R3PACK – REDUCE, REUSE, RETHINK PACKAGING TOWARDS NOVEL FIBRE-BASED PACKAGING AND REUSE SCHEMES

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EXECUTIVE SUMMARY

The objective of this task is to assess the food safety of reusable packaging by defining a comprehensive food safety protocol (performance and chemical tests on packaging) and auditing protocol applicable to washing practices for industrial reuse.

The task will address the 3 main areas to work on to ensure the packaging's food safety:

1. Performance on packaging material regarding the repeated uses
2. Migration of the material into the product (food contact tests)
3. **Audit grid to control washing efficiency depending on the material**

It will foresee the performance of a comprehensive set of chemical and mechanical tests and simulated rotations, allowing for up to 20 cycles of reuse, in all possible reuse conditions.

It will moreover allow the mapping of washing centers and different systems and protocols used in Europe with special focus on the concerned regions for the demonstration activities in WP5. It will lead to the definition of a food safety protocol and auditing protocol for washing centers for the different identified and analyzed reusable packaging options.

This report will concern only the audit grid to control washing efficiency depending on the material.

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INTRODUCTION

The R3PACK project aims to set up packaging reuse loops. The safety of users, in terms of food, is therefore essential.

The audit grid is key for the project to maintain consumers' safety while consuming food in reusable packaging.

Indeed, the marketing of washed reusable packaging must consider several criteria, some new ones, in order to prevent any risk.

SGS's mission is to draw up an audit grid.

This audit grid, which can be used by professional washers and other companies providing washing, will guide them in ensuring health safety.

In the first part, we will communicate on the methodology of the construction of this audit grid and present it to you

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1. AUDIT GRID

The main objective is to enable the development of the reuse market while controlling and framing the key stage of packaging washing.

The first step was therefore to identify the expectations and needs of the interested parties:

- Industrialists, users of this packaging
- Distributors, important links in the logistics and communication with consumers,
- Industrial washers, the service provider,
- The European Union, the project sponsor.

The general conclusion of the different workshops that were organised is the following:

The important thing is to harmonise functional result standards (visual appearance, drying level, bacteriological, microbiological, etc.) by giving a fairly open process framework. It is then the know-how/added value and responsibility of the washer to implement the right processes to achieve these results.

The working tool was therefore an obvious one: the **HACCP method.**

SGS France offers to its customers, food manufacturers, a HACCP audit service based on the principles described in the CODEX ALIMENTARIUS CXC 1-1969 (v 2020). The audit grid used for this service was therefore naturally used as a starting point for the development of the audit grid for washers.

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SGS HACCP audit grid:

1st part: Requirements on the application of the HACCP method: the 12 steps and the 7 principles.
2nd part: The basic prerequisites: purchasing, cleaning and disinfection, staff hygiene, air and water quality control, contamination control, staff training, infrastructure, maintenance operations, waste management, pest control, control of measuring equipment, product identification and traceability, warehousing and storage of food and non-food products, recycled products and protection against malicious acts.

The audit grid was then modified to consider the specificities of the packaging washing activity:

* In addition to the "classic" hazards (microbiological, physical, allergenic, and chemical), regulatory hazards were added (maintenance of suitability for food contact), functional hazards (integrity of the packaging), maintenance of sealing capacity, colour, and odour.

* 3 major prerequisites have been identified to reinforce the obligations of results: cleaning efficiency, control of cross-contamination, traceability.

NB: 1 requirement has been added concerning specific customer contracts when they refer to FOOD SAFETY, as long as they are more restrictive than the regulations, in order to allow manufacturers to prove the compliance of the packaging washing activity with their own procedure or even with their certified Quality System (e.g. IFS).

Although the requirements of this grid are oriented towards result obligations, some of them list a minimum of means obligations to meet the objective of harmonisation of this washing activity while remaining logical/consistent with current practices and the result obligation.

For instance:

3.7: It is expected that at least specific measures (CCP or Prpo / point of attention)
* At the sorting stage before washing,
* At the sorting stage after washing,
* At the sanitizing (=disinfecting) stage of washing,

6.2: This flowchart will include at a minimum:
* Sorting of packaging before washing:
- Acceptable reference (= reference included in the list of authorized packaging references following qualification tests),
- Level of soiling and integrity of the packaging, absence of caps,
* Pre-washing (optional),
* Washing,
* Rinsing,
* Drying
* Sorting of packages after washing :
- Absence of foreign bodies,
- Absence of label and/or glue residues,
- Absence of any trace of damage to the integrity of the packaging.

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17.1: The identification and tracking system of the packaging must be kept operational throughout the process.
NB: it is expected that the means used for this identification (e.g. QR code) is regularly tested/verified, at least at the entrance and exit of the process.

Finally, despite its title (audit grid), we wanted to write the requirements as exhaustively as possible so that it could also be a working and reflection document for the washers and facilitate/favour an objective audit by the auditors.

For instance:

6.6: The protocol used will have been previously qualified regarding the acceptable thresholds of the hazards identified during the hazard analysis and/or customer requirements.

NB: it is expected here that this qualification takes into account the most critical conditions i.e. e.g. the lowest time/T°/concentration parameters tolerated, the maximum time between receipt of dirty packaging and washing, etc.

6.15: The organization shall have a relevant monitoring and sampling plan in place to ensure the effectiveness of cleaning (including rinsing and drying).
Note 1: Relevant means frequency, sample size, nature of controls and compliance targets.
NB2: The targets will be consistent with the regulations and/or the qualitative aspects expected by the interested parties (color, absence of glue traces, labels, etc.) and/or the use expected by the customer (in particular for the microbiological targets).

9.1: A program is in place to ensure air quality during the drying stage.
Ex: Level of filter quality, maintenance/change, analysis of the bacterial load of the air leaving the nozzles, etc.

The final step was to compare this grid with the CITEO grid for glass packaging washing audits to ensure that the common requirements were in line.

=> 86 requirements included 20 key points (“KO”).

=> 14 requirements for HAZARD ANALYSIS AND CONTINUOUS IMPROVEMENT and 72 for PREREQUISITES.

A test phase in real washing conditions is planned between now and the end of the year 2023 to validate the form and content of the grid (use of results).

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2. AUDIT GRID RESULTS

The audit grid was presented and evaluated in a theoretical way to the principals (industrialists in particular) and to the washers, with readjustments if necessary.

To date, the audit grid has been approved by the consortium.

The next step is to carry out a blank audit at a washer to validate it in a concrete way on the substance (requirements) and on the form (audit duration and exploitation of the results).

A call for applications has been launched among washers and a test is planned for September 2023.

Here below the final audit grid.

2.1 HAZARD ANALYSIS AND CONTINUOUS IMPROVEMENT

1	Regulatory and technological watch	1.1	The organization ensures that it is informed in a timely manner of regulatory changes that may impact its business. Ex: Regulation of biocides (cleaning products), water potability, etc ...	
		1.2	The organization ensures a technological watch that would allow it to identify any optimization of its processes, especially on environmental aspects. Ex: Reduction of water consumption, eco-labelled cleaning products, etc.	
2	Flowchart	2.1	A flow diagram to visualize the sequence of operations must be formalized. NB: a march forward of operations is expected here.	
		2.2	A distinction between the so-called "dirty" stages and the so-called "clean" stages will have to appear on this flow diagram. This zoning will have to be justified. NB: It is expected here the identification of at least 2 zones. The organization is free to identify more.	MAJOR
		2.3	A flow plan of the different waters will also be available in order to visualize the absence of risk of cross-contamination. NB: At least, dirty water/clean water. If recycled water is used and/or temporarily stored in a container, this must also appear.	
3	Hazard analysis	3.1	The organization will have conducted a hazard analysis.	
		3.2	At a minimum, the nature of the hazards will include: microbiological hazards (salmonella, Listeria, Staphylococci), chemical (cleaning product residues), physical, allergenic, regulatory, functional and qualitative. NB: "regulatory": Compliance with the specific rules for the reuse of PACKAGING FOOD SAFETY. "functional": The risks of affecting the future functionality of washed packaging (strength, sealing/welding capacity). "Qualitative": The risks related to unwanted odors or colors.	MAJOR
		3.3	A set of prerequisites (= cross-cutting prevention measures) will have been established, including at least the topics addressed in the prerequisites chapter of this grid.	
		3.4	The organization will have carried out a hazard analysis by step of the process (see flow diagram).	MAJOR
		3.5	The hazard analysis will have made it possible to identify possible CCPs or points of attention according to a coherent approach. NB: "coherent approach" means any method consistent with the expected results and as defined by the CODEX ALIMENTARIUS. E.g. use of a scoring matrix and/or decision tree and/or specific definitions of CCPs/points of attention.	
		3.6	For any specific control measure identified (CCP or point of attention), a critical limit, a monitoring method; A frequency of monitoring, responsibility for control, recording of results and corrective and corrective actions are defined.	
		3.7	It is expected that at least specific measures (CCP or Prpo / point of attention) * At the sorting stage before washing, * At the sanitizing (=disinfecting) stage of washing, * At the sorting stage after washing,	MAJOR
4	Continuous improvement	4.1	The hazard analysis is reviewed periodically to ensure that it is kept up to date.	
		4.2	With the objective of continuous improvement, the results of internal monitoring (on process, product or supplier/service provider) and external monitoring (e.g.: audits, customer complaints, etc.) should be regularly reviewed in order to identify trends (with corrective/preventive actions if necessary) and to measure the effectiveness of this hazard analysis.	

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5	Customer Requirements	5.1	It is expected that the FOOD SAFETY customer requirements/specifications expressed through a contract, specifications or any other formalized act, have been taken into account in the functioning of the organization, as well as updated if necessary. NB: A test could be carried out here by sampling 1 day of service related to specific customer requirements.	MAJOR
6	Cleaning and Disinfection of Packaging	6.1	A flowchart of the different stages related to the washing of packaging has been formalized.	
		6.2	This flowchart will include at a minimum: * Sorting of packaging before washing: - Acceptable reference (= reference included in the list of authorized packaging references following qualification tests), - Level of soiling and integrity of the packaging, absence of caps, * Pre-washing (optional), * Washing, * Rinsing, * Drying * Sorting of packages after washing : - Absence of foreign bodies, - Absence of label and/or glue residues, - Absence of any trace of damage to the integrity of the packaging.	MAJOR
		6.3	The important parameters of each step will have to appear: Time, Temperature, concentration, etc.	
		6.4	The washing temperature will be at least 60°C. Any lower temperature must be justified by a hazard analysis and associated risk assessment.	
		6.5	The rinsing temperature will be at least 82°C if this step is the sanitation phase or a recognized alternative protocol (DGAL/SDSSA/2014-459: immersion 75°C/15s or 70°C/30s or sprinkling 75°C/10s or 70°C/20s or 65°C/20s).	
		6.6	The cleaning procedure will have been previously qualified with regard to the acceptable thresholds of the hazards identified during the hazard analysis and/or customer requirements. NB: it is expected here that this qualification takes into account the most critical conditions i.e. e.g. the lowest time/T°/concentration parameters tolerated, the maximum time between receipt of dirty packaging and washing, etc.	MAJOR
		6.7	The amount of residual water after drying should be kept to a minimum and controlled. NB: it is expected here "an absence" of water residues in coherence with the methodology of control set up which will have to be itself relevant with regard to the objective to be reached.	
		6.8	The products will be approved as suitable for cleaning food contact surfaces (TP4 minimum).	
		6.9	Their bactericidal spectrum should include at least the microbiological germs included in the hazard analysis.	
		6.10	If necessary (e.g. customer requirements), the same will apply to the virucidal and fungal spectrum.	
		6.11	If a biocidal product is used, it must appear on the list of authorised products in force.	
		6.12	The products will be guaranteed allergen-free.	
		6.13	The products will have the most neutral smell possible	
		6.14	In case of recycling or closed loop, the quality of the recycled product will be controlled. NB1: "Recycled product" here means the return of rinse water and/or cleaning/disinfection solutions from a previous cycle to a new cycle. NB2: it is expected here that the characteristics of the recycled product concerned are maintained at the level at which it has been qualified. This may include parameters such as concentration, saturation, suspended matter, etc. This includes soaking baths and rinsing water ("clean" water). NB3: The water used for the last rinsing stage will in all cases be of "potable" quality.	MAJOR
		6.15	The organization shall have a relevant monitoring and sampling plan in place to ensure the effectiveness of cleaning (including rinsing and drying). Note 1: Relevant means frequency, sample size, nature of controls and compliance targets. NB2: The targets will be consistent with the regulations and/or the qualitative aspects expected by the interested parties (color, absence of glue traces, labels, etc.) and/or the use expected by the customer (in particular for the microbiological targets).	MAJOR
		6.16	This efficiency will take into account at least the achievement of the objectives regarding bacteriological, chemical (residues), foreign bodies and allergens risks.	
		6.17	The organization is able to deal with any non-conforming monitoring/inspection results. NB: it is expected here in particular the treatment of the nonconforming products, the causes at the origin of the nonconformity and if necessary, the communication to the interested parties.	
		6.18	The procedure for cleaning/disinfecting packaging and related controls are formalized (work instructions, records).	

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7	Cleaning and Disinfection of the premises	7.1	A space cleaning and desinfection program is in place	
		7.2	This takes into account (in terms of frequency in particular), sensitive areas (Cf zoning).	
8	Staff hygiene	8.1	Specific instructions have been set concerning: dressing, hand washing, injuries, illnesses, personal effects, drinking, tobacco, the use of social premises (changing rooms, break room and / or canteen) and the use of administrative consumables (pen, etc ...).	MAJOR
		8.2	These instructions will be consistent according to the product risk (=zoning).	MAJOR
		8.3	Handwashing equipment in areas where clean packaging is handled will be non-manually controlled, with a single-use hand towel and a closed garbage can.	
9	Air quality	9.1	A program is in place to ensure air quality during the drying stage. Ex: Level of filter quality, maintenance/change, analysis of the bacterial load of the air leaving the nozzles, etc.	MAJOR
		9.2	If compressed air is used directly on the packaging, the absence of oil residues must be guaranteed/monitored.	
		9.3	The air in the "dirty" areas should not contaminate the atmosphere in the "clean" areas. NB: it is expected here a physical separation of the zones or a difference in pressure (overpressure in the clean zone) or other means.	MAJOR
		9.4	No vapor build-up in areas.	
		9.5	An air quality monitoring plan will need to be defined and in place to demonstrate the achievement of the above objectives.	
10	Control of cross-contamination	10.1	The risk of microbiological, physical, chemical and allergenic cross-contamination is controlled by all the measures put in place.	
		10.2	These measures include at least the risks of cross-contamination due to: personnel, waste, flows, air, water, condition of the structure, condition of equipment, maintenance operations, storage conditions, transport conditions, cleaning materials.	MAJOR
		10.3	The risk of glass and hard plastic is subject to monitoring.	
		10.4	Compliance with the application of measures taken to limit/eliminate the risk of cross-contamination is regularly monitored and corrective actions are taken if necessary.	
11	Staff training	11.1	Training instructions exist and specify "Who, When, How" staff are trained.	
		11.2	The training content includes at least: staff hygiene instructions, hand washing, pest control and basic notions of agribusiness.	MAJOR
		11.3	Specific training will be provided for staff in charge of piloting specific control measures, controlling parameters important for cleaning efficiency or controls (especially the sorting steps before/after washing if manual).	
		11.4	These trainings are recorded.	

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12	Infrastructure and Equipment	12.1	The infrastructure must not have a rust point, hole, peeling paint among others	
		12.2	Doors and windows will be closed.	
		12.3	Sufficient lighting, especially at visual control stations.	
		12.4	Their design must allow easy cleaning.	
		12.5	The washers equipment will be regularly dismantled and cleaned to check for organic residues, water (biofilm), missing moving parts, clogged nozzles, etc. Their maintenance program must at least follow the recommendations of the manufacturers.	
13	Maintenance	13.1	The instructions related to maintenance interventions must take into account the risks of cross-contamination related to this activity: loss of tools, dirt, grease residues, oil, etc.	
		13.2	Specific instructions could be applied in case of intervention in clean areas.	
		13.3	Products used in maintenance on equipment in contact with clean packaging will be guaranteed NSF H1, free of mineral oils and allergens.	
		13.4	Maintenance interventions will be recorded.	
14	Rubbish	14.1	The waste disposal stream must not present a risk of cross-contamination: personnel, time of disposal, final storage location.	
		14.2	Organic waste containers should be emptied as frequently as possible.	
		14.3	Intermediate waste storage containers in sensitive areas will be non-manually controlled.	
		14.4	A device is in place for the recovery and evacuation of waste water (washing baths in particular), in accordance with the legal provisions in force.	
15	Pest control	15.1	A pest control plan will be in place: rodents, crawlers, insects in particular; in accordance with the legal provisions in force.	MAJOR
		15.2	Any trace of infestation will be remediated as soon as possible.	
		15.3	Particular attention should be paid to: places of accumulation of organic waste (palatability), storage areas for dirty packaging, the absence of pests upon receipt of dirty packaging.	MAJOR
16	Metrology	16.1	Process measuring devices for T°, time, conductivity, concentration of cleaning products, optical sorting if applicable are under internal or external monitoring plan.	
		16.2	The same applies to the devices used for inspections: ATP meters, pH meters, conductivity meters, ovens (bacteriology), etc.	
		16.3	The consumables used for the controls will have a valid MDD and will be stored under the conditions recommended by the manufacturer (allergen kit, protein residue swab, pH paper, etc.).	
		16.4	The characteristics of the measuring devices (uncertainties, detection limits, temperature compensation, etc.) and the tolerated deviations during these controls will be in compliance with the criterion being controlled/piloted and to any regulatory or food safety limits.	MAJOR
17	Traceability	17.1	The identification and tracking system of the packaging must be kept operational throughout the process. NB: it is expected that the means used for this identification (e.g. QR code) is regularly tested/verified, at least at the entrance and exit of the process.	
		17.2	The company has set up a traceability system allowing it to associate all processing operations and analysis results with the "batch" it has previously defined (or defined according to customer specifications).	MAJOR
		17.3	This system will be regularly tested to prove its effectiveness.	
		17.4	Records related to traceability will be archived/retained for a minimum of 2 years.	
18	Storage and transport	18.1	The storage of cleaning products should not pose a risk to clean packaging. NB: it is expected here that access to this storage place is controlled.	
		18.2	The replenishment of cleaning products will be consistent with the expected volumes of use.	
		18.3	Only referenced products will be present in the premises.	
		18.4	The time between receipt and cleaning of dirty packaging is to be monitored (= cleaning qualification criterion).	
		18.5	The temperature of the storage area for "dirty" packaging should not exceed 30°C.	
		18.6	The conditions of storage of clean packaging shall not affect its conformity (Outdoor storage prohibited). NB: it is expected here that the packaging is protected, that the area is clean, etc …	MAJOR
		18.7	Clean packaging will be identified in accordance with the traceability procedure decided internally.	
		18.8	In the case of transport manned by the washer, the latter must ensure that the loading and transport conditions will not affect the characteristics of the washed packaging.	
19	Prevention of malicious acts	19.1	Access to the cleaning product and to the so-called "sensitive" areas will be controlled.	
		19.2	Washing parameters will be secured if automation.	
		19.3	Rules of circulation and/or access prohibition will be defined for external personnel (visitors, drivers, service providers, etc.).	

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3. BIASES AND RISKS ANALYSIS OF PACKAGING REUSE LOOP

3.1 WASHING AND MICROBIOLOGICAL RISKS

Regarding washing process, we must note it was not easy to start an audit grid without a washer partner in the consortium, this was a hindrance on several points.

First, their approach would have allowed us to adapt the washing protocol as much as possible upstream, without taking too many biases on the temperature, the duration of the cycle or the type of detergent *(see report on food safety protocol).*

Then, for the drafting of the audit grid, to be able to adapt to the practices already in place while providing a reassuring framework.

The audit grid imposes obligations of results and not of means, which is to the advantage of the washers. On the other hand, it will be imperative to monitor the results, particularly with regard to microbiological and allergenic tests.

At the same time, neither the audit grid nor the test protocol take into account the time elapsed between the collection of the dirty packaging and the washing. This time, more or less long, can drastically impact the packaging, its suitability for food contact and also impact the result of the washing and contain harmful substances at the time of its final reuse.

3.2 OTHER TOPICS

Responsibility

The first is the notion of responsibility when setting up the re-use loop, either it is opened or closed one. Today, the marketer is responsible for the safety of the product.

What will happen for reuse where the various players follow one another? How can this responsibility be defined? What happens in the case of open loops, for example when the packaging goes to the consumer who then returns it to the shop (misuse, uncontrolled deterioration)?

There are distributors, transporters, manufacturers, washers, industrials and even consumers. All these responsibilities are not shared today.

Traceability and information to consumers of the packaging

Concerning traceability, the aim here is to understand the life of the packaging, considering misuse but also a means of counting the maximum number of rotations of a package and to be able to count each cycle.

Concerning consumer information, we are aware of the difficulties of setting up bulk sales and providing information on the product, its use, and the risks. For reuse, it is the same thing. The regulations must take these parameters into account in order to guide the consumer as best as possible during use and to enlighten his choice.

In our R&D, we would like to point out that we have not considered baby food. Indeed, additional precautions must be taken. This is important information to note for consumers if not covered.

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CONCLUSION

This audit grid will play a key role in the development of reuse: not only will it make the professional practices of industrial washers more reliable through its control (audits) and informative (working document) aspects, but it will also reassure the consumer that food safety is being maintained, thus encouraging responsible purchasing.

The participation of all the actors concerned in its development is a positive sign as to its appropriation and adaptation under the best conditions.

However, there is still room for improvement about other environmental aspects such as energy consumption, water consumption, more environmentally friendly detergents, etc.

Those aspects that could be addressed at a later stage.

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