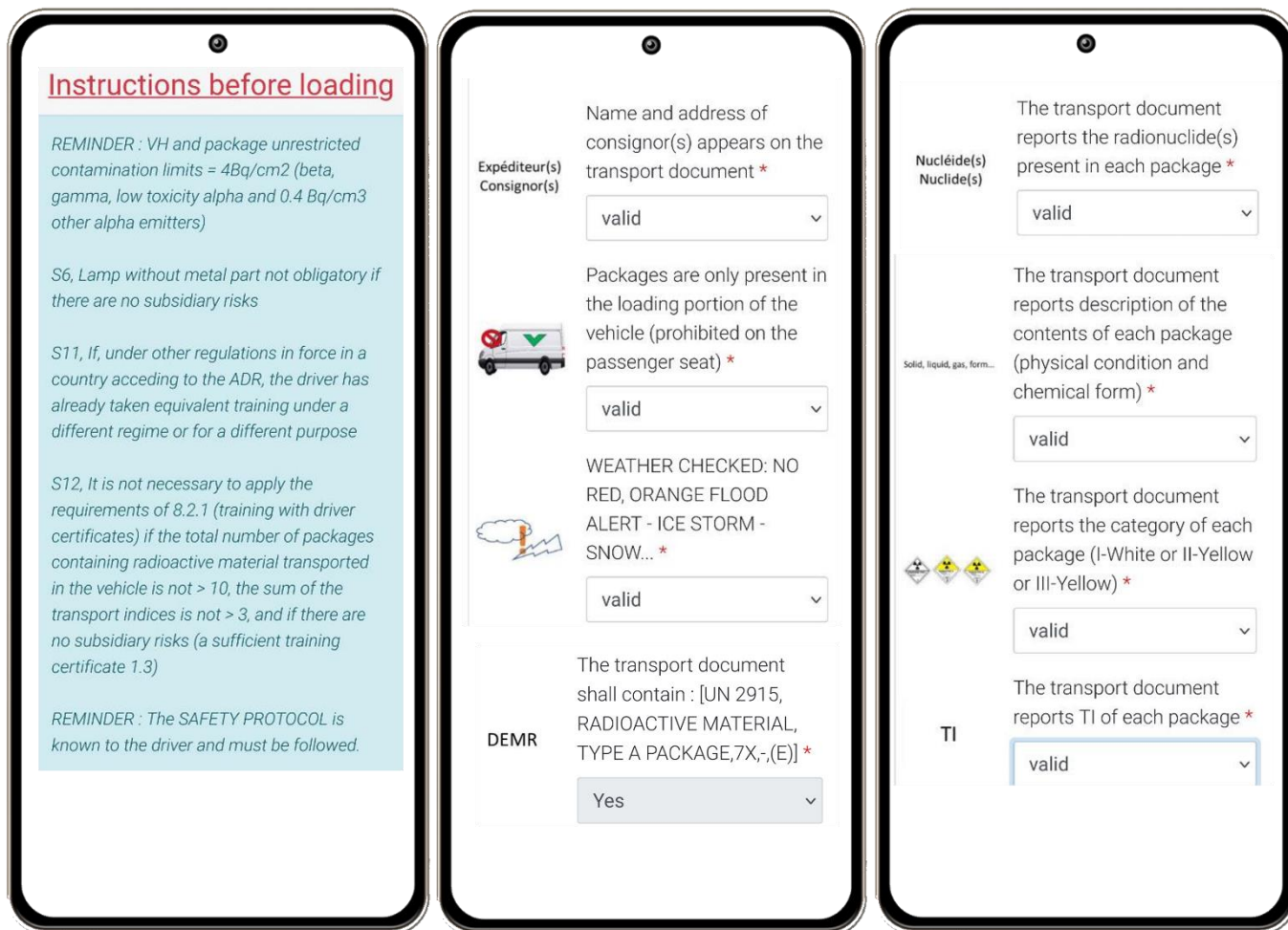


Figure 3. Instructions before loading

Your loading is reported a day later, will it be done by your co-worker? Just save your token to transfer it and your initial data are blocked and tracked. You want to modify the data later? Just save it again.

STEP FOUR: You check the driver and the vehicle.

Realize your check to comply with the driver and vehicle papers and equipment's as well. To allow all skill levels user, *QuickADR* questions are packed with numerous photos. Check can be done in ATEX area, without internet access if data are previously completed and saved. – **Figure 4.** -

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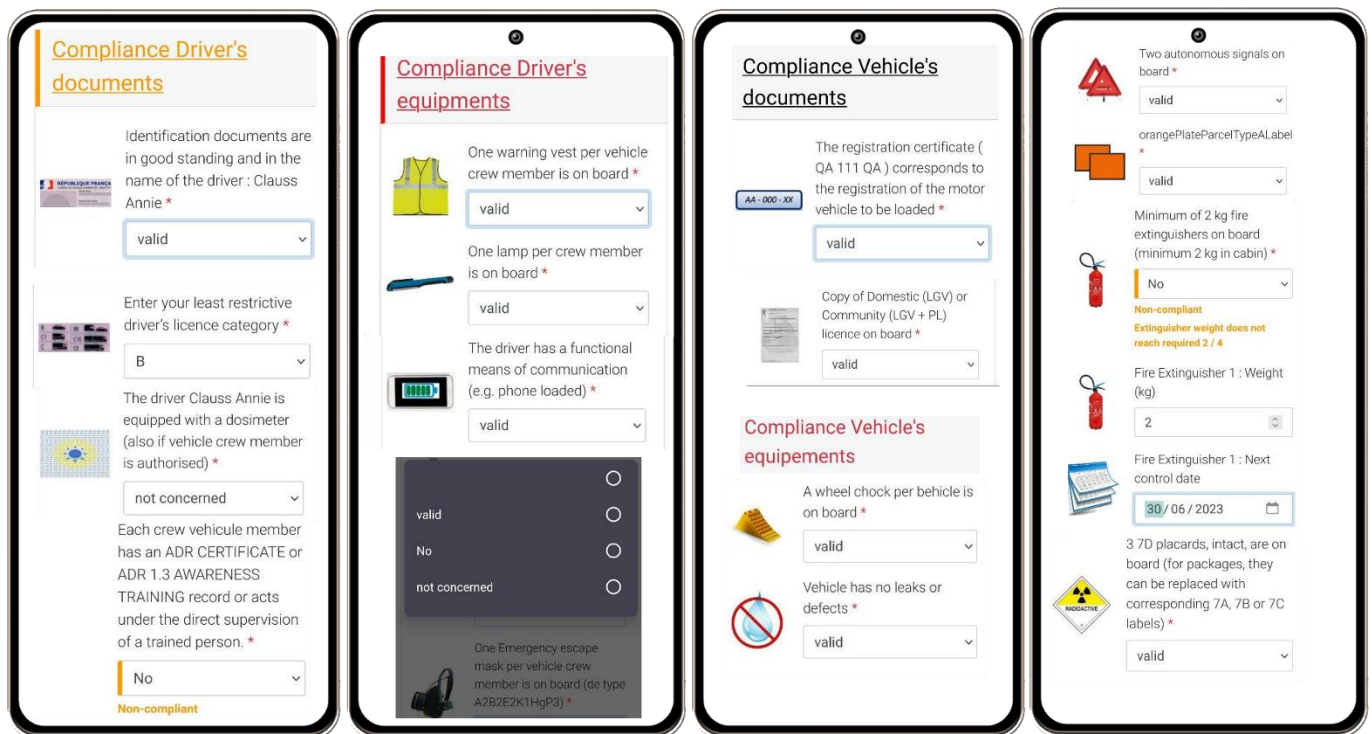
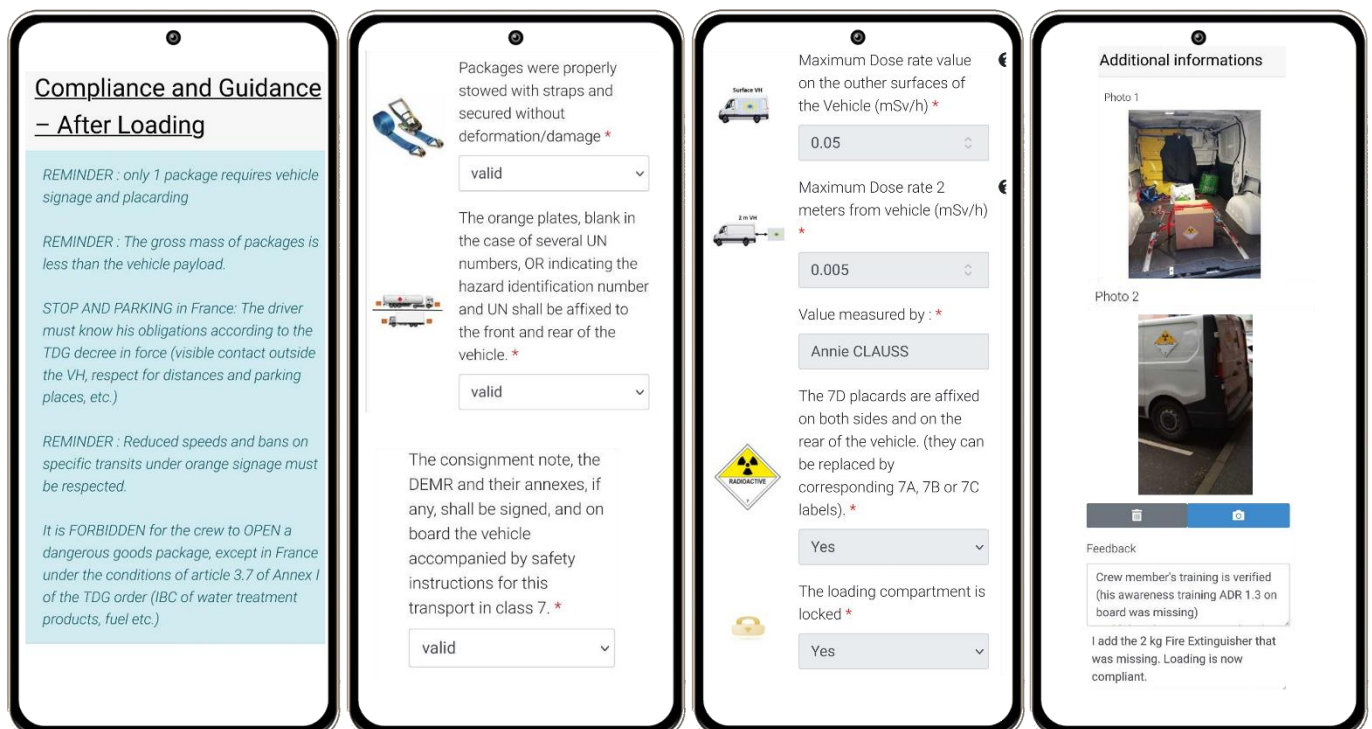


Figure 4. Checking Conductor and Vehicle.

LAST STEP: You check compliance after loading and you edit the checklist.

Before editing the final control for archiving, you can add photos and/or notes to indicate how you have resolved the non-compliancy points or to prove why you refused the loading, etc. – **Figure 5.**



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Figure 5. After Loading

All the data, the checking, the calendar of the different involved people, and other, photos and notes are traced in the report – **Figure 6.** – Basic access will automatically print a PDF document that is saved on your laptop, telephone, or tablet. The used token is released now, you can start a new checking.

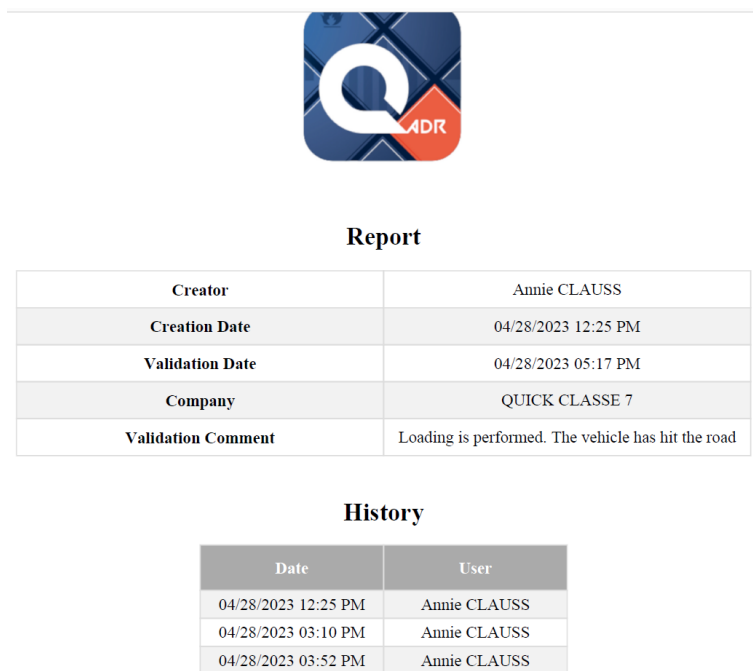


Figure 6. Report Trackability Extract

EXPERIENCE FEEDBACK

This first version demonstrates the flexibility of QuickADR. We can add or remove some specific control or remark without interfering with global and common rules.

About ten Safety Adviser were involved in testing before deployment that first version in order to correct bugs and about sixty external users are still giving their feedback on the French version. Also, French Competent Authority has tested the tool. They were surprised by the quality and density of the scenarios integrated in the application. The accuracy, in relation to the regulations and the facility to use has also be highlighted. All these feedbacks are useful and contribute to potential improvements and prior developments. Some improvements examples are listed below:

Safety Adviser feedback

- Anticipating recurring information's.
- Integration of the multimodal check (mostly maritime due to RORO (Roll-on/Roll-off) ships)
- Moving OVERPACK check in the packaging check.

USER feedback

- Enhancing picture's ability.

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- Adding a specific section for filling or draining tanks, in complement to the vehicle and conductor check.
- Pre-configuration of different scenarios to reduce checking time (through a setting system).
- Data exploitation for enterprise internal use via API connecting.
- Inter-modality mode

COMPETENT AUTHORITIES feedback

The checking's are still on-going, and we are expecting a status before summer 2023.

Most of the suggestions and corrections have been already integrated or are in the process of being implemented. QuickADR for Class 7 is in a pre-production version and will also be tested by partners before validation. These evolutions are an important proof-of-concept that our application can be adapted to specific requirements, an activity, a specific loading, a regulatory control organization etc.

ON GOING WORK AND LONG-TERM VISION

Clearly, the priorities are linked to integrate and validate the Class 7 rules for excepted and non-fissile Type A packaging (in French and English version).

In a second time, the challenge is to improve the setting system to optimize different customer scenarios.

At the same time, the additional rules for maritime transport IMDG [12] will be implemented. Therefore, the deal is to highlight *QuickADR* in its inter-modality mode. That evolution will, of course, authorize to perform at the other modes of transport of dangerous goods: Inland Waterways ADN [13], rail RID [14], air IATA [15]).

In addition, as the vocation of this digital application is response to the international regulation and the different country specifications, the multi-language will be introduced in all standard versions.

Finally, regarding the robustness and the flexibility of the QuickADR rules engine, the vision for the future, is to associate the engine to IA algorithm. The first tests are already encouraging. Obviously, that will speed up the overall checking process and improve the reliability of the data.

Evidently, the long-term vision will be aligned to the market and partner requirements.

CONCLUSIONS

In conclusion, making the Transport of Dangerous Goods safer, more secure, more traceable are the key points of *QuickADR*. The return of experience, after two years feedback, is clearly positive in link with our expectations. Based on a robust, flexible, and scalable rule's engine, we are able to follow up the road map.

Initially developed for checking compliance on loading, *QuickADR* is pretty adapted to check (i) the exemptions thresholds, the transport document, the authorized packages, the special provisions when preparing the shipment - (ii) to update safety procedures - (iii) for the training of people involved in the transportation of dangerous goods – (iv) for decision support.

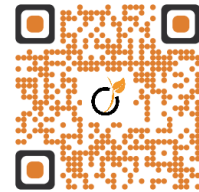
Due to the specificities related to the transport of radioactive materials, the deployment of a dedicated version for excepted and type A packages is imminent. The last checks are in progress in French and English versions.

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In order to facilitate connections with the other components of an information system, this application is open to the outside world through secure and documented API's.

All data and checking's are included in the final report. For security reasons, no data is stored by the application when the control is closed. In addition, the system of transferable tokens for the different loading stages is an additional advantage of the application. Comments and photos, before editing the final report, allows good traceability and de facto archiving.

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- [5] ADR, Chapter 1, Section 1.1.3.6
- [6] ADR Special Provisions: Chapter 3.2.1 – Column (6), (11), (13), (16 to 19)
- [7] ADR Chapter 3.4 - Dangerous goods packed in Limited Quantities (LQ)
- [8] ADR Chapter 3.5 - Dangerous goods packed in Excepted Quantities (EQ)
- [9] ADR, Chapter 5, Section 5.1.5.3 – Section 5.2.1.7
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