HEXANE
IN OUR FOOD

The Avril agro-industrial group at the heart of a health scandal

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The original French version shall prevail

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Content

Summary

With the publication of this report, **Greenpeace France wishes to draw attention to the hexane health scandal**: this petrochemical solvent, which is currently relatively unknown to the general public, is nevertheless found on consumers' plates. **Hexane, used as an extraction solvent to extract vegetable oils on a large scale (soya, rapeseed, sunflower, etc.), is at the heart of the agri-food industry.** Its use allows for the extraction of almost all of the fat and the production of a high protein concentration meal1[1], thus meeting the industry's productivity requirements.

However, its use is not without risk to public health, as **hexane has been scientifically recognised as hazardous to health** for some time. It is a **neurotoxic** solvent, **also suspected of being reprotoxic**. It is also a potential endocrine disruptor. In this context, Greenpeace France has conducted analyses with a university laboratory to detect the presence of hexane residues in food, notably by testing more than fifty widely consumed food products. **The results are extremely concerning: hexane was detected in 36 of the 56 products tested, almost systematically in oils, butter and milk, including infant milk. Hexane residues were also found, to a lesser extent, in chicken.**

These findings are all the more worrying given that consumers have no way of knowing about them: **hexane, considered to be a "processing aid" under European regulations, is not subject to any labelling requirements and therefore does not appear on the packaging of the products concerned**. Beyond allowing a controversial substance to be introduced into our food without informing consumers, current regulations provide very inadequate oversight of the presence of these hexane residues in consumer products. Firstly, authorisations are based on obsolete toxicological data dating back to 1996, provided by the industry itself, whose validity in terms of health protection is now being questioned by public authorities and scientists. In its 2024 report, the EFSA (European Food Safety Authority) deemed this study insufficient and inadequate. Furthermore, this regulation does not impose any restrictions on the presence of hexane residues in some major food products and it thus largely underestimates the population's exposure to this substance. It is surprising, for example, that it authorises the presence of hexane in animal feed without restriction (its reporting is only mandatory above a quantitative threshold common to all chemical residues).

1 A dry, compact paste, rich in protein, remaining after the oil has been extracted from the seeds.

However, during the industrial process of separating vegetable oil from oilseeds or oleaginous fruits, 30 to 60% of hexane losses end up in the resulting solid matter, which is used as a major ingredient in animal feed. This hexane is thus absorbed by farm animals and remains in commercially sold animal products (meat, milk, eggs, etc.). The contamination of these products with hexane is documented in a recent study by the INRAE (French National Research Institute for Agriculture, Food and the Environment) and in analyses carried out by Greenpeace France presented in this report.

Furthermore, with this report, Greenpeace France wishes to highlight the responsibility of one key player regarding the presence of hexane residues in our food: the agro-industrial group Avril. Ranked fifth among France's largest agri-food groups, with a turnover of €7.7 billion in 2024, Avril processes nearly half of the oilseeds crushed in France. We demonstrate how, through its central role within the oilseed and protein crop sector, Avril has a fundamental influence on the organisation and the strategic direction of the entire French sector.

With this work, Greenpeace France exposes the group's omnipresence in the decision-making bodies of all organisations in the sector (technical institutes, French and European inter-professional and lobbying organisations, communication projects, trade unions), resulting in a major influence on technical and economic policy, and therefore on the use of hexane. Furthermore, the group communicates misleading information about the virtuous nature of its oil extraction process.

Furthermore, **the following report demonstrates that hexane is central to the industrialisation of animal feed, which is itself a driving force behind industrial livestock farming:** indeed, historical analysis shows us that the use of hexane in oilseed and protein crop processing plants goes hand in hand with the industrialisation of animal feed and, ultimately, with the industrialisation of livestock farming. The latter is actively encouraged by various players, notably the leaders of the majority agricultural union (the FNSEA), headed by Arnaud Rousseau, who is also the chairman of the board of directors of Avril. This is despite the fact that the industrialisation of livestock farming is leading to a decline in the number of farms, particularly among the most sustainable ones, and maintaining excessively high levels of meat production and consumption – when, for reasons of public health and environmental concerns, both need to be reduced and improved in quality.

Greenpeace France alerts public authorities and health authorities and calls for the protection of the French and European population. Due to its harmful effects on public health, **Greenpeace France is calling for a ban on hexane as an extraction solvent in food products and a ban on the import of products containing it.** It is also asking public authorities to actively support the development and promotion of existing hexane-free extraction methods.

What's more, this must necessarily be accompanied by renewed research into the chronic toxicity of hexane and health analyses to assess the population's exposure to this product.

Finally, Greenpeace France **calls for the inclusion of processing aids on food labels** for reasons of transparency and consumers' right to information. To this end, the public authorities, the government, as well as French and European MPs, must take responsibility for this major public health issue, using the legislative tools and opportunities at their disposal.

List of abbreviations

ANSES	French National Food Safety Agency
CAS	Chemical Abstracts Service
CEFIC	European Council of the Chemical Industry
CMR	Carcinogenic, mutagenic, reprotoxic
CVO	Compulsory voluntary contributions
ADI / TDI	Acceptable daily intake / Tolerable daily intake
NOEL	No observed effect level
EPA	Environmental Protection Agency
ECHA	European Chemicals Agency
EFSA	European Food Safety Authority
EMA	European Medicines Agency
FASO	French Oilseed Strategic Action Fund
FOP	French Federation of Oilseed and Protein Crop Producers
FEDIOL	EU Vegetable Oil and Proteinmeal Industry
FIDOP	Interprofessional Development Fund for the Oilseed and Protein Crop Sector
ICPE	Facilities classified for environmental protection
INRAE	National Research Institute for Agriculture, Food and the Environment
INRS	National Institute for Research and Safety
INERIS	National Institute for Industrial Environment and Risks
ITERG	French Institute Specialising in Vegetable Oils and Proteins
MDD	Private labels
MRL	Maximum residue limits
SMP	Solvents Management Plan
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RMOA	Risk Management Option analysis
SCF	Scientific Committee on Food
SVHC	Substance of Very High Concern
VOCs	Volatile Organic Compounds
TRVs	Toxicity Reference Values

Introduction

Who would imagine that by giving your child infant formula, you are unknowingly feeding him/her residues of a petroleum-derived solvent? Or, as the French MP who has been sounding the alarm for several months about the presence of hexane in our food, Richard Ramos, recently said: **"Who would imagine, when making a salad dressing, that it contains a hydrocarbon?"**

These questions perfectly sum up the purpose of this report: to help raise awareness about the use of a petrochemical solvent that is largely unknown to the general public, but which is likely to be found in a wide variety of everyday food products: hexane. Derived from petrochemicals, it is mainly used to extract oil from oilseeds using a large-scale industrial process that produces vegetable oils as well as oilseed meal, the resulting solid residue being used in animal feed. Whilst hexane enables efficient and cost-effective extraction, its toxicity to human health, increasingly documented by scientific research, raises major health concerns. Far from being a mere technical issue, the use of hexane raises questions regarding our dietary habits, current health standards, and the economic interests that prevail within the agri-food industry. Whilst hexane residues can be found in both plant-based and animal-based products, regulation remains surprisingly lax, to the detriment of the precautionary principle and the protection of public health, particularly that of the most vulnerable populations.

In April[2] 2021, a memo written on behalf of a chemical company by a researcher working within the industry gives us some insight into manufacturers' knowledge of the health risks and unpopularity of using such a solvent in our food. It states: "Ultimately, honest French speakers who seek to form an opinion about hexane will not find a plethora of outrageous denunciations, but all of the information that is available points to the toxic and explosive characteristics of this solvent and is not counterbalanced or nuanced by more reassuring information."

Furthermore, after mentioning hexane's CMR2 classification and specifying its potential effects on reproduction, the note explains that **"it would probably be difficult to include hexane on the list of solvents authorised by Directive 2009/32 if it had to prove its safety by applying the current standards."**

2 Patrick Carré, "Utilisation d'hexane dans l'extraction des huiles végétales", ITERG, Terres Inovia, April 2021.

Finally, this note mentions a measure put forward by the Citizens' Climate Convention that aimed to "regulate the production, import and use of processing aids and food additives" and points out that even if the conditions for such regulation are not specified, it is likely that the use of "a processing aid such as hexane, which does not have a toxicological dossier that meets current standards, could be called into question."

This report documents the issues surrounding the use of hexane through four main analyses. First, **we analyse the central role of hexane in our eating habits**, particularly through an understanding of the oilseed crushing process, right through to the production of oilseed meal for livestock as well as the hexane losses that may end up in our food. We will then address **the health risks posed by this solvent, explaining the complex issues surrounding its chemical composition** and emphasising the inadequacy of current regulations and health standards to protect and inform consumers. Thirdly, **we will decipher a series of analyses that we conducted with a university laboratory**, illustrating the real and worrying presence of hexane residues in a wide variety of common food products.

Finally, **we will focus on a key player: Avril, a symbol of the agro-industry's responsibility in the hexane health scandal**. We will analyse this giant, which has a virtual monopoly on the oilseed and protein crop sector, and whose economic weight is based on the processing of oilseeds and the marketing of oilseed meal. We will analyse its role in the agro-industrial inertia surrounding hexane, as well as its influence and centrality in decisions made within the oilseed and protein crop sector.

Part 1

HEXANE AT THE HEART OF OUR EATING HABITS

A. The crushing of oilseeds: a key link in our food chain

Oilseeds, such as rapeseed, sunflower seeds and soybeans, play a central role in our diet thanks to their high fat and protein content. They are processed into **edible oils**, which are consumed directly or incorporated into a wide range of products (baby formula, margarine, etc.), but they are also the **raw material for oilseed meal** (a dry, compact paste, rich in protein, that remains after the oil has been extracted from the seeds), which is used as feed for farm animals. These products are then found, in various forms and sometimes processed, in our supermarkets and ultimately on our plates.

Today, the oilseed and protein crop sector in France represents 120,000 producers, 500 traders and cooperatives, 40 industrial operators, and 300 animal feed factories – covering **2.6 million hectares of crops**, producing 7.5 million tonnes of seeds and 6.3 million tonnes of crushed seeds. Of these 6.3 million tonnes of crushed seeds, **3.6 million tonnes are processed into oilseed meal for animal feed** and **2.6 million tonnes become crude oil for food and non-food production**[3]. It is therefore an industry of considerable economic importance.

The process of extracting oil from oilseeds is known as crushing. In the food industry, this process is mainly carried out using a chemical method: the seeds are first pressed, then treated with a solvent, most commonly hexane, a petroleum-derived compound. This allows almost all the fat contained in the seeds to be extracted, which optimises yield, produces oilseed meal with a very high protein concentration, and thus meets the productivity requirements of the food industry (See Figure 1 in the section 'Hexane, at the heart of our eating habits' and Appendix 1 'The stages of crushing').

Standard crushing practices in France follow the technical standards of the profession, which are widely documented in specialist literature and specialist publications[4]. They are aligned with those defined by FEDIOL (European Vegetable Oil and Protein Meal Industry), the European union of vegetable oil and oilseed meal producers[5].

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3 "Le plan d'action 2024-2026 de la filière des huiles et protéines végétales", Terres Univia, 2023. https://www.terresunivia.fr/fichiers/publications/le-plan-d-action-2024-2026-C.pdf

4 AOCS (American Oil Chemists' Society) website: https://www.aocs.org/

5 Site internet de FEDIOL : https://www.fediol.eu/

> Nearly 90% of seeds crushed in France are processed in factories that use hexane.

The main advantage of this solvent is its cost-effectiveness and high yield: **hexane can be used to extract around 97% of the oil from seeds, compared with 89% using mechanical methods alone**[6]. In addition, hexane has several interesting properties, among which the fact its use involves a limited energy cost[7] (see Part 4). It is, however, not essential for processing oilseed and protein crops, **and alternatives do exist**. In fact, **less than a third of French oilseed processing plants** currently **use hexane**[8]. Nevertheless, because this solvent is used by the largest industrial players (notably Avril, Cargill and Bunge), whose plants crush several hundred thousand tonnes of seeds each year, **nearly 90% of the seeds crushed in France are processed in plants that use hexane**[9].

It should also be noted that organic farming specifications prohibit the use of hexane for extracting oil from oilseed and protein crops and for processing animal feed.

6 Fine et al, "Les agro-solvants pour l'extraction des huiles végétales issues de graines oléagineuses", OCL, vol. 20, no. 5, September-October 2013, phttps://doi.org/10.1051/ocl/2013020
7 Ibid.
8 See Methodology.
9 Ibid.

”Moving away from hexane: viable alternatives for an industry in transition”

According to Christian Cravotto, Postdoctoral Researcher in the Industrial Agro-Biotechnologies Research and Development Unit at AgroParisTech[10].

After studying under Professor Chémat (described by his peers as a "pioneer in the field of eco-extraction of natural products"[11]), this researcher obtained a doctorate in chemistry from the University of Avignon, in collaboration with the University of Turin. Author of leading scientific articles on hexane and its substitutes[12], he is currently continuing his work on the development of sustainable practices in the agri-food industry, particularly in the field of plant extraction.

1) Why is hexane a health and environmental concern?

Hexane is a petrochemical solvent widely used for the extraction of vegetable oils. Its toxicity is now well documented: classified as neurotoxic, it is also suspected of altering the reproductive system and acting as an endocrine disruptor. Exposure is not limited to workers alone: Hexane metabolites have been detected in the urine of populations not exposed to it in the workplace, indicating widespread contamination. In addition, its widespread use contributes to emissions of volatile organic compounds (VOCs), which contribute to air pollution and climate change. These factors call for an urgent reassessment of its use in the agri-food industry, as recently highlighted by the European Food Safety Authority (EFSA) in an opinion published in September 2024.

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10 "Agro-Biotechnologies Industrielles - ABI" (Industrial Agro-Biotechnologies), AgroParisTech, 11 February 2022, https://www.agroparistech.fr/recherche/unites-recherche/agro-biotechnologies-industrielles-abi

11 Florent de Corbier, " Le chercheur Farid Chemat ouvre une chaire à l’Unesco," La Marseillaise, accessed 8 July 2025, https://www.lamarseillaise.fr/societe/le-chercheur-farid-chemat-ouvre-une-chaire-a-l-unesco-KB12757481

12 Christian Cravotto et al., "Towards Substitution of Hexane as Extraction Solvent of Food Products and Ingredients with No Regrets," Foods 11, no. 21, January 2022, https://doi.org/10.3390/foods11213412; Leading Edge Technologies and Perspectives in Industrial Oilseed Extraction," Molecules 28, no. 16, January 2023, https://doi.org/10.3390/molecules28165973

2) Why is it still widely used in industry?

Hexane remains the benchmark solvent for the industry because it combines efficiency, stability and cost-effectiveness. It has a strong affinity for neutral lipids, enables high extraction yields and offers excellent cost-effectiveness. Its moderate boiling point and immiscibility with water facilitate its recovery and reuse, limiting losses during the process. The resulting oilseed meal is dry, well degreased and suitable for use in animal feed. These characteristics and high level of performance which are the result of several decades of technical optimisation, explain the reluctance to abandon hexane in intensive production systems.

3) How can we do without it?

Although the alternatives currently available do not yet achieve the same levels of performance in all industrial contexts, viable alternatives to hexane already exist. Some industries are turning to **mechanical extraction**, which eliminates the need for solvents altogether, or to renewable solvents such as **2-methyloxolane**, which is already authorised for use in foodstuffs in Europe[13]. This bio-based and biodegradable solvent has a favourable toxicological profile, with studies demonstrating its safety within regulatory limits — unlike hexane, which has not been fully evaluated despite its widespread use.

Other technologies, such as **supercritical CO_2** extraction, also offer interesting prospects, particularly for vegetable oils or lipophilic compounds with high added value.

In the context of the transition to sustainable production, these solutions are not only feasible, but highly desirable. However, switching from hexane to alternative solvents requires greater support for innovation: targeted investment, particularly in the most advanced technologies (TRL > 6), as well as small-scale Pilot studies, are essential to overcome the remaining obstacles. A firm commitment from industry, accompanied by appropriate public policies, will be crucial in enabling the gradual phasing out of toxic solvents in agri-food extraction processes.

13 Patrick Carré et al., "Solvent Solutions: Comparing Extraction Methods for Edible Oils and Proteins in a Changing Regulatory Landscape", Part 7: "Overall Comparison between Solvent Solutions", OCL 2025, 32, 9, https://www.mdpi.com/2304-8158/11/21/3412

The stages of crushing and hexane extraction: focus on the industrial process

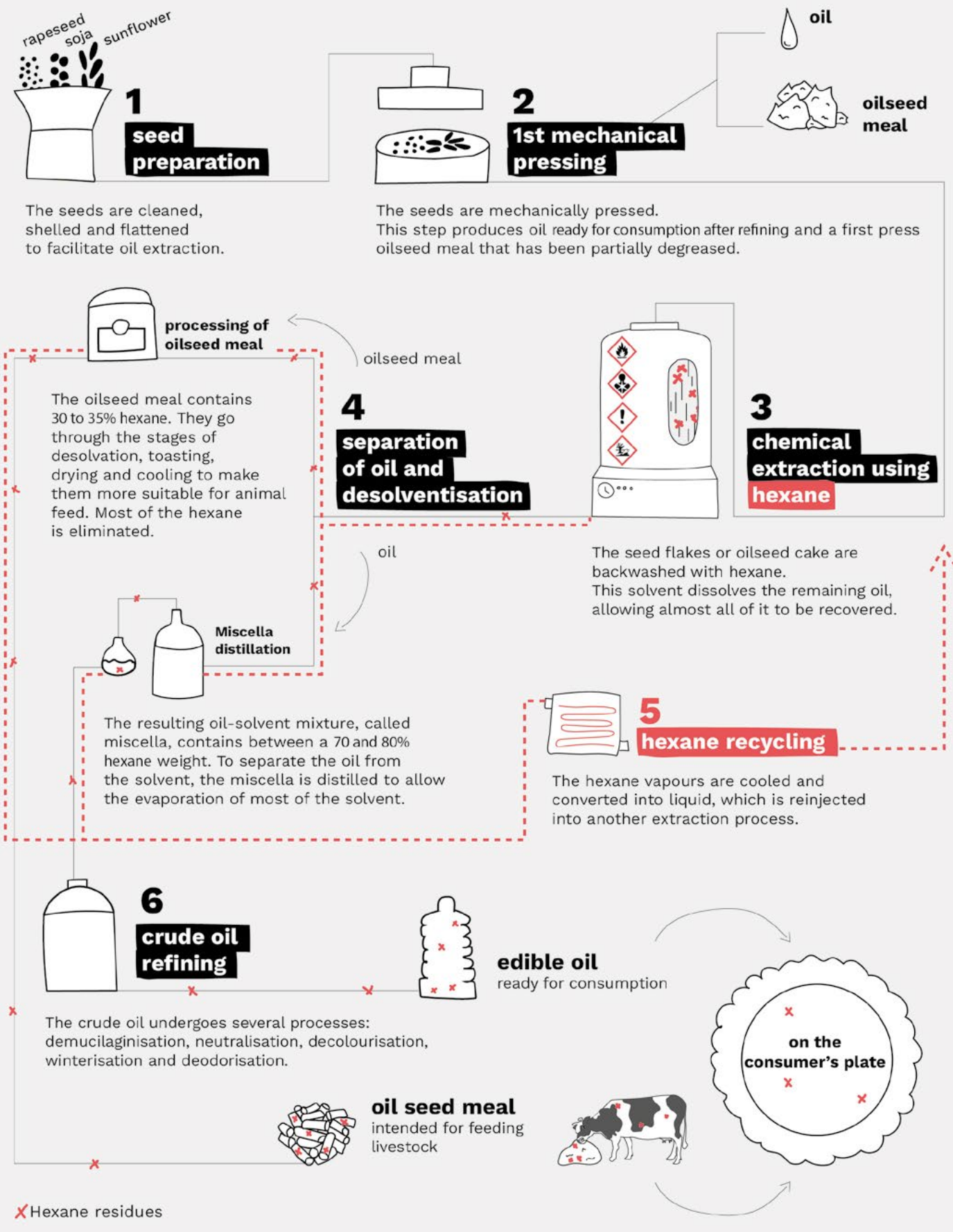

Figure 1 - The stages of crushing and hexane extraction: focus on the industrial process

B. Oilseed meal, an essential component of animal feed

1. The importance of oilseed meal in animal feed

Oilseed meal, a product largely unknown to the general public, is nevertheless central to the diet of farm animals. It is the solid residue obtained after extracting oil from oilseeds. Oilseed meal is of major importance for animal feed: it is the **second most important type of feed after cereals, and above all the main source of protein**[14], particularly for cattle, pig and poultry farming. This is a huge sector: in 2023, 19.1 million tonnes of compound feed were produced in France, generating a turnover of **€12.7 billion**[15].

Historically, the industrialisation of animal feed has played a crucial role in the development of industrial livestock farming, especially pig and poultry farming, in western France[16]. In the 1950s, the first hexane crushing plants were established in France[17] and, by the end of the 1960s, major international traders (Cargill, Bunge) were opening factories there with the stated aim of meeting the demand for animal feed for **livestock farms in the west, which were in the midst of industrialisation**[18]. It is no coincidence that when the French oilseed and protein crop sector became more structured in the 1970s, it was mainly to produce oilseed meal (oil was seen as a by-product) and to feed French livestock which was ever increasingly larger, without depending on imports of American soya[19].

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14 Course on oilseed meal given to students at Vet Agro Sup (Lyon Veterinary School): https://www2.vetagro-sup.fr/ens/nut/webBromato/ cours/cmtourte/introtou.html

15 "Plan sectoriel Nutrition Animal", AFCA-CIAL, La Coopération agricole, SNIA, April 2024. https://www.lacooperationagricole.coop/ressources/plan-sectoriel-alimentation-animale-pour-une-nutrition-animale-decarbonee-et-competitive

16 "Comment la filière porcine s'est industrialisée en Bretagne", Splann, July 2024: https://splann.org/enquete/les-travers-du-porc/comment-la-filiere-porcine-sest-industrialisee-en-bretagne/; Marc-Olivier Déplaude, "Naissance de l'élevage hors-sol en Bretagne: le regard d'un géographe", 2019: https://ritme.hypotheses.org/7735

17 Guillaume Coudray, De l'essence dans nos assiettes. Enquête sur un secret bien huilé (Essence on our plates: Investigation into a well-oiled secret), La Découverte, 2025 (see chapter 11: 'Hexane conquers the world').

18 Telex dated 16 May 1975, To Christine Souffiet From Mrs Rossetti, For the attention of Mr Attali; Minutes of the meeting at Mr Domergue's/ Agriculture, Soja France information sheet, 29 February 1977; Request for assistance from the special industrial adaptation fund, 18 July 1980, Société Soja France; Soja-France file, Request for financial assistance from the State, 16 June 1980; Le Télégramme, 9 August 1982.

19 Guillaume Assogba, "Les dynamiques industrielles des filières: une application au domaine des oléo-protéagineux," thesis, Economics and Finance, University of Bordeaux, 2018.

Oilseed meal is central to livestock farming logistics: it is a particularly cost-effective and efficient way of providing protein[20]. In the animal feed sector, the value of the raw material depends on its protein concentration: straw has a very low value, cereals are rich in energy but low in protein, while oilseed meal, particularly soya meal, has a high protein value[21] without being too rich in fibre. It is therefore highly valued, particularly for pigs and poultry, which are unable to synthesise certain essential amino acids and are entirely dependent on the protein provided by their feed[22].

However, meat and animal products (milk, yoghurt, cheese, eggs) **account for more than a third of the foods most consumed by the French**[23]. The reason for this is the lack of guidance and support from public authorities and politicians with regard to diets that promote reducing meat consumption in favour of higher quality meat. Thus, considerable quantities of oilseed meal are needed to feed all farm animals: **in 2023, approximately 7.2 million tonnes of oilseed meal were consumed by farm animals in France** (2 million more than in 1993[24]), of which 41% was soy-based, 37% rapeseed-based, 18% sunflower-based and 4% based on various other products[25] (peanuts, flax, cotton, etc.).

The European Union produces nearly 30 million tonnes of oilseed meal annually and consumes 50 million tonnes to feed its livestock. France, Germany, Spain and the Netherlands are the four main users[26].

The rapeseed and sunflower consumed in France are largely grown domestically (although a certain volume is also imported): for several decades, public authorities and major players in the sector have been trying to reduce French livestock farming's dependence on imported proteins, including soya, even though certain oilseeds are particularly suited to certain animals. As a result, France now cultivates vast areas of rapeseed and sunflower, and their oilseed meal has become an important component of animal feed. For example, in thirty years (1993-2023), rapeseed crops in France have increased from 565,000 hectares to 1,345,000 hectares[27].

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20 "Les tourteaux : types et utilisations en alimentation animale", Agryco, 2025: https://www.agryco.com/blog/elevage/tourteaux#:~:text=Oil%20seed%20cake%20is%20an%20ingredient%20used%20in%20cattle%2C%20pig%20and%20sheep%20feed

21 "Importations françaises de matières premières visées par la stratégie nationale de lutte contre la déforestation importée entre 2012-2021", Ministry for Ecological Transition and Territorial Cohesion, 2023: https://www.agryco.com/blog/elevage/tourteaux#:~:text=Oil%20seed%20cake%20is%20an%20ingredient%20used%20in%20cattle%2C%20pig%20and%20sheep%20feed

22 "Importance des protéines animales transformées dans l'alimentation animale", Nutztiergesundheit Schweiz (Livestock Health Switzerland), University of Applied Sciences and Arts, 2023.

23 "La consommation alimentaire", Ministry of Agriculture and Food Sovereignty, 2021: https://agriculture.gouv.fr/infographie-la-consommation-alimentaire

24 "Statistiques Oléagineux & Plantes riches en protéines", Terres Univia, 2023, 2024 edition: https://www.terresunivia.fr/fichiers/publications/recueil-statistiques-2023.pdf

25 *Ibid.*

26 *Ibid.*

27 *Ibid.*

Between July 2023 and June 2024, 4.2 million tonnes of rapeseed were harvested in France and 1.3 million tonnes were imported[28]. Of this total of 5.7 million tonnes, 4.4 million tonnes were used in France (almost entirely for the production of oilseed meal and oil) and 1.2 million tonnes were exported. For sunflower, over the same period, 1.9 million tonnes of seeds were harvested in France and 202,000 tonnes were imported. Of the 2.3 million tonnes, 1.5 million were crushed and 569,000 were exported[29]. However, a considerable proportion of these areas are used to feed livestock or to produce agrofuels, rather than for direct human consumption. In 2017, 1 hectare of rapeseed processed in France produced 500 litres of edible oil, 1,000 litres of oil processed into agrofuel and 1,900 kg of oilseed meal[30].

The intersection between industrialised livestock farming and growth in animal feed consumption.

Thus, **while this desire to limit our imports may seem laudable, it is not accompanied by a reconsideration of the necessary reduction in the production and consumption of industrial meat**. On the contrary, the stabilisation, or even increase, of this production, particularly through the industrialisation of livestock farming, is a key lever in the economic strategy of these companies specialising in animal feed. However, a reduction in production and consumption is essential, both for environmental reasons and for public health and in terms of availability of arable land. Finally, this desire to reduce imports appears to contradict recent public policies which are strongly supported by the main agricultural union[31], which favour the development of livestock farming dependent on imports[32] at the expense of sustainable, economical, autonomous and pastoral models. As a result, French animal production sectors remain heavily dependent on imports.

As regards soya, most of it comes from products imported in the form of already crushed meal. In 2024, **3.1 million tonnes of soya meal** were imported into France[33], mainly from Brazil. A smaller volume of soybeans is also imported in the form of seeds to be crushed locally: in 2023-2024, 402,000 tonnes of soybeans were imported (again, Brazil is the leading exporter) and 331,000 tonnes were collected in France.

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28 Added to this is an initial rapeseed stock of 0.2 million tonnes. Source: "Statistiques Oléagineux & Plantes riches en protéines" (Oilseed & Protein-rich Plant Statistics), Terres Univia, 2023, 2024 edition. https://www.terresunivia.fr/fichiers/publications/recueil-statistiques-2023.pdf

29 *Ibid.*

30 "Let's save French rapeseed", Terres Univia, October 2017.

31 There have been numerous attacks on regulations governing facilities classified for environmental protection (ICPE) in the livestock sector in recent years, particularly in the context of the Duplomb law. Their ultimate goal is to reduce environmental standards and the number of industrial livestock farms subject to these procedures in order to promote the industrialisation of livestock farming. See the note "Industrial livestock farming: the background to the weakening of regulations on facilities classified for environmental protection (ICPE)", part II: "Recent setbacks in regulations on intensive livestock farming."

32 Note "Faced with geopolitical risks, increasing our food autonomy to reduce our agricultural vulnerabilities", *Greenpeace France, Friends of the Earth France, Foundation for Nature and Man, Climate Action Network, April 2025.*

33 French Customs, Imports, CN Code 12019000.

The main factory for crushing imported soya in France is located in Brest. It specialises in the manufacture of oilseed meal for animal feed[34]. It was formerly a Cargill factory until **taken over by Bunge in 2016**[35].

2. The issue of hexane in oilseed meal

Depending on the intended use, the scale of production and concerns about product quality and safety, production methods and results vary. A distinction is made between **oilseed meal extracted by pressing** (see Appendix), without the use of chemicals, and **industrial "48" oilseed meal**, which is produced by chemical extraction (mostly with hexane). The number 48 refers to the high protein yield (46%) and low fat content (2%). **It is the most common type of meal in the animal feed industry**: ruminants, pigs, chickens and fish are fed on it. Organic farming prohibits its use[36] (see Part 3 of the present report).

> Nearly 90% of the oilseed meal produced in France today is produced in factories that use hexane.

In total, according to calculations by Greenpeace, **nearly 90% of oilseed meal produced in France today is produced in factories that use hexane**[37].

The situation is identical, if not even more problematic, for imported oilseed meal: the majority of soybean crushing plants in Brazil use solvents[38]. And hexane is the solvent most commonly used worldwide[39], **including in Brazil**[40].

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34 Presence of the Bunge group in France. https://www.bunge.com/France

35 "Brest. L'usine de soja Cargill du port de commerce vendue à Bunge", Le Télégramme, 2016: https://www.bunge.com/France

36 INAO, Reading Guide, Appendix II, Part V, "Production d'aliments transformés pour animaux »: 2.2: "The processing of any feed material used or processed in organic production using synthetic solvents is prohibited. Organic and non-organic second-press oilseed meal must not have been treated with chemical solvents (such as hexane)."

37 See Methodology. Please note that the capacities of the Boulazac plant, operated by Sanders Périgord, are missing due to the unavailability of data.

38 Abiove, Statistics, Installed capacity, Processing units, 2024.

39 Anibal Demarco, Véronique Gibon, "Overview of the soybean process in the crushing industry", 2020: "*Hexane has maintained the dominant position as a solvent for the major plants which extract oil from seeds.*" Also: https://www.sciencedirect.com/science/article/abs/pii/S0959652619335309

40 Simone C. Miyoshi *et al.*, "Life Cycle Assessment of the Replacement of the Hexane by Ethanol on the Soybean Oil Extraction Process", conférence, 12th European Congress of Chemical Engineering, september 2019: "*Brazil is the second larger soybean producer which oil is traditionally extracted with hexane. The replacement of the hexane by ethanol, that comes from a renewable source.*"

South American soybeans, a disastrous product for the environment[41].

In addition to being extracted with hexane, soybean meal is one of the main drivers of deforestation in South America. The industrialisation of livestock farming and overproduction of meat in certain regions of the world, including Europe, have caused global demand for soybeans to skyrocket. Exporting countries have therefore increased their production, too often at the expense of precious ecosystems. Indeed, the expansion of pastureland for cattle farming and the extension of soybean fields are the main causes of the destruction of South America's forest ecosystems (Amazon, Cerrado, Gran Chaco). Worse still, this deforestation is sometimes accompanied by illegal land grabbing.

Deforestation is not the only problem posed by industrial soybean cultivation: GMO soybeans are widely grown in South America; in Brazil and Argentina, more than 95% of soybeans are genetically modified. Furthermore, its cultivation involves the heavy use of glyphosate and other herbicides and pesticides, some of which are banned in the European Union because they pose serious public health problems and harm biodiversity.

Most South American countries therefore grow this legume in disastrous sanitary, social and environmental conditions to feed industrial livestock farms.

41 "Soja et déforestation", Greenpeace France website: https://www.greenpeace.fr/soja/

C. Hexane losses that end up in our food

At each stage of production, hexane is lost into the atmosphere, into crude oil and into oilseed meal[42]. However, there is **no regulatory authority responsible for monitoring the level of hexane residues in food products, whether imported or produced in Europe**, "*which can lead to dangerous exposure of citizens to this toxic solvent*[43] ."

Only oils undergo a final refining stage (to remove gums, waxes and colour). This also reduces their hexane content, even though theoretically the 1 ppm requirement can be met before the refining stage (in compliance with regulations imposing maximum residual limits of 1 mg/kg for oils[44]). As for the oilseed meal, although it is partially desolventised in the desolventiser-toaster, it still contains hexane residues that are virtually impossible to remove for technical and chemical reasons. As we shall see later, the only regulation that applies to oilseed meal does not specifically relate to hexane but simply to the classification of this substance as a "chemical impurity" (maximum permitted level of 1000 mg/kg, a level well above what is actually practised in the factories currently).

Authorised "losses" are regulated by INERIS (the French National Institute for Industrial Environment and Risks): crushers are allowed to lose 0.7 kg of hexane per tonne of seeds processed[45]. However, **30 to 60% of losses are found in oilseed meal used to feed animals in industrial livestock farms** and 2 to 6% in edible oils[46].

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42 See Solvent management plans for factories using hexane, documents obtained by Greenpeace France through requests for information from prefectures.

43 Cravotto *et al.*, "Towards Substitution ...", *op. cit.*: "*As far as the authors are aware, the hexane content in food products manufactured in Europe is not monitored by any authority, nor is it monitored in imported products, which may lead to dangerous exposure of citizens to this toxic solvent.*"

44 Directive 2009/32/EC of the European Parliament and of the Council of 23 April 2009 on the approximation of the laws of the Member States on extraction solvents used in the production of foodstuffs and food ingredients. https://eur-lex.europa.eu/ legal-content/EN/TXT/HTML/?uri=CELEX:02009L0032-20230216

45 Decree of 27 February 2020 on best available techniques (BAT) applicable to certain classified facilities in the agri-food sector subject to authorisation under headings 3642, 3643 or 3710 of the ICPE nomenclature. https://aida.ineris.fr/reglementation/arrete-270220-relatif-meilleures-techniques-disponibles-mtd-applicables-a-certaines

46 European Commission, JRC Science for Policy Report, Best Available Techniques (BAT) Reference Document for the Food, Drink and Milk Industries, Industrial Emissions Directive 2010/75/EU, 2019. "Hexane losses via meal are generally predominant in the total losses and are typically in the range of 30-60%."

Use of hexane: from industry to consumers' plates

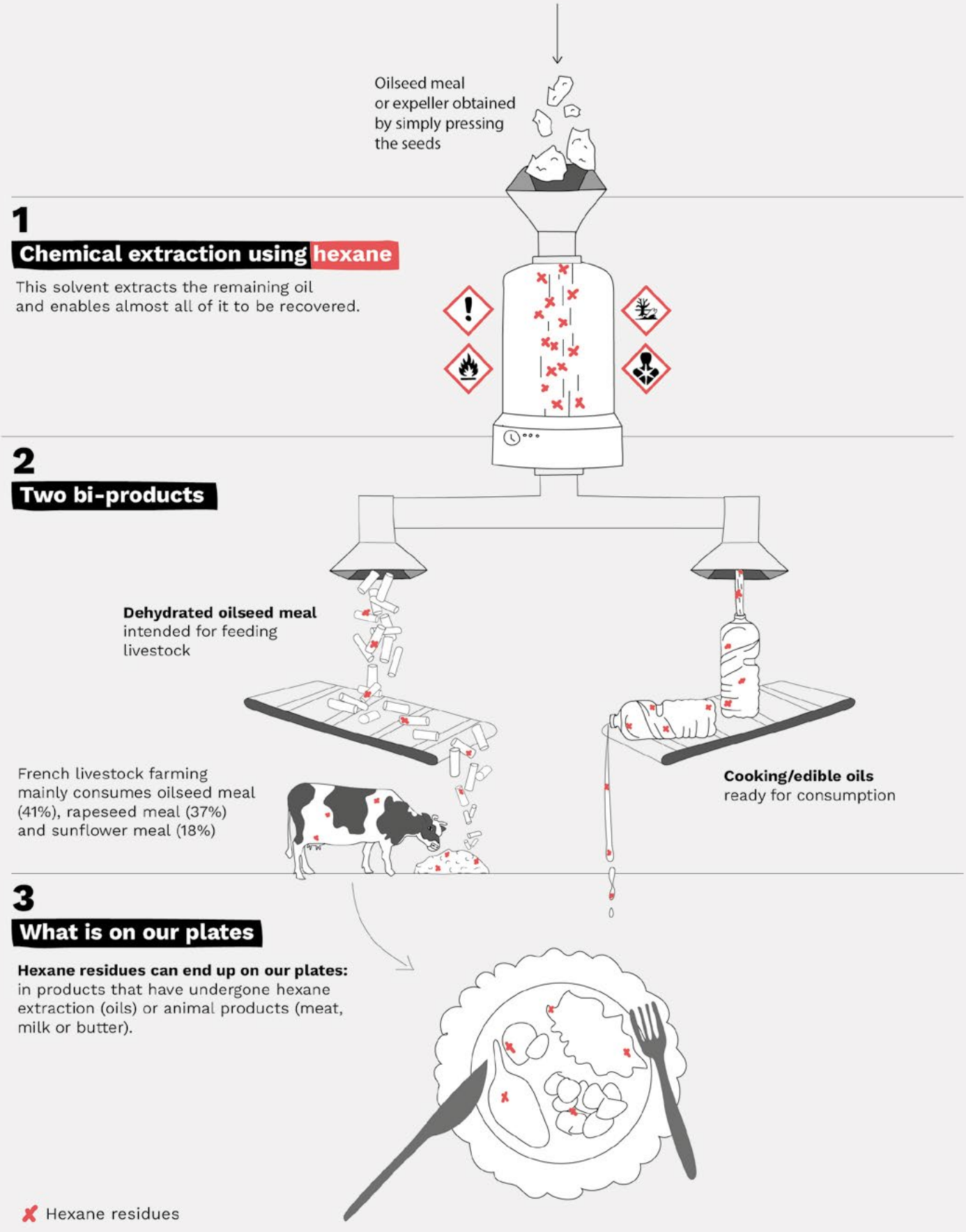

Figure 2 - Use of hexane: from industry to consumers' plates

Hexane losses at the Saipol (Avril group) plant in Le Mériot in 2024[47] :

⟶ In 2024, the factory produced 123,000 tonnes of oil (19% of its food production) and 524,000 of tonnes of oilseed meal (81% of its food production);

⟶ 66 tonnes of hexane ended up in the finished products (oils and oilseed meal), in addition to losses in the environment. Yet this is a modern plant;

⟶ Of these 66 tonnes, 6 tonnes ended up in oils and 60 tonnes in oilseed meal, meaning that **91% of losses in the food chain end up in oilseed meal**.

> Consumers are likely to be exposed to hexane residues in their food by consuming either products that have undergone hexane extraction or animal products.

In practical terms, this means that **consumers are likely to be exposed to hexane residues in their diet by consuming products that have undergone hexane extraction (oils)** or **animal products (meat, milk or butter)** if the animals from which they originate have been fed with oilseed meal obtained by hexane extraction[48].

It should also be noted that, even in hexane-based factories, a first stage allows oils to be obtained by pure pressing **without the use of hexane[49]**: it would be entirely possible for industrial players to use only this pressed oil for human consumption and reserve the oil produced by hexane for non-food uses, **but this is not current practice.**

47 Saipol, "Plan de gestion des solvants, Environnement", Monthly Self-Monitoring Report, 2024.

48 This indirect exposure has not yet been properly studied, but a very recent study by INRAE demonstrates the possibility of exposure to hexane residues through the consumption of non-organic animal products (see Part 2: "L'hexane, un solvant toxique mal régulé - les lacunes criantes de la réglementation sur les produits d'origine animale").

49 Coudray, *De l'essence..., op. cit.* See Chapter 3: "Nous sommes ce que nous mangeons."

Numerous scientific studies[50] have indeed demonstrated the presence of hexane residues in food products such as vegetable oils and margarine. As we will see in the next section, animal products can also be contaminated.

However, **hexane is a toxic solvent**, and **scientists are now warning of the risks to consumers that might result from chronic ingestion through food products**[51].

50 Yousefi, Hosseini, "Evaluation of Hexane Content in Edible Vegetable Oils Consumed in Iran", *JECT*, 2017,1, 27-30 ; Peña *et al.*, "Direct Sampling of Orujo Oil for Determining Residual Hexane by Using a Chemsensor", *J. Am. Oil Chem. Soc.*, 2003, 80, 613-618 ; Michulec, Wardencki, "Determination of Solvents Residues in Vegetable Oils and Pharmaceuticals by Headspace Analysis and Capillary Gas Chromatography", *Chromatographia*, 2004, 60, S273-S277 ; Oh *et al.*, "Headspace Analysis for Residual Hexane in Vegetable Oil", *Food Sci. Biotechnol.*, 2005, 14, 456-460 ; Ligor, Buszewski, "The Comparison of Solid Phase Micrœxtraction-GC and Static Headspace-GC for Determination of Solvent Residues in Vegetable Oils", *J. Sep. Sci.*, 2008, 31, 364-371 ; Ramezani *et al.*, "Dendrimer Grafted Nanoporous Silica Fibers for Headspace Solid Phase Micrœxtraction Coupled to Gas Chromatography Determination of Solvent Residues in Edible Oil", *Anal. Methods*, 2018, 10, 1379-1384 ; Samsuri *et al.*, "Optimization of Residual Hexane in Edible Oils Analysis Using Static Headspace Gas Chromatography", *Int. J. Anal. Chem*. 2021, 1941336 ; Jeong *et al.*, "An Analysis Method for Determining Residual Hexane in Health Functional Food Products Using Static Headspace Gas Chromatography", *Food Sci. Biotechnol*, 2017, 26, 363-368 ; Ito *et al.*, "Analysis of Residual Solvents in Annatto Extracts Using a Static Headspace Gas Chromatography Method", *Am. J. Anal. Chem.*, 2012, 3, 638.

51 Cravotto *et al.*, "Towards Substitution…", *op. cit.* https://www.mdpi.com/2304-8158/11/21/3412: "*Since hexane residues are undoubtedly found in various foods, it seems more than necessary to clearly assess the risks associated with this hidden exposure*" ; "*Given the widespread use of this solvent at the industrial level, chronic exposure to low concentrations could potentially occur via various industrial products, including some foods that have been shown to contain traces of n-hexane, as described in the following section.*"

Part 2

HEXANE, A POORLY REGULATED TOXIC SOLVENT

"What we see today is a significant lack of transparency surrounding the issue of livestock feed, whether it concerns hexane, GMOs or antibiotics. Manufacturers are doing everything they canto ensure that consumers do not ask too many questions about this subject."

Julien-Boris Pelletier,
Director of Moulin Marion[52].

There is no transparency surrounding how oils are produced. Extraction using hexane, a neurotoxic solvent, is an absolute scandal in this regard: for sixty years, people have believed that sunflower oil, for example, is pure sunflower 'juice', when in fact it is a highly processed oil that contains hexane residues. Consumers have the rightto know what they are having!

Sébastien Loctin,
Founder of Biofuture
and former executive in the oil industry[53].

52 Greenpeace France interview with Julien-Boris Pelletier, director of Moulin Marion, miller and manufacturer of organic animal feed, 26 June 2025. See Methodology.

53 Interview by Greenpeace France with Sébastien Loctin. See Methodology.

A. What is hexane?

1. A petrochemical solvent not listed on any labels

Hexane is a petrochemical solvent. The general public and consumers have never heard of it because **the solvent is not considered to be an ingredient per se but a processing aid**, as an extraction solvent[54]. A processing aid "is a substance used in the manufacturing process of 'processed foodstuffs' to fulfil a certain technological purpose during processing or transformation. **The substance used must no longer be present in the finished product, except unintentionally and in the form of technically unavoidable residues**. As such, it is not included in the list of ingredients, unlike additives. These technically unavoidable residues may **only** be present **if they do not pose any health risk and have no technological effect on the finished product[55]."**

As a result, hexane is not subject to any **labelling requirements** and is therefore not listed on the packaging of consumer products[56]. This is extremely **problematic in terms of transparency and the consumer's right to information**, as they have no way of knowing whether this product is present in the food they consume. This transparency is, however, essential because hexane has been scientifically recognised as hazardous to health for some time. It **is a proven neurotoxic solvent, suspected of being reprotoxic[57] and a potential endocrine disruptor[58] that puts us at risk but which, because it is not talked about, escapes our attention.**

54 In Europe, hexane is listed in directive 2009/32/EC (see note 44). Twenty solvents (7 gaseous and 13 liquid) are listed in this directive.

55 Regulation (EC) No. 1333/2008 of the European Parliament and of the Council of 16 December 2008 on food additives; Ministry of Agriculture and Food Sovereignty, "Qu'est-ce qu'un auxiliaire technologique?", 24 October 2024.

56 Regulation (EU) No. 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, Article 20, "Omission de constituants d'une denrée alimentaire de la liste des ingrédients."

57 ANSES, "Profil toxicologique du *n*-hexane (n° CAS 110-54-4)", Collective expert report, May 2014.

58 ANSES, " L'Anses publie ses recommandations en vue de réduire l'exposition à cinq substances reprotoxiques et/ou perturbatrices endocriniennes", 2014; *Cravotto et al.*, "Towards Substitution..", *op. cit.*

2. The variable composition of hexane: a challenge for hazard assessment

Hexane is a mixture of hydrocarbons derived from the distillation of crude oil, listed in the European Directive[59] as an authorised extraction solvent, and defined as a "commercial product consisting mainly of saturated acyclic hydrocarbons containing six carbon atoms and distilling between 64° and 70°."

To fully understand the issues surrounding hexane, it is essential to understand the specific nature of its chemical composition, which distinguishes it from other extraction solvents. Unlike other solvents, **hexane is not a pure molecule, but a variable chemical mixture**.

In chemistry, substances that share the same molecular formula (in this case $\mathbf{C_6H_{14}}$) but have a different arrangement of atoms in the molecule are called isomers. **This variation in structure often gives them distinct physical and toxicological properties.** Each chemical substance is identified by a unique CAS (Chemical Abstracts Service) number.

The term "hexane" actually refers to **a family of five different isomers:** *n*-hexane; 2-methylpentane; 3-methylpentane; 2,2-dimethylbutane; and 2,3-dimethylbutane. Of these, **pure *n*-hexane (CAS 110-54-3) is the most concerning from a health perspective, particularly due to its proven neurotoxicity** (see next section). It is registered under the REACH Regulation[60], for volumes between 1,000 and 10,000 tonnes per year in the European Economic Area[61].

Explosion risks endanger workers

Due to its chemical composition, **hexane is a highly explosive and flammable solvent**[62]: according to Anne-Laure Barral's investigation for Radio France, a simple electrostatic friction of hair can cause it to ignite[63]. Thus, when hexane is handled during industrial processes, explosive vapours can form and expose workers in the sectors to explosion hazards. According to the ARIA ministerial database listing industrial risks, **more than a hundred serious or even fatal accidents in recent decades have been linked to hexane**[64].

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59 Directive 2009/32/EC (see note 44).

60 Identity card for 6-carbon hydrocarbons (n-alkanes, iso-alkanes, cyclics) enriched in *n*-hexane from ECHA. https://echa.europa.eu/registration-dossier/-/registered-dossier/16191

61 European Union, Iceland, Norway, Liechtenstein, Switzerland.

62 Report by the Industrial Risk and Pollution Analysis Office for the Ministry of Ecological and Solidarity Transition: " La fabrication des huiles végétales: une activité à risques", 2018. https://www.aria.developpement-durable.gouv.fr/wp-content/uploads/2019/02/La-fabrication-des-huiles-végétales-VP-Vpublicfinale-2.pdf

63 "L'hexane: un résidu d'essence bien présent dans nos assiettes", Radio France Investigation Unit, 2025. https://www.radiofrance.fr/franceinter/podcasts/secrets-d-info/secrets-d-info-du-samedi-24-mai-2025-7578771

64 *Ibid.*

In February 2018, **two technicians were killed in Dieppe**, at the Saipol site, a subsidiary of Avril (see Part 4). Two workers aged 25 and 44, employed by a maintenance company (SNAD), had been called in to clear a section of the hexane extraction circuit where seed residues had accumulated. Due to the levels of hexane in the air, a spark caused the machine to explode, killing both men.

In March 2025, **Saipol and SNAD were found guilty of "corporate manslaughter in the workplace."** The aggravating circumstance of "deliberate violation of specific safety and security obligations by the employer" was upheld by the court. Saipol was fined €250,000 and SNAD €150,000[65]. The company did not appeal the court's decision. A worker who was present on site on the day of the accident testified on France Inter radio: "We should never have done that job. We were really in a hurry, it had to be up and running again quickly. **They lose money when a factory like this is shut down."**

During the trial last March, Gérald Le Corre, head of occupational health issues at the CGT trade union in Seine-Maritime, pointed out: "Hexane can be eliminated without difficulty because there are alternatives. Yields may be lower, **but the basic principle of risk prevention is to eliminate a product that is extremely dangerous for employees**[66]."

In the food industry, particularly for the extraction of vegetable oils, what is known as **technical hexane** or commercial hexane is used[67]. This is not an isolated isomer but a mixture of hydrocarbons, mainly composed of *n*-hexane (between 50 and 85%[68]), accompanied by other isomers and compounds derived from petroleum.

The exact composition of this technical hexane depends on the type of crude oil used as raw material, as well as the refining processes employed[69]. In total, the products sold as "Technical hexane" from different suppliers[70] can have very different chemical profiles: i**n addition to the main component, *n*-hexane, it is a poorly defined mixture of isomers whose composition varies depending on its origin.** This type of hexane, also known as "hydrocarbons", "C5-C7", "n-alkanes", "isoalkane" and "*n*-hexane rich", can therefore refer to several types of substances[71] without having a unique CAS number[72].

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65 "Explosion mortelle à Dieppe: l'usine Saipol et la Snad condamnées pour homicides involontaires", France Bleu, March 2025: https://www.francebleu.fr/infos/faits-divers-justice/explosion-mortelle-a-dieppe-l-usine-saipol-et-la-snad-condamnees-pour-homicides-involontaires-5624855

66 "L'hexane : un résidu d'essence bien présent dans nos assiettes", Radio France, May 2024: https://www.radiofrance.fr/franceinter/podcasts/secrets-d-info/secrets-d-info-du-samedi-24-mai-2025-7578771

67 A description of this "technical hexane" used for food applications can be found under EC number 925-292-5 in the classification European REACH12, which states that the "hexane" in question is a combination of structures mainly C6, mainly CnH2n+2 and CnH2n. In other words, the hexane used in crushing plants is not a pure isomer but a mixture of hydrocarbons rich in *n*-hexane.

68 *Ibid.* ; Fereidoon Shahidi, *Bailey's Industrial Oil and Fat Products*, John Wiley & Sons, Hoboken, USA, 2005.

69 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

70 In Europe and the United States, the main oil and gas companies that produce hexane are The Royal Dutch Shell Company, TotalEnergies SE and Exxon Mobile Corp. In addition, there are many specialty petrochemical producers that produce hexane, such as Phillips66 (see https://products.phillips66.com/solvents/hexane-s/ and https://products.phillips66.com/ solvents/applications/seed-oil-extraction/).

71 *N*-hexane, naphtha or hydrotreated light distillate.

72 ECHA's identity card for 6-carbon hydrocarbons (n-alkanes, iso-alkanes, cyclics) enriched with *n*-hexane. https://echa.europa.eu/fr/registration-dossier/-/registered-dossier/16191

> *"This lack of information does not allow for a complete assessment of the risk posed by exposure to hexane."*
>
> **European Food Safety Authority**

This lack of a rigorous definition of hexane, in its use for oilseed crushing, makes it extremely difficult to identify its precise composition and **raises major questions in terms of toxicological assessment**. Each isomer has specific properties, and their combination leads to varying health risks. In addition, commercial hexane may contain impurities, including benzene and toluene, two compounds known for their toxicity.

The EFSA warns: "This lack of information does not allow for a complete assessment of the risk posed by exposure to hexane[73]."

The recognition of benzene as a carcinogen and mutagen since the 1980s has led manufacturers to adapt their processes to reduce its presence[74]. Regulatory limits set the maximum permitted concentration of benzene residues at 1,000 mg/kg of solvent[75]. However, these standards are not applied globally, and their application varies depending on the supplier. As for toluene, there are currently no regulatory limits on its concentration in this type of solvent, even though it is also a toxic compound[76].

The lack **of** transparency surrounding the exact composition of technical hexane is all the more concerning given that this mixture can contain up to **85% pure *n*-hexane** for the manufacture of food-grade products.

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73 Authority (EFSA) *et al.*, "Technical Report on the Need for Re-Evaluation of the Safety of Hexane Used as an Extraction Solvent in the Production of Foodstuffs and Food Ingredients", EFSA Supporting Publications 21, n° 9, 2024, 9001. https://www.efsa.europa.eu/en/supporting/pub/en-9001: "*This lack of information does not allow a complete assessment of the risk posed by the exposure to technical hexane.*"

74 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

75 "Standard Specification for Commercial Hexanes", ASTM (Advancing Standards Transforming Markets), 2021. https://www.astm.org/d1836-07r21.html

76 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

B. An alarming toxicological assessment

> ***"n-hexane is primarily known to be a neurotoxic and CMR [carcinogenic, mutagenic, reprotoxic] substance because it is suspected of impairing fertility, is toxic to aquatic species with lasting effects, and is suspected to be an endocrine disruptor.***
>
> ***In addition to this main compound, hexane may also contain other hexane isomers, cyclic hydrocarbons such as cyclohexane, or even aromatics such as toluene and benzene[77].***
>
> **Christian Cravotto *et al.***

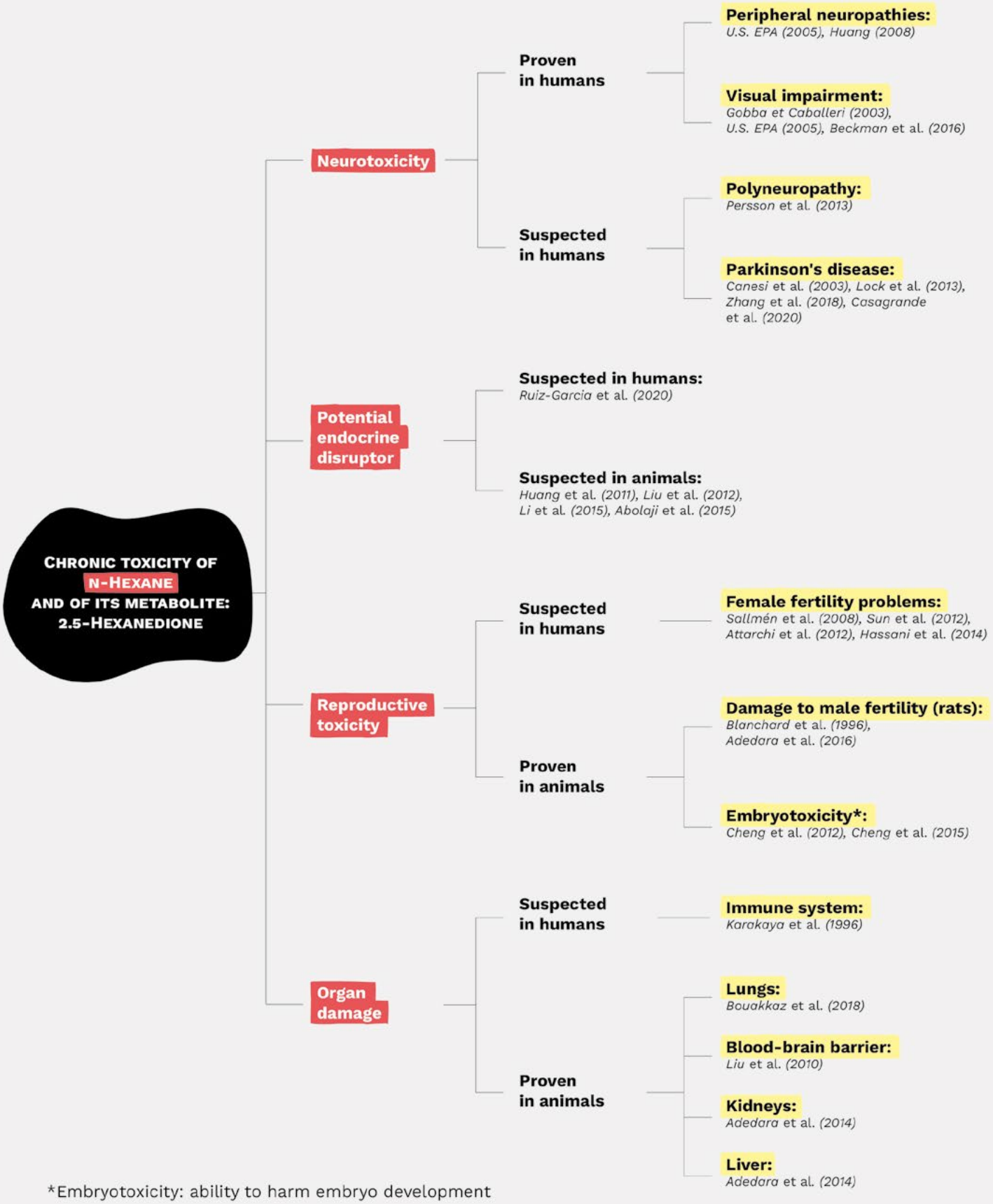
According to ECHA, the European Chemicals Agency[78], *n*-hexane presents:

- → a proven risk of toxicity in case of inhalation and chronic exposure;
- → a suspected risk of toxicity to reproduction and organs in the event of repeated or single exposure;
- → a risk of skin irritation.

The same agency **recognises hexane as a category 2 CMR substance (carcinogenic, mutagenic, reprotoxic)[79]**. ANSES (the French Agency for Food, Environmental and Occupational Health & Safety) has confirmed **its neurotoxic effects**[80] and the INRS (the French National Research and Safety Institute) has highlighted **the risk of peripheral neuropathies** linked to occupational exposure to hexane[81].

77 *Ibid.*
78 ECHA website: https://echa.europa.eu//home
79 ECHA, "Substance Infocar, *n*-hexane", https://echa.europa.eu/es/substance-information/-/substanceinfo/100.003.435
80 Anses, "Profil toxicologique du *n*-hexane...", *op. cit.* ; "Valeur toxicologique de référence chronique par voie respiratoire pour le *n*-hexane", 2014. https://www.Anses.fr/fr/system/files/SUBCHIM2013sa0070Ra.pdf
81 INRS, "Fiche toxicologique de l'hexane", 2019. https://www.inrs.fr/publications/bdd/fichetox/fiche.html?refINRS=FICHETOX_113

Summary of the main health studies on hexane and their conclusions



*Embryotoxicity: ability to harm embryo development

Diagram adapted and adopted from Crovotto et al..

Figure 3 - Summary of the main health studies on hexane and their conclusions

A solvent toxic for workers

Before the issue of exposure to the solvent through consumption arose, its harmful effect on workers was already well known. As early as the 1970s, exposure to hexane was listed as a cause of occupational diseases in several European countries, including France[82] (1973).

Its **toxicity has therefore been officially recognised for more than fifty years.** Workers in shoe factories, paint factories and oil mills exposed to high doses suffered from paralysis of the arms, dizziness and vomiting. In 1980, a survey of workers at an animal feed factory, Ralston Purina, in the United States showed that more than half of them had eye and nose irritation and headaches[83]. In 2009, **137 workers were poisoned by hexane and benzene vapours in Chinese factories subcontracting for the Apple group. Four of them died**[84]. This scandal led the multinational to stop using hexane-based cleaners for its iPhone screens.

Thus, **much of the scientific knowledge on the toxicity of hexane has been obtained by documenting the effects of this substance on workers' health, and therefore the dangers of inhalation or skin absorption.** This highlights the dangers that manufacturers pose to workers in their factories. At the same time, it explains the lack of more specific data on food consumption.

Nevertheless, it should be noted that **the way in which standards governing occupational exposure to toxic substances, particularly hexane, have been defined** is also criticised in scientific literature. In a 1999 article, neurology researcher Douglas J. Lanska explains: **"The exposure values defined are not based strictly on health considerations but rather reflect the levels of exposure considered to be workable in industry when they were adopted** [...]. The exposure values were strongly influenced by corporate interests[85]." This research highlights that workers are not sufficiently protected against the toxicity of the products they handle.

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82 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

83 "L'hexane : un résidu d'essence...", *op. cit.*

84 "Apple n'utilisera plus ni benzène ni *n*-hexane sur ses chaînes d'assemblage", *Techniques de l'ingénieur*, 2014. https://www.techniques-ingenieur.fr/actualite/articles/apple-nutilisera-plus-ni-benzene-ni-*n*-hexane-sur-ses-chaines-dassemblage-16729/

85 Lanska, "Limitations of Occupational Air Contaminant Standards, as Exemplified by the Neurotoxin N hexane", *Journal of Public Health Policy*, vol. 20, n° 4, 1999. https://www.jstor.org/stable/3343130: "*TLVs are not based strictly on health considerations, but instead reflects levels of exposure considered to be achievable in industry at the time the limits were adopted*" ; "*The ACGIH standards reflect a compromise between health considerations and perceived industrial feasibility (as generally determined by economic rather than technological considerations)*" ; "*TLVs were heavily influenced by corporate vested interests by (1) giving corporate representatives primary responsibility for reviewing documentation for their own company's products, (2) relying on unpublished and unreviewable corporate data on health effects of chemicals, and (3) allowing or fostering a [conflict of interest in] committee membership*" ; "*TLVs were often found to represent the prevailing exposure levels in major firms, rather than the levels at which no adverse health effects are reported.*"

1. Hexane, a proven neurotoxic solvent

Due to the high prevalence of n-hexane[86] in its composition, hexane is widely recognised as a **powerful neurotoxin** by several scientific organisations, particularly **for humans exposed to it in the workplace.** As the EFSA points out that: "Technical hexane has been used in various industrial sectors. [...] The toxicity of its main component, n-hexane, has therefore been extensively studied in humans and animals following exposure by inhalation and skin contact[87]." **The lack of scientific studies on the neurotoxicity of hexane when ingested is extremely problematic,** given that we consume hexane on a daily basis: one of the few studies on the subject of ingestion, conducted on rats, clearly shows that hexane can have neurotoxic effects through ingestion, particularly due to its toxic metabolite, 2,5-hexanedione[88].

> The lack of scientific studies on the neurotoxicity of hexane when ingested is extremely problematic.

The nervous system is the main target of *n*-hexane toxicity. Chronic exposure can cause sensory-motor polyneuropathies or peripheral polyneuritis[89] simultaneously affecting a large number of peripheral nerves throughout the body. Symptoms include muscle weakness, tingling sensations, numbness, decreased sensitivity, vision problems, headaches, pronounced fatigue, and muscle weakness that can lead to respiratory failure – otherwise known as polyneuropathy[90].

The link between ***prolonged exposure to n-hexane and the onset of peripheral neuropathies in exposed workers has been clearly demonstrated by scientific studies***[91], and by the US Environmental Protection Agency[92] (EPA). In addition, chronic exposure to *n*-hexane can also cause colour vision impairment[93].

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86 It is mainly the metabolite 2,5-hexanedione that is responsible for the toxicity of *n*-hexane in humans. Anses, " Profil toxicologique du *n*-hexane..", op. cit.

87 Authority (EFSA) *et al.*, "Technical Report on the Need for Re-Evaluation of the Safety of Hexane Used as an Extraction Solvent in the Production of Foodstuffs and Food Ingredients."

88 Krasavage, *et al.,* "The Relative Neurotoxicity of Methyl-n-Butyl Ketone, *n*-Hexane and Their Metabolites", *Toxicol. Appl. Pharmacol.* 1980, 52, p. 433-441. Cité *in* Cravotto *et al.*

89 Picot, "Approche chimique de la toxicologie", L'Actualité chimique, 1993. https://new.societechimiquedefrance.fr/wp-content/uploads/2019/12/1993-177-oct-nov-p51-securite_et_prevention.pdf

90 Rubin, "Présentation des causes et symptômes de la polyneuropathie", The MSD Manual, 2024. https://www.msdmanuals.com/fr/accueil/disorders-of-the-brain-spinal-cord-and-nerves/peripheral-nerve-diseases-and-related-diseases/polyneuropathy

91 Huang, "Polyneuropathy induced by *N*-hexane Intoxication in Taiwan", *Acta Neurol. Taiwanica,* 2008, 17, p. 3-10.

92 "Toxicological Review of *N*-Hexane", *N*-Hexane Casrn 110-54-3|Dtxsid0021917|Iris|US EPA, Ord. 2005.

93 Gobba, Cavalleri, "Color Vision Impairment in Workers Exposed to Neurotoxic Chemicals", *NeuroToxicology* 2003, 24, p. 693-702.

In addition, *n*-hexane could play **a significant environmental role**[94] **in the development of Parkinson's disease,** a neurodegenerative disorder characterised by motor symptoms. The number of people affected by this disease could reach 12 million by 2040[95]. A scientific study observed that Parkinson's patients have a reduced ability to metabolise 2,5-hexanedione (2,5-HD), the main neurotoxic metabolite of *n*-hexane[96]. This reduced ability could be a risk factor for the development of the disease. Similarly, a study conducted by C. Zhang et al. in 2018 demonstrated that 2,5-HD causes neurodegeneration in rats[97]**. This result points to a role for *n*-hexane in the aetiology of Parkinson's disease.**

These results highlight the importance of limiting environmental exposure to *n*-hexane in order to prevent neurodegenerative disorders. It also appears necessary to take into greater account what are known as "windows of exposure", i.e. periods of particular sensitivity for the body: **puberty, the postnatal period and, specifically, pregnancy.**

2. Hexane: a potential endocrine disruptor

Hexane is suspected of being an endocrine disruptor[98] in both animals and humans. *N*-hexane appears to disrupt the female reproductive hormone system, particularly by altering progesterone levels[99]. Its metabolite, 2,5-HD, may influence follicle-stimulating hormone levels[100]. These observations suggest that ***n*-hexane could be an endocrine disruptor, particularly for women of childbearing age.**

> *n*-hexane appears to disrupt the female reproductive hormone system, particularly by altering progesterone levels.

94 Zhang et al., "2,5-Hexanedione Induces Dopaminergic Neurodegeneration through Integrin AMβ2/NADPH Oxidase Axis-Mediated Microglial Activation," Cell Death Dis. 2018, 9, 60; Casagrande et al., "The Imbalance between Dynamic and Stable Microtubules Underlies Neurodegeneration Induced by 2,5-Hexanedione," Biochim. Biophys. Acta (BBA)-Mol. Basis Dis. 2020, 1866, 165581; Canesi et al., "Poor Metabolisation of *N*-Hexane in Parkinson's Disease," J. Neurol. 2003, 250, pp. 556-560.

95 Dorsey et al., "The Emerging Evidence of the Parkinson Pandemic," J. Park. Dis. 2018, 8, S3-S8.

96 Canesi et al., "Poor Metabolisation..", op. cit.

97 Zhang et al., "2,5-Hexanedione..", op. cit.

98 The WHO defines an endocrine disruptor as "an exogenous substance or mixture that alters the function(s) of the endocrine system and consequently causes adverse health effects in an organism, its progeny, or (sub)populations."

99 Huang *et al.*, "The Impact of *N*-Hexane on the Secretion of Mouse Estrogen and Progesterone", *Adv. Biosci. Biotechnol.* 2011, 2, p. 429-433 ; Liu *et al.*, "The Effect of *N*-Hexane on the Gonad Toxicity of Female Mice", *Biomed. Environ. Sci. BES,* 2012, 25, p. 189-196.

100 Salamon *et al.*, "Possible Role of *N*-Hexane as an Endocrine Disruptor in Occupationally Exposed Women at Reproductive Age", *Toxicol. Lett.,* 2020, 330, p. 73-79.

In 2020, a study[101] highlighted that women of childbearing age who were occupationally exposed to a mixture of volatile organic compounds, of which hexane was the main compound, experienced significant hormonal disturbances compared to unexposed women.
These disruptions included an increased prevalence of oligomenorrhoea (abnormally spaced menstrual cycles) and a decrease in fertility[102].

3. Hexane is suspected of being reprotoxic

Several studies suspect that exposure to mixtures of organic solvents, including *n*-hexane, which is harmful to female and male fertility, and therefore to human reproduction. The ECHA also states that *n*-hexane "is suspected of impairing fertility or the unborn child[103]." Scientists suspect that hexane poses significant risks to human reproduction. Firstly, occupational exposure to organic solvents may increase the risk of spontaneous abortion (or miscarriage[104]). Secondly, animal studies have shown that inhalation of *n*-hexane can lead to a reduction in the number of growing oocytes and fertility in female mice[105] and severe testicular damage in male rats[106] which can lead to irreversible atrophy[107]. Other physical changes were observed for up to fourteen months after exposure ceased[108]. The INRS concludes in its toxicological dossier that *n*-hexane causes chromosomal aberrations and sperm abnormalities in rats after exposure by inhalation[109].

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101 *Ibid.*

102 Sallmén *et al.*, "Reduced Fertility among Shœ Manufacturing Workers", *Occup. Environ. Med.* 2008, 65, p. 518-524 ; Attarchi *et al.*, "Assessment of Time to Pregnancy and Spontaneous Abortion Status Following Occupational Exposure to Organic Solvents Mixture", *Int. Arch. Occup. Environ. Health* 2012, 85, p. 295-303.

103 ECHA, Substance information, *n*-hexane. https://echa.europa.eu/fr/substance-information/-/substanceinfo/100.003.435

104 Ruiz-García *et al.*, "Possible Role of *N*-Hexane as an Endocrine Disruptor in Occupationally Exposed Women at Reproductive Age", *Toxicol. Lett.* 2020, *330*, p. 73-79 ; Sallmén *et al.*, *op. cit.* ; Attarchi *et al.*, *op. cit.*

105 Liu *et al.*, *op. cit.* ; Mast *et al.* "Inhalation developmental toxicology studies: Teratology study of *n*-hexane in mice: Final report", may 1988. https://doi.org/10.2172/6936329

106 Richburg *et al.*, "The Sertoli Cell as a Target for Toxicants", *in* Charlene McQueen (dir.), *Comprehensive Toxicology*, Amsterdam, Elsevier, 2018.

107 Nylén *et al.*, "Testicular atrophy and loss of nerve growth factor-immunoreactive germ cell line in rats exposed to *n*-hexane and a protective effect of simultaneous exposure to toluene or xylene", *Arch Toxicol.*, 1989. https://doi.org/10.1007/BF00278643

108 Blanchard *et al.*, "Fate of Germ Cells in 2,5-Hexanedione-Induced Testicular Injury: I. Apoptosis Is the Mechanism of Germ Cell Death", *Toxicol. Appl. Pharmacol.* 1996, 137, p. 141-148.

109 INRS, "Fiche toxicologique de l'hexane", *op. cit.*

Furthermore, the potential impact of hexane ingestion on **foetal and infant neurodevelopment is another source of concern.** Following animal studies, Scientists have demonstrated that *n*-hexane can cross the placental barrier. **This means that 2,5-HD can be found in the foetus after maternal exposure,** according to studies on rats[110]. Experts are particularly concerned about the embryotoxic effects of *n*-hexane, especially during the intrauterine neurodevelopment phase when the nervous system of the foetus and then the infant is being built, and in the months following birth. Studies on chicken embryos have shown that chronic exposure to the metabolite 2,5-HD can cause **fatal morphological abnormalities in the central nervous system**[111], as well as other malformations unrelated to the nervous system[112]. In the study on rats exposed to *n*-hexane, scientists showed that once it crosses the placental barrier, **the metabolite 2,5-HD is found in the foetus**[113]. Finally, other toxicological studies have shown that chronic exposure to *n*-hexane can also have consequences for other organs such as the lungs[114], liver, and kidneys[115].

It should also be noted that, due to the classification of *n*-hexane as a category 2 reprotoxic substance, in 2014, the ANSES recommended that pregnant women avoid using any DIY, cleaning and repellent products that contain *n*-hexane[116].

Hexane, and particularly *n*-hexane, thus poses a major threat to human health. Its powerful neurotoxic effect, well documented by scientific studies and confirmed for over fifty years, seriously affects the peripheral nervous system and can contribute to the development of occupational diseases such as neuropathies. It may even be associated with the development of Parkinson's disease. At the same time, hexane is also suspected of being an endocrine disruptor. As far as animals are concerned, its reprotoxic effect has been confirmed by research on rats showing serious damage to fertility and foetal development: in rats, it crosses the placental barrier and is distributed throughout the foetus without any preferential site. Finally, potential alterations affecting other vital organs in animals reinforce the urgency of limiting worker and consumer exposure to hexane.

110 Bus *et al.,* "Perinatal Toxicity and Metabolism of *N*-Hexane in Fischer-344 Rats after Inhalation Exposure during Gestation", *Toxicol. Appl. Pharmacol.* 1979, 51, p. 295-302. https://www.sciencedirect.com/science/article/abs/pii/0041008X79904721

111 Cheng *et al.,* "Effects of 2,5-Hexanedione on Angiogenesis and Vasculogenesis in Chick Embryos", *Reprod. Toxicol.* 2015, *51,* p. 79-89.

112 Cheng *et al.*, "Exposure to 2,5-Hexanedione Can Induce Neural Malformations in Chick Embryos", *NeuroToxicology* 2012, 33, p. 1239-1247.

113 Bus *et al.*, "Perinatal Toxicity...", *op. cit.*

114 Bouakkaz *et al.*, "Pulmonary Toxicity Induced by *N*-Hexane in Wistar Male Rats After Oral Subchronic Exposure", *Dose-Response,* 2018.

115 Adedara *et al.*, "Impairment of Hepatic and Renal Functions by 2,5-Hexanedione Is Accompanied by Oxidative Stress in Rats", *J. Toxicol.* 2014, p. 239-240.

116 "L'Anses publie ses recommandations en vue de réduire l'exposition à cinq substances reprotoxiques et/ou perturbatrices endocriniennes", Anses, 2014. https://www.anses.fr/fr/content/lanses-publie-ses-recommandations-en-vue-de-reduire-lexposition-cinq-substances

C. Health standards that protect industrial interests

1. Industrial logic, at the expense of the precautionary principle

The definition of MRLs (maximum residue limits) for oils dates back to 1996 and is based on studies that are now considered insufficient

The European directive on extraction solvents such as hexane takes into account the possible presence of residues in food. Indeed, the directive states that "an extraction solvent is understood to mean a solvent used in the extraction process during the processing of raw materials, foodstuffs, components or ingredients thereof", **which is eliminated and which may cause the unintentional but technically unavoidable presence of residues or derivatives in the foodstuff or ingredient**[117]." However, this directive "considers that an extraction solvent is used in accordance with good manufacturing practice **if its use only leads to the presence of residues or derivatives in technically unavoidable quantities that do not pose a risk to human health**[118]."

Yet, according to the specialist literature, **it cannot be stated that hexane residues in foodstuffs do not pose a risk to human health[119].**

With regard to oils, the current MRLs date from 1996 and were established by the SCF[120] (Scientific Committee on Food, the predecessor of the EFSA). To define these values, the committee had access to the presentation of a 90-day study conducted on rats, "as well as the analysis of this study by its authors[121]." This study, along with others cited by the SCF concerning hexane, was presented by industry representatives: FEDIOL[122] and CEFIC[123].

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117 Directive 2009/32/EC (see note 44).
118 *Ibid.*
119 Cravotto *et al.*, "Towards Substitution...", *op. cit.*
120 European Commission, "Food science and techniques", Reports of the SCF, 35th series, 1996.
121 *Ibid.* "*The Committee has now had the opportunity to evaluate the original slides from the 90-day toxicity study together with an additional analysis by the study author.*"
122 EU Vegetable Oil and Proteinmeal Industry: lobby group for the vegetable oil and protein meal industry.
123 European Council of the Chemical Industry: European chemical industry lobby.

It was this study that enabled SCF regulators to define a no observable adverse effect level (NOAEL)[124] used as the basis for subsequently setting MRLs. With regard to oils, an MRL of 1 mg/kg, lower than the previous level, was also set, as manufacturers were able to reduce levels to this limit[125]. However, for other products, they requested that the limits then in force be maintained, "while providing only incomplete data on actual residues[126]." Thus, it was by calculating the estimated daily quantities that an individual would consume for each of the products containing hexane, with the established NOAEL, that the SCF obtained the MRLs still in force, namely: 1 mg/kg for cocoa oils and butter, 10 mg/kg for protein products and defatted flours, 5 mg/kg for defatted cereal germ preparations and 30 mg/kg in defatted soy products sold to consumers.

There are serious questions about the method used to establish these MRLs. First, **they seem to give considerable weight to the capabilities of industry,** and second, the use of a 90-day study is questionable. In any case, it is important to note that in 2024, EFSA[127] concluded that "the information provided by the 90-day study on rats taken into account by the SCF **was no longer considered sufficient to adequately conclude on the safety of technical hexane." This means that, even where regulations exist for hexane, it is now insufficient to assess the real danger posed by these products.**

Given the abundance of scientific data on the risks posed by *n*-hexane, how is it possible that industrial crushers and regulatory agencies do not subject products obtained through hexane treatment to satisfactory health standards that would protect citizens' health?

124 In English, NOEL: No Observed Effect Level.

125 European Commission, "Food science...", *op. cit.* : "*The Committee has been informed that for fats and oils, residues of less than 1 mg/kg can now be achieved.*"

126 *Ibid.* : "*With respect to the remaining categories of foodstuffs, industry has asked that the existing legal limits be maintained but has provided only imprecise information concerning actual residues.*"

127 Authority (EFSA) *et al.*, "Technical Report...", *op. cit*.

Summary table on the quality of current regulations on the conditions for using hexane in the agri-food sector in Europe

Conditions of use	Regulatory limits in place for foodstuffs and ingredients (Directive 2009/32/EC)	Examples of mass-market products concerned	What is the problem?
Production or fractionation of oil fats and production of cocoa butter.	MRL (Maximum Residue Limit): 1 milligram per kilogram (mg/kg).	All oils except those labelled "virgin" or "first pressing": sunflower, rapeseed, soybean, palm kernel, palm (if fractionated), grape seed, wheat germ, peanut, walnut, rice bran, cotton, safflower, borage, evening primrose, etc. Also includes cocoa butter, margarine and lecithins.	**These MRLs are taken from a 1996 SFC report that is now being questioned by the EFSA[128].** **ANSES states that hexane could have an impact on health even at very low doses[129]. However, no tolerable daily intake (TDI) is currently in force[130].** **A scientific article summarising the knowledge acquired on hexane states that its oral toxicity has not yet been fully characterised, as confirmed by the absence of an officially recognised reference dose for chronic oral exposure[131].** **The exposure levels taken into account in the 2009 directive are questioned by the EFSA[132] and several scientific articles[133].**
Preparation of products based on proteins and defatted flours.	MRL: 10 mg/kg in foodstuffs containing the defatted protein product and defatted meal.	Non-organic soy proteins, soy isolate, soy concentrate, defatted soy flour, defatted cocoa, etc. incorporated into products such as conventional soy steak or sausage.	
	MRL: 30 mg/kg in defatted soy products, as sold to the end consumer.	Non-organic soy protein, soy isolate, soy concentrate, defatted soy flour, defatted cocoa, non-organic wheat germ.	
Defatted cereal germ preparation.	MRL: 5 mg/kg in defatted cereal germ.	Non-organic wheat germ.	
Preparation of flavourings from natural flavouring substances.	MRL: 1 mg/kg in foodstuffs.	Rosemary extracts, oleoresin from various products. Certain vanilla extracts, roasted peanut flavouring, cocoa flavouring (certain fatty extracts), coffee flavouring (oily roasting extract), etc.	
Production of oilseed meal for animal feed.	**Threshold above which an impurity (hexane or other) must be indicated in the product's composition: 1,000 mg/kg.** (EU Commission Regulation No. 68/2013).	Meat, milk, infant milk, eggs, etc.	**The value of 1,000 mg/kg is not an MRL but only the threshold above which an impurity must be indicated in the composition of the product.** **This threshold is identical for all chemical, plant or mineral impurities present in oilseed meal and is not specific to hexane.** **The presence of hexane in animal products (from livestock fed with oilseed meal containing hexane) is not subject to any regulations, even though analyses carried out by INRAE and others presented in this report by Greenpeace confirm its presence in these foods.** **In the absence of a TDI validated by the health authorities, any dose is problematic.** **This is all the more so as *n*-hexane and 2,5-HD are presumed to be endocrine disruptors[134] and are therefore potentially active at exposure doses in the order of ng/kg body weight/day.**

128 Authority (EFSA) *et al.*, "Technical Report…", *op. cit.*
129 Anses, "Valeur toxicologique de référence chronique par voie respiratoire pour le *n*-hexane", Rapport d'expertise collective, juily 2024.
130 Cravotto *et al.*, "Towards Substitution…", *op. cit.*
131 *Ibid.*
132 EFSA *et al.*, "Technical Report on the Need for Re-Evaluation of the Safety of Hexane Used as an Extraction Solvent in the Production of Foodstuffs and Food Ingredients", *EFSA Supporting Publications* 21, nº 9, 2024, 9001E, https://doi.org/10.2903/sp.efsa.2024.EN-9001
133 Salamon *et al.*, "Urinary Levels of Free 2,5-Hexanedione in Italian Subjects Non-Occupationally Exposed to *n*-Hexane" ; Xing-Fu *et al.*, "Determination of Total Urinary 2,5-Hexanedione in the Chinese General Population", https://doi.org/10.3390/app9245277
134 Ruiz-García *et al.*, "Possible role of *n*-hexane as an endocrine disruptor in occupationally exposed women at reproductive age", *Toxicology Letters*, 330, 15 september 2020, p. 73-79, https://doi.org/10.1016/j.toxlet.2020.04.022

Inadequate regulations for oilseed meal

In 2014, **ANSES confirmed that hexane-extracted oilseed meal "contains *n*-hexane[135]"** (see Part II). However, when it comes to oilseed meal, the regulations are even more problematic. Currently, the presence of hexane in oilseed meal is not regulated by specific standards, but only by the application of general regulations. The current limit for oilseed meal is 0.1%, or 1,000 mg/kg (or 1,000 ppm), **which is in fact the generic limit that distinguishes a component from a chemical impurity[136]**. To be considered a chemical impurity and not a component, hexane residues must be less than 1,000 mg/kg, a limit that was not based on any specific health study on hexane.

Furthermore, one might question whether hexane should be considered a processing aid. Several European texts stipulate that these aids may only be used on condition that their **"residues have no adverse effects on animal health, human health or the environment, and have no technological effects on the finished product[137]"** or that they "do not present a health risk and have no technological effects on the finished product[138]." However, there is currently no evidence that hexane residues in oilseed meal do not pose a risk to animal or human health. Indeed, Cravotto et al. confirm: "Given that hexane toxicity is mainly due to long-term exposure and that an official reference dose for chronic oral exposure has not yet been established, it is difficult to **scientifically demonstrate** that these residues [possible presence of hexane in products derived from animals fed with hexane-degreased feed] **are safe for human health[139]**."

Worse still, in 2024, a researcher working at the technical institute for the sector (Terres Inovia), accompanied by five colleagues, pointed out that although, in his opinion, hexane residues remain under control in food products[140] (which contain, in particular, edible oils), "it is still possible to **question the potential consequences of residues remaining in oilseed meal,** particularly because of the possibility that the solvent may pass into fats, for which **it has a strong affinity, but to our knowledge, there are no studies available on the subject[141]."**

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135 "Filières, usages et expositions liés à la présence de substances reprotoxiques et/ou perturbatrices endocriniennes dans les produits de consommation : le *n*-hexane (n° CAS 110-54-3). Rapport d'expertise collective", Anses, May 2014, p. 30.

136 Commission Regulation (EU) No. 68/2013 of 16 January 2013 on the catalogue of feed materials. The catalogue of feed materials introduces a threshold of 0.1% (1,000 ppm) for setting the maximum levels applicable to these chemical impurities.

137 Regulation (EC) No 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition.

138 Regulation (EC) No 1333/2008 of the European Parliament and of the Council of 16 December 2008 on food additives

139 Cravotto *et al.*, "Towards Substitution ...", *op. cit.*

140 "Food" is distinct from "feed", which refers to animal feed.

141 Carré *et al.*, "Solvent solutions: comparing extraction methods for edible oils and proteins in a changing regulatory landscape. Part 2: Hazards control", *OCL-Oilseeds and fats, Crops and Lipids*, 31, 33, 2024. "*It remains possible to raise questions about the possible consequences of residues left in the meals used to feed farm animals, particularly with regard to the possibility of the solvent passing through fats for which it has a great affinity, but to our knowledge, there are not available studies on the topic.*"

Furthermore, although farm animals are often slaughtered too young to detect any chronic harmful effects linked to hexane consumption, recent studies (the results of which are still to be finalised) suggest the existence of **chronic liver damage**[142] in cattle fed with hexane-extracted oilseed meal, particularly when compared to cattle fed with oilseed meal extracted with an alternative solvent, 2-methyloxolane. Moreover, available studies on rodents show that 2,5-HD, a toxic metabolite of hexane, causes damage to the organs responsible for purification[143] (liver, kidneys, etc.).

Finally, the regulations surrounding oilseed meal clearly illustrate **the predominance of industrial logic over health considerations.** Today, most oilseed meal has a hexane content well below the theoretically authorised 1,000 mg/kg, **for a reason that has nothing to do with health issues, but is mainly related to the prevention of explosion risks:** in Germany, for example, the OVID organisation[144] has developed a safety data sheet specifying 300 ppm as the maximum hexane content in rapeseed meal to prevent the risk of explosion during transport by barge[145]. According to experts interviewed on this subject, this is a limit that is well known to manufacturers.

Finally, European legislation also specifies that "the primary responsibility for food safety lies with the food business operator." **It is therefore the industrial players who should be able to ensure the safety of the hexane present in the meal**[146]. Furthermore, among animal feed manufacturers, the presence of hexane residues in oilseed meal is not generally subject to laboratory testing, at least not on a routine basis[147].

It therefore seems clear that industrial considerations govern the maximum hexane content in oilseed meal, rather than concerns about public health. The precautionary principle is clearly not being applied in this case. **Further research is urgently needed to assess the real impact of hexane residues inoilseed meal on animal health, as well as on human health and food safety.**

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142 European Federation of Animal Science, *Book of Abstracts of the 75th Annual Meeting of the European Federation of Animal Science*, Florence, Italie, 1-5 Septembre 2024, n° 34. Garcia-Vazquez *et al.*, "Session 76, Evaluation of plasma parameters in fattening beef cattle fed hexane vs 2-methyloxolane defatted soybean meal", 1 UCA, INRAE, VetAgroSup UMR Herbivores, Theix, 63122 Saint-Genès-Champanelle, France: "*Although these results should be complemented by additional studies, they may suggest potential chronic and subclinical liver damage in beef cattle fed SBM extracted with Hex compared to 2-meOx.*"

143 Adedara *et al.*, "Impairment of Hepatic and Renal Functions by 2,5-Hexanedione Is Accompanied by Oxidative Stress in Rats", *J. Toxicol.*, 2014. https://onlinelibrary.wiley.com/doi/10.1155/2014/239240

144 Association of the oilseed processing industry in Germany.

145 Sector reference document on the manufacture of safe feed materials from oilseed crushing and vegetable oil refining, EFISC (European Feed and Food Ingredient Safety Certification)/FEDIOL, 2014. https://wwwefisc-gtp.eu/data/SANTE-2016-11986-04-00-EN-TRA-00.pdf

146 Regulation (EC) No. 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs.

147 Coudray, De l'essence..., *op. cit.* (See Chapter 3: "Nous sommes ce que nous mangeons").

The glaring gaps in regulations on animal products

In relation to oilseed meal, another even more worrying discrepancy has come to light: **the total absence of standards governing hexane residues in products of animal origin.** While certain foods, such as oils, are subject to maximum residue limits (albeit being based on study that is now disputed), no equivalent regulations apply to animal products. To date, although regulatory reassessment processes are underway with regard to the toxicity of hexane in certain food products (see Part 2. [there is] "Increased recognition of the health risks of *n*-hexane, but [it is] still scandalously unsatisfactory"), animal-based foods are completely absent, as are recent studies on hexane residues in animal products: one of these, published in particular by researchers from INRAE[148], confirms that when cows are fed hexane-extracted oilseed meal, **residues can be found in milk, for example.** This study was carried out as part of research comparing the consequences for cattle with a diet based on a hexane-extracted oilseed meal versus a 2-methyloxolane-extracted oilseed meal, an alternative solvent to hexane developed by Minafin and EcoXtract, authorised by the European Union in 2023 as a processing aid[149].

The question also arises in the case of meat. Indeed, with repeated exposure, hexane accumulates in adipose tissue with a half-life[150] of 64 hours[151], meaning it can be stored in the bodies of farm animals. This means that hexane ingested by an animal 64 hours before slaughter is likely to be found in trace amounts in the meat, particularly in meat that contains the most fat[152].

What are industries doing about the precautionary principle that applies in the food sector? European Regulation (EC) No.178/2002 of the European Parliament and of the Council[153], the cornerstone of food safety legislation, which is directly applicable in France features Article 7 which sets out a 'precautionary principle' designed to ensure the protection of health in the food sector. According to this regulation, **"no foodstuff shall be placed on the market if it is unsafe."**However, as we have seen in the case of hexane, numerous scientific studies attest to the neurotoxic nature of this solvent and suspect it of being reprotoxic, with proven or suspected health impacts on humans. **It therefore seems clear that the presence of hexane in many everyday consumer products does not comply with the precautionary principle.**

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148 Menoury *et al.*, "Replacing hexane with 2-methyloxolane for defatting soybean meal fed to dairy cows. Effects on dairy performance and nitrogen partitioning", *Journal of Dairy Science*, vol. 108, issue 6, june 2025.

149 Press release from the Minafin Group, "The use of methyloxolane authorised as a substitute for hexane", 2023. https:// ecoxtract.com/the-use-of-methyloxolane-has-been-authorised-as-a-substitute-for-hexane/

150 Half-life is the time it takes for a substance (molecule, drug, or other) to lose half of its pharmacological or physiological activity.

151 Anses, "Profil toxicologique du *n*-hexane...", *op. cit.*

152 Hexane has a Log Kow (octanol/water partition coefficient) of 3.9 (source: https://substances.ineris.fr/substance/110-54-3), which shows a strong affinity for fats.

153 Article 14 of Regulation ECNo 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. https://eur-lex.europa.eu/legal-content/FR/ALL/?uri=celex%3A32002R0178

2. Lack of scientific knowledge on the consequences of chronic hexane consumption

The same European regulation[154] tipulates that a food is considered dangerous if it is harmful to human health and that no dangerous food may be placed on the market. The text specifies that authorities must take into account the probable immediate and/or short-term and long-term effects that the food will have on consumer health. According to the European regulation, it is also necessary to take into account the cumulative toxic effects on consumers and their offspring. In order to determine whether a food is harmful to health, it is also necessary to take into account the particular health sensitivities of certain individuals who are likely to consume it, i.e. whether they are genetically predisposed.

However, as we have seen, **none of these aspects have been properly examined in terms of the impact on human health of consuming hexane residues,** even though hexane is a proven neurotoxin, suspected of being reprotoxic and a potential endocrine disruptor. Furthermore, the regulations greatly underestimate our actual chronic consumption of hexane – and **therefore ignore the true cumulative effects of the presence of hexane in many everyday food products.** Worse still, these regulations do not take **the specific risk that hexane could pose to particularly vulnerable individuals** into consideration.

Although ANSES defined a chronic toxicological reference value (TRV) for hexane in 2014, **this value is specific to the respiratory tract,** i.e. to the absorption of hexane by inhalation. Similarly, the European Medicines Agency suggests an acceptable daily intake of 2.9 mg of hexane for a 50 kg adult **in pharmaceutical products**[155] (équivalent à 0,058 mg/kg), (equivalent to 0.058 mg/kg), considering the product to be a "solvent to be avoided[156]." This highlights, on the one hand, that our exposure to hexane is multifactorial **and, on the other hand, that regulatory gaps in the food sector are particularly scandalous.**

In fact, **there is currently no equivalent standard for food consumption.** There is **no tolerable daily intake** (TDI) for the presence of hexane in food products, as scientist Christian Cravotto[157] : writes: "It is surprising that no food safety authority has ever established a tolerable daily intake." Yet, **it is the TDI that defines the amount of a substance that an individual can ingest each day without risk to their health.**

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154 *Ibid.*

155 European Medicines Agency, "ICH Q3C (R9) Residual solvents – Scientific guideline", https://www.ema.europa.eu/en/ich-q3c-r9-residual-solvents-scientific-guideline

156 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

157 *Ibid.* "*Surprisingly, a tolerable daily intake (TDI) has apparently never been established by any food safety authority.*"

This means that the risks associated with the toxicity of chronic exposure (repeated absorption in small quantities over a period of years) to hexane have **not been assessed in a manner that meets the criteria of modern toxicology.** Indeed, as Francelyne Marano[158], chair of the specialist committee on environmental risks and Professor Emeritus of cell biology and toxicology at the University of Paris[159]points out: "One of the recent discoveries in toxicology is the existence of different biological effects depending on whether a chemical acts at high or low doses, so that the dose-effect relationship is more complex than that which has served as the basis for toxicological assessment for more than fifty years."

3. A lack of regulation that fails to protect the most vulnerable

There is no systematic data on potential hexane residues in milk and high-fat dairy products such as butter and *crème fraiche* (fresh cream). These gaps are all the more problematic given that hexane has a very strong affinity for fatty substances[160] **and** can be **found in human breast milk,** according to research by the Quebec Commission for Standards, Equity, Health and Safety at Work (CNESST).

Another worrying fact is that not only does hexane cross the placental barrier in rats and spreads throughout the foetus without targeting any specific tissue or organ, but in humans too, ***n*-hexane crosses the placental barrier**[161] and can spread throughout the body, especially in adipose tissue, then the liver, brain, muscles, kidneys, heart and lungs[162].

Previous toxicological studies conducted on pregnant rats have shown that *n*-hexane and its metabolites can be found **in the liver, kidneys, brain, blood and developing foetus up to 18 hours after exposure**[163].

Regulatory gaps could therefore be particularly dangerous for infants and children. These populations are potentially more vulnerable to various types of everyday contamination, exposure and pollution, such as hexane, and it is therefore unacceptable that no regulatory limits have been set to take into account their specific exposure to this solvent.

158 Presentation by Francelyne Marano. https://www.hcsp.fr/explore.cgi/personne?clef=2214

159 Francelyne Marano, "Effets des faibles doses et relations “dose-effet” non monotones", *in* V. Camel, G. Rivière, B. Le Bizec (dir.), *Risques chimiques liés aux aliments. Principes et applications*, Paris, Lavoisier, 2018, chap. 24, p. 415-426. https://doi.org/10.3917/lav.camel.2018.01.0415.

160 See note 152.

161 INRS, "Fiche toxicologique de l’hexane", *op. cit. https://www.inrs.fr/publications/bdd/fichetox/fiche.html?refINRS=FICHETOX_113*

162 *Ibid.*

163 Bus *et al.*, "Perinatal toxicity...", *op. cit*.

Furthermore, products that are particularly consumed by children, such as milk and infant formula (in the case of infants[164]), are among the products that may contain levels of hexane that are currently completely unregulated. The EFSA has raised the alarm on this issue, emphasising that **exposure among infants and children could be higher than expected**[165].

In 2014, in conclusion to an opinion issued following a public assessment of exposure to hexane by inhalation, ANSES stated that "no published study to date allows for a satisfactory assessment of the effects of *n*-hexane on the central nervous system or on neurodevelopment. These effects may occur at lower concentrations than those affecting the peripheral nervous system[166]."

As noted above, hexane is classified as a suspected endocrine disruptor by ANSES. The specific characteristic of endocrine disruptors is that they can have harmful effects on the body even at infinitesimal doses[167]. In the case of hexane, **the aggregate exposure[168] of consumers** is particularly significant: this is the sum of all the residues that come from different sources and accumulate in our bodies. As we have seen, hexane can be found in a multitude of products, **some of which are covered by regulations.** Thus, it is clear today that **the regulatory limits applicable to hexane are totally insufficient to protect consumers and workers in the sector,** who are exposed not only chronically through their work, but also through their diet.

4. Increased recognition of the health risks of n-hexane but still scandalously unsatisfactory

Over the past two years, **the risks associated with chronic exposure to *n*-hexane have been increasingly recognised, as evidenced by the reclassification or reassessment of hexane undertaken by several European authorities.**

Between 2012 and 2017, an initial substance evaluation (SEv) was conducted by the BAuA[169] (German Federal Institute for Occupational Safety and Health), coordinated by ECHA. This evaluation, which focused on the exposure of workers and consumers to hexane, concluded that follow-up regulatory action by the European Union was necessary in order to harmonise the classification and labelling of products.

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164 See the following section on the tests carried out by Greenpeace France.

165 Authority (EFSA) *et al.*, "Technical Report...", *op. cit.* : "*An exposure assessment based on regulatory limits showed that the exposure of infants, toddlers and other children may be higher than that considered by the SCF.*"

166 "Avis relatif à l'élaboration de valeur toxicologique de référence chronique par voie respiratoire pour le *n*-hexane", Anses, 2014. https:// www.Anses.fr/fr/system/files/SUBCHIM2013sa0070Ra.pdf

167 "Perturbateurs endocriniens : Des toxiques pas comme les autres", *Que choisir*, 2017. https://www.quechoisir.org/decryptage-perturbateurs-endocriniens-des-toxiques-pas-comme-les-autres-n42404/

168 Guillaume Perouel, "Agrégation des expositions", *in* V. Camel, G. Rivière, B. Le Bizec (dir.), *Risques chimiques..., op. cit.*, chap. 5, p. 65-74. https://doi.org/10.3917/lav.camel.2018.01.0065: "De ce fait, l'Homme peut être exposé à un agent chimique par le biais de multiples sources d'exposition. La notion d'**exposition agrégée** est alors utilisée pour définir l'exposition à une substance chimique *via* l'ensemble des différentes sources d'exposition et voies d'exposition dont elle peut être issue."

169 "Substance evaluation conclusion as required by REACH", Article 48 and evaluation report, BAuA, May 2017.

This work was extended by **a Regulatory Management** Option **Analysis** (RMOA) from 2020 to 2024, also by ECHA and the German BAuA. The aim was to identify whether regulatory risk management activities were necessary for hexane and, if so, to recommend the most appropriate instrument to address these concerns[170].

This RMOA concluded that follow-up regulatory action by the European Union was necessary: due to its neurotoxicity, hexane should be classified as a Substance of Very High Concern (SVHC) and subject to a REACH **(Registration, Evaluation, Authorisation and Restriction of Chemicals)** restriction. The procedure that could lead to the reclassification of hexane as an SVHC is underway: the dossier is being handled by Slovenia and should be **submitted to ECHA on 4 August 2025**[171]. Next, ECHA is expected to launch a public consultation during which any stakeholder can submit comments. Finally, hexane could be formally added to the SVHC list, which would create immediate legal obligations for its manufacturers and users[172].

170 "Risk Management Option Analysis Conclusion Document: *n*-Hexane in consumer products", BAuA, August 2024. https://www.reach-clp-biozid-helpdesk.de/SharedDocs/Downloads/DE/REACH/Verfahren/RMOA-Conclusions/REACH-RMOA-n-hexan. pdf?blob=publicationFile&v=1

171 "ECHA Considers Adding *n*-Hexane to SVHC Candidate List", CIRS (Chemical Inspection and Regulation Service), 2025. https://www.cirs-group.com/en/chemicals/echa-considers-adding-*n*-hexane-to-svhc-candidate-list

172 "Liste SVHC de REACH : comment gérer les substances extrêmement préoccupantes", *3E*, 2023. https://www.3eco.com/fr/article/liste-svhc-de-reach-comment-gerer-les-substances-extremement-preoccupantes/

Developments in hexane regulation in the European Union

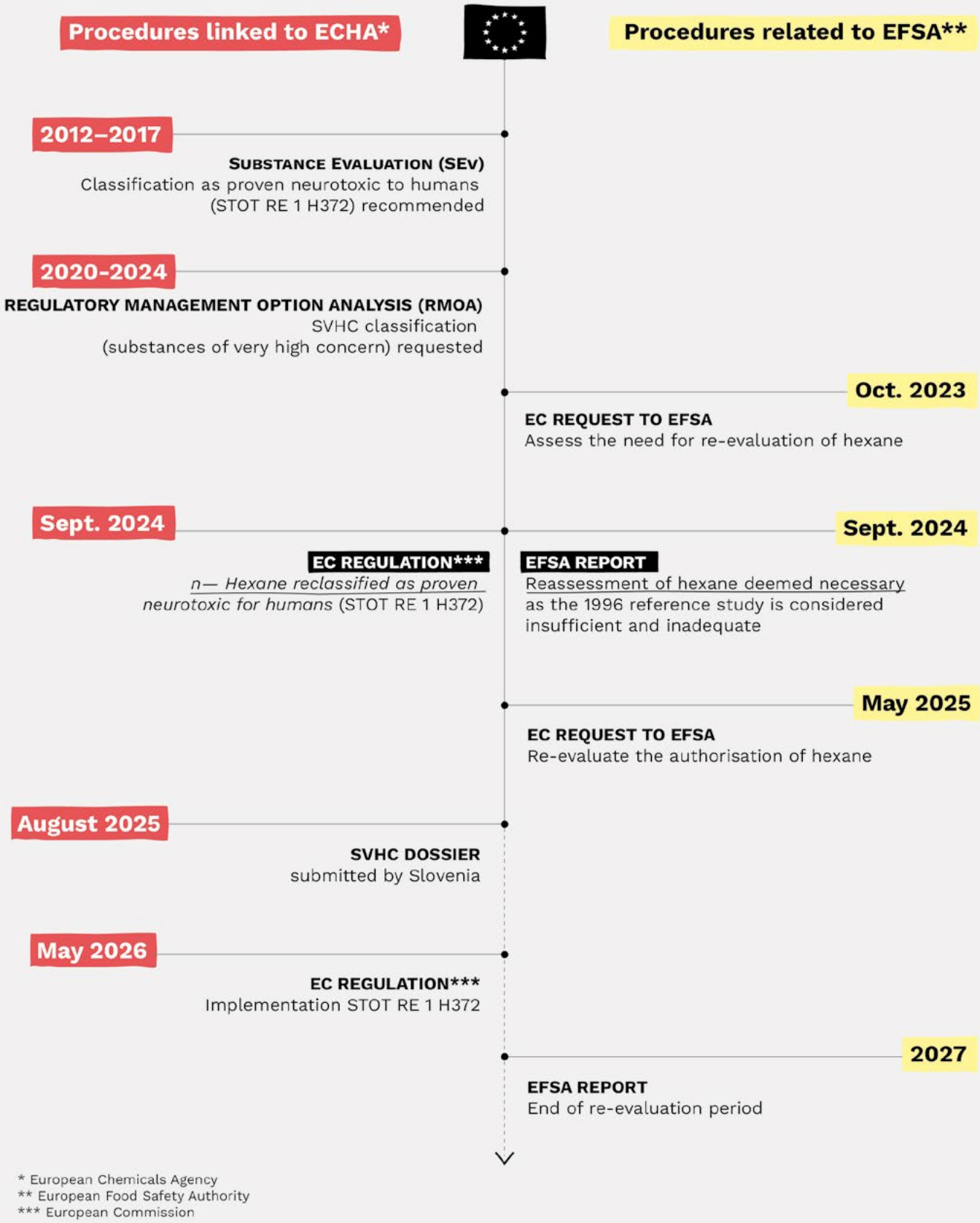

Figure 4 - Changes in hexane regulations in the European Union

As a result, hexane was reclassified by the ECHA on 30 September 2024: *n*-hexane was reclassified from "suspected neurotoxic" (STOT RE 2) to "proven neurotoxic" (STOT RE 1 – H372 – nervous system[173]) for humans. This reclassification, which corresponds to the highest level of danger for specific toxicity to a target organ after repeated exposure, based on studies demonstrating the neurotoxic effects of *n*-hexane, including **polyneuropathies and colour vision disorders** in certain individuals exposed to it in an occupational context. This change means that **Europe recognises specific target organ toxicity** (STOT[174]) aat the highest level of danger, and serious effects on the nervous system, even at low doses, if repeated[175].

> In 2024, *n*-hexane was reclassified from "suspected neurotoxic" to "known neurotoxic" to humans by the European Chemicals Agency.

In this context, and following a request from the European Commission, EFSA concluded in September 2024[176] that it was necessary **to reassess the safety of hexane as an extraction solvent,** in view of population exposure and new scientific evidence. On 23 May 2025, EFSA received a mandate from the European Commission requesting a re-evaluation **of the safety of technical hexane as a solvent,** in view of population exposure and new scientific evidence. On 23 May 2025, **EFSA received a mandate from the European Commission requesting the re-evaluation of the safety of the use of technical hexane** as an extraction solvent in the production of food and food ingredients[177], in order to update its current authorisation.

While this step forward in recognising the risks seems positive, Greenpeace nevertheless criticises the fact that **the EFSA report does not address animal feed, the presence of hexane residues in oilseed meal, or the hexane residues potentially present in food products of animal origin** and therefore their health consequences for consumers[178].

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173 ECHA, "Summary of Classification and Labelling of *n*-hexane." https://echa.europa.eu/fr/information-on-chemicals/cl-inventory-database/-/discli/details/115449; "Neurotoxicity of *n*-hexane." https://echa.europa.eu/fr/registration-dossier/-/registered-dossier/15868/7/10/1

174 Toxicité spécifique pour certains organes cibles (Specific Target Organ Toxicity).

175 ECHA, "Substance identity of *n*-hexane." https://echa.europa.eu/fr/brief-profile/-/briefprofile/100.003.435

176 Authority (EFSA) *et al.*, "Technical Report…", *op. cit.*

177 EFSA, "Webinar on the Safety of Technical Hexane Used as an Extraction Solvent for Food and Food Ingredients", accessed on 12 June 2025, https://www.efsa.europa.eu/en/events/webinar-safety-technical-hexane-used-extraction-solvent-food-and-food-ingredients

178 Authority (EFSA) *et al.*, "Technical Report…", *op. cit.* : "*This document dœs not consider the exposure to technical hexane in animal feed potentially transferred to food of animal origin.*"

When EFSA was questioned by a journalist[179] seeking to understand who is responsible for issues relating to hexane residues in oilseed meal, the agency explained that it has "no specific mandate regarding the presence of hexane in animal feed" and that, consequently, this issue "does not fall within the remit" of its panel of experts, even though the panel is responsible for assessing the impact of "additives and products or substances used in animal feed[180]." Furthermore, according to the same letter, hexane is not dealt with by the "Panel on Contaminants in the Food Chain[181]." In other words, **residual hexane in oilseed meal is still not subject to assessment by an EFSA panel.**

The use of hexane during the crushing process, which is central to the agro-industrial system and our daily diet, poses a risk to our health, yet health authorities have failed to respond. This is a genuine health scandal.

179 Coudray, *De l'essence dans nos assiettes..., op. cit*. Letter from EFSA to the author, 11 June 2024.

180 FEEDAP Scientific Panel on additives and products or substances used in animal feed. https://www.efsa.europa.eu/fr/ science/scientific-committee-and-panels/feedap

181 CONTAM Scientific Panel on Contaminants in the Food Chain. https://www.efsa.europa.eu/fr/science/scientific-committee-and-panels/contam

Part 3

AROUND FIFTY FOOD PRODUCTS ANALYSED: Greenpeace France detects hexane in the majority of the products tested

To illustrate the problems and health emergency raised by this report, Greenpeace France conducted an analysis of hexane residues in food, **in collaboration with a university analysis laboratory, and carried out a series of in-depth tests on around fifty widely consumed food products** (see Methodology). The sampling deliberately focused on everyday consumer products, with a variety of brands selected based on their market share and availability in shops. **The results are extremely worrying: hexane was detected in thirty-six of the fifty-six products tested, almost systematically in oils, butter and milk, including infant milk. In addition, hexane residues were also found, to a lesser extent, in chicken**[182]. **It is nevertheless important to note that even when hexane is detected in a product, this does not necessarily mean that other samples of that product systematically contain it. It is also possible that certain products in which Greenpeace did not detect hexane may contain it in another sample.** However, the products selected do not cover all the products purchased by French consumers. We are therefore very concerned that these results may extend to an even wider range of product lines and brands that are central to French dietary habits.

Greenpeace France has found hexane in the majority of food products tested, even though the cumulative effects of this multiple exposure have not been studied and there is a lack of health studies on chronic daily absorption, particularly through ingestion. **Greenpeace France therefore warns that the level of exposure of the population to hexane is greatly underestimated by the authorities.** Finally, more generally, there is currently no scientific basis for ruling out the danger of consuming hexane in so many products; the lack of studies makes it impossible to define a standard that adequately protects consumers, such as a TDI, particularly for vulnerable individuals (children, infants, pregnant women, people with certain genetic predispositions, etc.).

In parallel with these tests, **Greenpeace France wishes to point out that recent studies on the exposure of the European population to hexane show that it is greatly underestimated.** Without conducting a study on this subject directly, EFSA published three exposure scenarios based on estimates using the maximum legal residue limits. The first simulation is based on a report by an economic operator, the second is based on maximum MRL levels, and the third is an alternative scenario also based on MRLs. Based on the exposure levels obtained, EFSA states in its report that the assessment in question showed, in particular, "that **exposure in infants, young children and other children** may be higher than that taken into account by the SCF." Indeed, to date, it is the SCF's 1996 regulatory assessment of hexane that remains in force.

182 See Methodology and Appendix 2.

In addition, several scientific studies have examined population exposure in various countries by testing for 2,5-HD, a toxic metabolite of hexane, in urine. The Salamon *et al.* study[183] monitored 99 people in Italy who were not exposed to hexane due to their occupational activities. According to calculations made by Laurence Jacques, CEO of EcoXtract[184], presented in April 2025 at an AOCS[185] (American Oil Chemists' Society) conference in April 2025, the Salamon *et al.* study found hexane exposure to be 2.2 to 3.7 times higher (depending on the scenario) **than anticipated by the EFSA.**

The findings of Salamon et al. therefore demonstrate not only that the European population's exposure to hexane is significant, but also that the MRLs established in 1996 do not adequately protect it. One reason for this is that **these MRLs completely ignore the problem of population exposure through the consumption of animal products**, animals fed with oilseed meal containing hexane. According to the above-mentioned presentation, half of the exposure levels identified in various studies cannot be explained by regulated products: **they are therefore thought to be linked to residues from animal products** (other studies a priori rule out a significant risk of exposure through ambient air[186]).

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Products tested by Greenpeace France in which hexane residues were found*

*** The product photographs used in this report are of products similar to those tested. They are not photographs of the exact samples tested.**

183 Salamon *et al.,* "Urinary Levels of Free 2,5-Hexanedione in Italian Subjects Non-Occupationally Exposed to *n*-Hexane", *Appl. Sci.,* 2019, 9, 5277. https://doi.org/10.3390/app9245277

184 EcoXtract, together with the Minafin group, is behind the development of an alternative solvent to hexane, 2-methyloxolane, authorised by the European Union in 2023 as a processing aid. It is a solvent produced from agricultural by-products such as sugar cane bagasse. See the EcoXtract.

185 Laurence Jacques, "Investigating the origin of high hexane residue contamination in the general population's blood and urine", AOCS Annual Meeting & Expo, Health and Nutrition, 2025.

186 *Ibid.*

A. Oils

The results showed concentrations ranging from an average of 0.04 mg/kg to 0.08 mg/kg, with **particularly high peaks for certain oils from the Lesieur Isio4 brand, owned by the Avril group.** Although hexane residues in edible oils are regulated, these regulations are very lax, date back to 1996, are not based on any recent toxicological studies, and do not include any assessment of the effects of chronic exposure. De facto, the regulations in force do not ensure the safety of MRLs covering edible oils in which hexane is found. Indeed, as we have seen, the EFSA considers that the 1996 study is no longer adequate. Furthermore, as Cravotto et al. explain: "Even though oils with hexane concentrations below 1 mg/kg comply with legislation, **the few studies on the effects of chronic oral hexane intake do not provide solid scientific evidence that ingesting low levels of hexane over a prolonged period is safe for human health**[187]."

All edible oils tested as part of the Greenpeace France report:

Isio 4 oils
Lesieur

Residues up to
0,08 mg/kg
of *n*-hexane

Simply oils
Carrefour

Residues up to
0,07 mg/kg
of *n*-hexane

Oils
Sunflower seed
Lesieur

Residues up to
0,05 mg/kg
of *n*-hexane

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Rapeseed oil
Lesieur

Residues up to
0,05 mg/kg
of *n*-hexane

Greenpeace tested **10 bottles of oil from four different brands:** two bottles of ISIO4, two bottles of Simply, three bottles of Cœur de Tournesol and three bottles of Fleur de Colza. Detailed results for each product tested can be found in the appendix to the report **(see Appendix 2: "Detailed results of tested products").**

187 Cravotto *et al.*, "Towards Substitution...", *op. cit.*

B. Butter and chicken

In the results of tests carried out on butter, **hexane residues ranged on average from 0.02 mg/kg to 0.06 mg/kg** and were found in a wide range of brands on supermarket shelves.

Greenpeace also analysed nine chicken samples. Hexane residues were found in **only one of the nine samples** analysed, with a **content of 0.04 mg/kg.** This presence can be explained by the fact that farm animals are fed industrial oilseed meal. Although most of the chickens analysed did not contain hexane residues, these results nevertheless mean that it is possible for hexane to pass into chicken fat and skin, which is all the more worrying given that poultry is the most consumed meat by French people in 2024, with an average of 31.6 kg per year per person[188].

As seen above, these results raise particular concern because, unlike oils, for which an MRL exists (albeit too low because it is not based on recent toxicological data and a TDI), **there are currently no regulations governing the presence of solvents in products of animal origin.**

All of the butters tested as part of the Greenpeace France report:

Go Gourmet unsalted butter
Président

Residues up to
0,03 mg/kg
of *n*-hexane

Semi-salted gourmet butter
Président

Residues up to
0,03 mg/kg
of *n*-hexane

Soft unsalted butter
Elle & Vire

Residues up to
0,04 mg/kg
of *n*-hexane

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Soft semi-salted butter
Elle & Vire

Residues up to
0,06 mg/kg
of *n*-hexane

Unsalted butter from Brittany
Les Croisés - Leclerc's flagship brand

Residues up to
0,02 mg/kg
of *n*-hexane

© Nastasia Frolow

Moulded butter - Mild
Paysan Breton

Residues up to
0,03 mg/kg
of *n*-hexane

188 Anvol, "La volaille devient la viande la plus consommée du pays", February 2025. https://interpro-anvol.fr/la-volaille-devient-la-viande-la-plus-consommee-du-pays/. At the same time, 50% of the chicken meat consumed was imported in 2022: FranceAgriMer, "Meat consumption in France in 2022", 2023.

Greenpeace tested **10 packs of butter from four different brands:** three packs of Président butter (two semi-salted and one unsalted), three packs of Elle&Vire butter (two unsalted and one semi-salted), two packs of Paysan Breton unsalted butter and two packs of Les Croisés unsalted butter.Detailed results for each product tested can be found in the appendix to the report **(see Appendix 2:"Detailed results of the products tested").**

All chickens tested as part of the Greenpeace France report:

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Whole chicken
Les Fermiers - Loué

No hexane residues detected within the laboratory's detection limit

© Greenpeace France

Whole chicken
Le bon Poulet - Lionor

No hexane residues detected within the laboratory's detection limit

© Nastasia Frolow

Chicken thighs
Le Gaulois

No hexane residues detected within the laboratory's detection limit

© Nastasia Frolow

Chicken thighs
Monoprix

Residues up to **0,04 mg/kg** **of *n*-hexane**

Greenpeace tested **nine poultry products:** three trays of chicken thighs from Le Gaulois, two whole chickens from Loué, two whole chickens from Lionor, and two trays of chicken legs from Monoprix. Of the nine products tested, **only the Monoprix chicken thighs** contained hexane residues above the laboratory's quantification limit (up to 0.04 mg/kg).

Detailed results for each product tested can be found in the appendix to the report **(see Appendix 2: "Detailed results of the products tested").** These results indicate that although hexane contamination of poultry products is not systematic, it is nevertheless possible and has been proven in this case.

The tests on eggs did not yield conclusive results.

Greenpeace France also carried out tests to detect hexane residues in 10 boxes of eggs from four different brands (see Appendix 2: "Detailed results of the products tested"). These tests did not detect any hexane residues, according to the laboratory's detection and quantification limits.

C. Milk and infant formula

Although milk is less contaminated than butter and oils, most of the samples tested also contained hexane. Five out of seven bottles of liquid milk, including two bottles of infant formula, contained traces of hexane averaging between 0.01 and 0.02 mg/kg[189]. As seen above, it is highly likely that the hexane detected in milk comes from the oilseed meal fed to dairy cows. Like the animal products mentioned above, these are not covered by current regulations. They should not contain hexane residues.

The situation is particularly worrying in the case of infant formula, as **the effects of chronic exposure to hexane in infants have never been studied.** It is difficult to identify the precise source of this contamination for this category of products. There are several plausible routes of contamination: it could come from both the oilseed meal used in dairy cow feed and the vegetable oils (rapeseed and sunflower) present in the composition of certain infant formulae[190]. In any case, **it is extremely worrying that babies may be exposed daily to a recognised neurotoxic solvent** without any scientific studies having assessed the effects of this exposure on their health, either in the short or long term.

Greenpeace also tested powdered milk: **traces of hexane above the quantification limit were detected** (0.04 to 0.05 mg/kg on average). However, in the case of these products, it is necessary to take into account that the final product is designed to be diluted, and that, as a result, the traces of hexane fall below 0.01 mg/kg. Nevertheless, **this means that powdered milk may also contain traces of hexane, which is serious information given the lack of data on the effects of exposure to this product in young children.**

189 The limit of quantification is the smallest level of a substance (molecule, pollutant, drug, etc.) that an analytical method can quantify with acceptable precision and accuracy.

190 In addition, other compounds present in formulations may contribute to the presence of traces of hexane, particularly certain polyunsaturated lipids such as docosahexaenoic acid (DHA) and arachidonic acid (ARA), which are often added to infant formula. See, for example: Cornucopia Institute, "Questions and Answers about DHA/ARA and Infant Formula." https://cornucopia.org/DHA/DHA_QuestionsAnswers.pdf

All infant formula tested as part of the Greenpeace France report:

Infant formula
Blédina
for 1- to 3-year-olds

Residues up to
0,02 mg/kg
of *n*-hexane

Infant formula
Gallia
for 1- to 3-year-olds

Residues up to
0,02 mg/kg
of *n*-hexane

© Nastasia Frolow

Powdered infant milk
Blédina
for 12 months olds

Residues up to
0,05 mg/kg
of *n*-hexane

All milk products tested as part of the Greenpeace France report:

Semi-skimmed milk
Lactel

Residues up to
0,01 mg/kg
of *n*-hexane

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Semi-skimmed milk
Délisse - Leclerc's benchmark brand

Residues up to
0,01 mg/kg
of *n*-hexane

Greenpeace tested **10 powdered or bottled milks from four different brands:** three semi-skimmed milks from Lactel, two semi-skimmed milks from Leclerc's own brand (Délisse), one from Gallia and four from Blédilait, including three powdered milks. Detailed results for each product tested can be found in the appendix to the report **(see Appendix 2: "Detailed results of products tested").**

D. Oilseed meal intended for livestock

The presence of hexane residues in oilseed meal from factories using this solvent is **clearly demonstrated by the Solvent Management Plans** (SMPs) drawn up by the operators of the factories in question[191]. Greenpeace France has submitted requests for information to the prefectures in order to obtain these documents. At the time of writing, the prefectures concerned have provided eight of the ten SMPs requested[192], including those for four of Saipol's five factories. **The documents obtained show the presence of hexane residues in the oilseed meal after extraction.** Although this level decreases after leaving the factories due to a natural "degassing" process that causes part of the solvent to evaporate, analyses carried out by Greenpeace show that hexane remains in the oilseed meal after it has left the factory to be used in animal feed.

Indeed, these analyses, carried out on rapeseed and soya meal intended for feeding livestock, **reveal hexane concentrations, some of which are well above the MRLs authorised for *food*** (regulated human consumption), ranging from 19.9 mg/kg to 21.1 mg/kg on average for rapeseed meal, and from 65.1 mg/kg to 81.6 mg/kg on average for soybean meal analysed. In addition, traces of another hexane isomer, 2-methylpentane, were also found in these meals, although it was not regulated by an ADI (acceptable daily intake) measure either. This data reinforces the hypothesis of a transfer of the contaminant throughout the food chain, particularly via animal feed. As for rapeseed meal, the sample analysed by Greenpeace France came from a Saipol factory. Although it is not possible to identify the processor of the soybean meal, it should be noted that the majority of soybean meal used in France comes from Brazil and is marketed by traders or animal nutrition companies.

These results deserve particular attention because **current regulations do not provide for any real MRLs for oilseed meal,** unlike cocoa butter and oil, for which thresholds exist (see Part 2.C. "Standards that protect industrial interests"). However, the framework for these

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191 Article 28-1 of the decree of 2 February 1998 (relating to water abstraction and consumption as well as emissions of any kind from facilities classified for environmental protection subject to authorisation), as created by the decree of 29 May 2000 (amending the decree of 2 February 1998 relating to water abstraction and consumption and emissions of any kind from classified facilities subject to authorisation for environmental protection), requires any operator of a facility consuming more than one tonne of solvents per year to implement an SMP. This SMP specifies, in particular, the inputs and outputs of solvents from the facility. It is kept available for inspection by the classified facilities inspectorate.

192 These are the SMPs for the Grand-Couronne, Le Mériot, Sète and Bordeaux (Saipol) plants, as well as the Montoir-de-Bretagne and Saint-Nazaire (Cargill) plants, the Brest (Bunge) plant and the Grandes Huileries du Midi plant in Béziers.

is very unambitious; these regulations, which date from 1996[193] are not based on any recent toxicological studies and do not include any assessment of the effects of chronic exposure. Although the concentrations of hexane in finished animal products are obviously much lower than those measured in oilseed meal, **feeding contaminated raw materials to animals intended for human consumption on a daily basis cannot be considered harmless, especially since the safety of these hexane residues has not been demonstrated.** This indirect exposure raises major questions about contamination throughout the food chain. As we saw in the previous section, the presence of hexane in animal products raises the question of its classification as a processing aid, the residues of which, by definition, cannot have **"any adverse effect on the animal health, human health or the environment[194]" or pose "a health risk[195]."** Indeed, it has not been proven that they don't pose a risk to health.

This is all the more problematic given that, as explained above (see Part 1. "Hexane, at the heart of our eating habits"), a large part of hexane losses in factories occur via oilseed meal, the solid residue from extraction. This is also confirmed by the results of our tests. **This illustrates how hexane passes through oilseed meal into animal products,** as shown by our analysis results for butter, milk and chicken.

These results constitute a significant set of data and reveal the presence of hexane in various products from the agri-food chain. **These findings are particularly important when we consider that no recent toxicological studies have examined the potential impact of daily exposure to hexane on consumers.** Furthermore, the presence of hexane in animal products highlights the inadequacy of the MRLs established for oils, as they greatly underestimate the much wider exposure of the population to hexane *through* unregulated consumption. This gap in health standards, in the face of such widespread contamination, raises urgent public health questions and highlights the need to reassess the use of this substance in food processing.

193 European Commission, "Food science...", *op. cit.*
194 Regulation (EC) No. 1831/2003..., op. cit.
195 Regulation (EC) No. 1333/2008..., op. cit.

> The findings of Greenpeace France provide a significant set of data and reveal the presence of hexane in various products from the agri-food chain.

The specifications for organic farming prohibit the use of hexane for extracting oil from oilseed crops and therefore for processing animal feed. The organic farming label therefore guides consumers towards food products[196] that have not used hexane in the oil extraction process, thereby protecting their health, *unlike* non-organic products. If hexane were to be found in organic food products, this could mainly be the result of cross-contamination when organic products pass through processing equipment that has previously been used for conventional products but has not been sufficiently cleaned. However, it should be noted that every effort is made at each stage of the supply chain to ensure that there is no mixing and to prevent this type of risk (in particular through strict separation of production in terms of space or time). This first hypothesis, which seems to be the most likely, effectively shifts **the responsibility** for contamination risks from organic products to **the "conventional" sector, where the use of this petrochemical solvent is permitted.** With regard specifically to monogastric animals (i.e. foods such as eggs, chicken and pork), hexane could also come from non-organic feed (5%) authorised by derogation for young monogastric animals (mainly laying hens and pigs) – but this remains extremely minor because chickens raised organically would not be exposed to hexane for most of their laying period. Finally, it is not impossible that fraud exists, as is the case in conventional farming. However, **it remains certain that the risk of hexane contamination in organic products is much lower than in conventional products, due to the strict specifications prohibiting the use of this solvent.**

196 "Hexane: a petrol residue..", op. cit.

Part 4

AVRIL, SYMBOL OF THE AGRO-INDUSTRY'S RESPONSIBILITY IN THE HEXANE HEALTH SCANDAL

The Avril Group is a giant in the French agro-industry. Avrill[197], whose legal form is a limited partnership with share capital, is the parent company of the group. Sofiprotéol, the group's former name and original entity, is a subsidiary of Avril, which owned 70.6% of it at the end of 2017[198]. The remainder was then owned by inter-professional organisations in the sector (ONIDOL/UNIP, now IOP/UNIVIA) as well as financial players (Crédit Agricole Group 5%, Crédit Mutuel 5%, Groupama 11%, Natixis 3%, etc.) and agro-industrial players (Unigrains 3%).

In 2024, the group generated turnover of €7.7 billion and net profit of €25 million. With 82 industrial sites worldwide, including 62 in France, it operates in 18 countries.

The group is a leader in the oilseed and protein crop sector, which includes the production of edible oil, biofuels and oilseed meal for livestock feed. **The vast majority of Avril's processing activities are carried out using hexane.**

Avril's strong influence lies in the fact that the group is present at all stages of the **industrial processing chain of oilseed and protein crops *through* its various divisions.** Avril controls seed crushing plants, as well as animal feed manufacturing companies and consumer brands such as Lesieur and Puget. In addition, through Sofiprotéol, the group invests directly in the structuring of agricultural and agri-food sectors (seeds, genetics, agricultural supplies, plant protection products, biotechnologies, collecting organisations[199]etc.).

Due to its central position, proximity to political circles and economic power, **the Avril Group dominates and structures the French crushing industry. It is the main user of hexane for the production of foodstuffs and animal feed.** The Avril Group is therefore partly responsible for the hexane health scandal.

197 SIREN 799403050

198 Sofiprotéol, minutes of the combined general meeting of 6 December 2017.

199 Terres OléoPro, "Organismes fondateurs." https://www.terresoleopro.com/organismes-fondateurs-40-ans-de-passion-au-service-de-la-filiere

A. Avril, a giant whose industrial power is based on the processing of oilseeds and the marketing of oilseed meal

1. Sofiprotéol takes over the country's processing plants

Ironically, it was partly an explosion linked to hexane that led to the creation of Avril and symbolically placed hexane at the heart of this group. In June 1980, the Bordeaux-Bassens crushing plant caught fire, killing one worker and injuring several others[200]. Already in the throes of a socio-economic crisis, the oilseed and protein crop sector was in need of restructuring.

It was in this context that Avril's predecessor was created in 1983: a **financing company called Sofiprotéol** (Société de financement de l'industrie des corps gras), driven by players in the sector and the French government. Sofiprotéol's objective at the time was to respond to producers' financing needs, while providing them with outlets[201]. To do this, Sofiprotéol benefited in particular from compulsory voluntary contributions (CVO) in order to **take over and finance French oilseed processing plants.** The CVOs were collected by inter-professional organisations from all stakeholders in the sector, particularly farmers[202]. The use of part of these funds by Sofiprotéol was also widely criticised in a 2002 report by the Court of Auditors[203], which questioned the legality of certain operations.

200 "En 1980, l'explosion d'un silo fait un mort à Bassens, près de Bordeaux", *Sud-Ouest,* 2021. https://www.sudouest.fr/gironde/bassens/souvenez-vous-il-y-a-41-ans-l-explosion-d-un-silo-fait-un-mort-a-bassens-en-gironde-1130850.php

201 Philippe Tillous-Borde, *Un homme d'entreprise visionnaire. Quarante ans au service d'une ambition agricole pour la France,* Paris, Eyrolles, 2015.

202 Assogba, "Les dynamiques ...", *op. cit.*

203 Court of Auditors, Annual Public Report 2002, Part 2e: "Observations des juridictions financières", "L'utilisation de "cotisations volontaires obligatoires" prélevées sur les producteurs d'oléoprotéagineux", p. 583.

According to this report, CVOs were diverted from their primary purpose by Sofiprotéol for the purpose of financial gain or to exert influence, due in particular to a lack of attention from the State.

Guillaume Assogba writes in his thesis that the creation of Sofiprotéol "marks the **beginning of the construction of a new order** within the production of vegetable oils and proteins, but also within the entire sector. Indeed, **Sofiprotéol will gradually take over almost all production facilities,** thus equipping itself with a **powerful industrial tool** and **greater weight in various relationships,** both internally (with other players in the vegetable oil and protein manufacturing segment) and externally (with upstream and downstream business segments)."

Sofiprotéol has therefore taken control of a large part of the country's processing facilities, while ensuring its own economic development by promoting industrial solutions that benefit the group, such as agrofuels[204].

2. Avril today, French leader in seed processing and animal feed

Sofiprotéol acquired the Lesieur and Puget oil groups in 2003 and 2004, **becoming the leading manufacturer of edible oils in France,** and took over **the animal nutrition group Glon Sanders in 2007**[205]. The company thus implemented a genuine **vertical integration strategy,** seeking to control the entire protein crop value chain, from the purchase of raw materials to bottling for oil and the sale of oilseed meal for animal feed.

Sofiprotéol became the Avril Group in 2015, undergoing a major reorganisation that involved a change in legal structure and the adoption of the status of a limited partnership with share capital. The "Avril Foundation" was created. The group now defines itself as "the industrial and financial player in the vegetable oils and proteins sector[206]."

Within the group, **Sofiprotéol** continues to exist and is dedicated to financial engineering, investing *through* loans and equity holdings, generally minority stakes, in agri-food companies (livestock farming, seeds, genetics, agricultural supplies, plant protection products, biotechnology, collection agencies, etc.), integrating the architecture of agro-industrial projects and managing relations with financial partners.

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204 Assogba, "Les dynamiques...", *op. cit.*

205 *Ibid.*

206 Presentation of the Avril Group. https://www.sudouest.fr/gironde/bassens/souvenez-vous-il-y-a-41-ans-l-explosion-d-un-silo-fait-un-mort-a-bassens-en-gironde-1130850.php

Avril's hegemony in the oilseed and protein crop sector

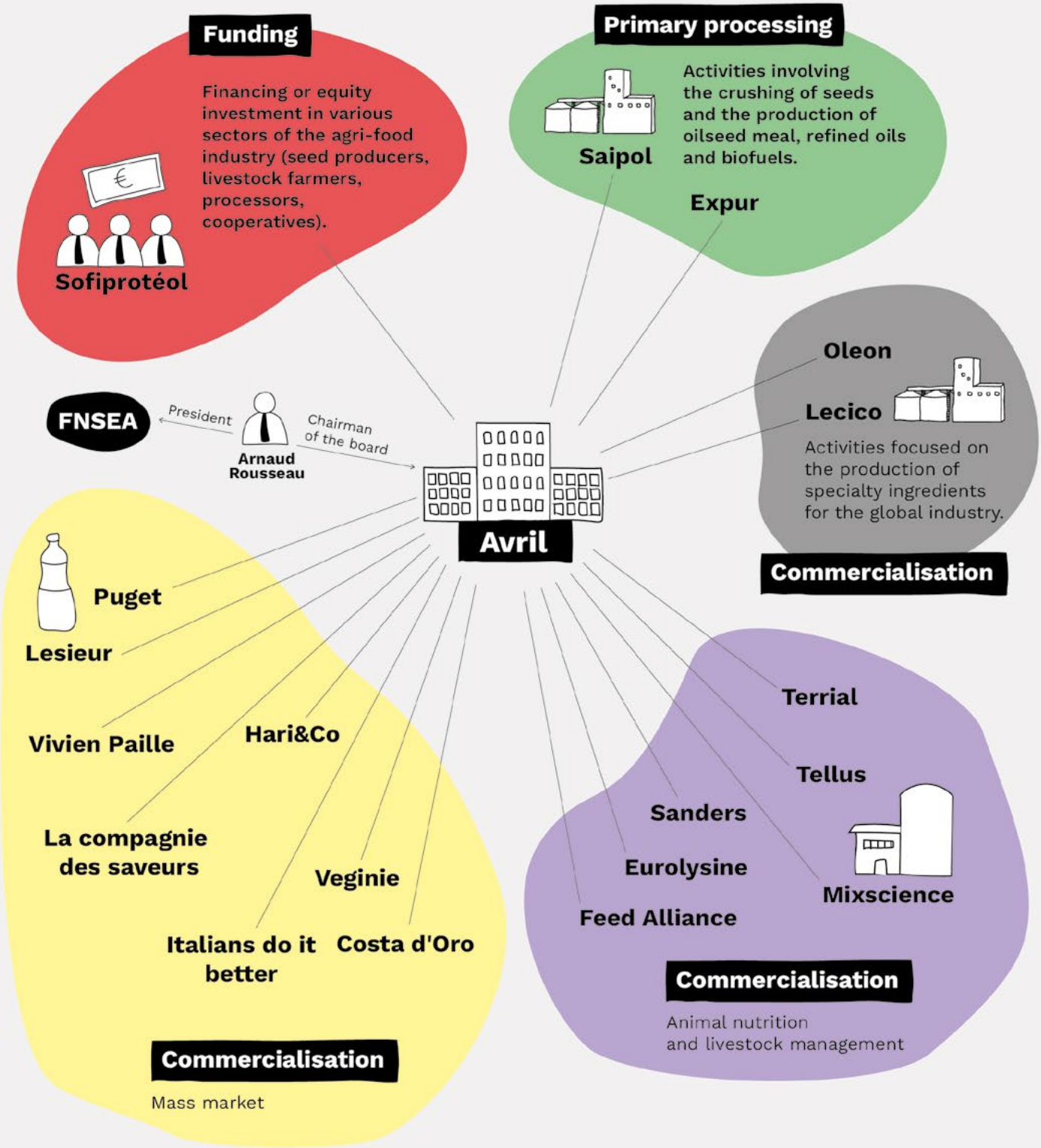

Figure 5 - Avril's hegemony in the oilseed and protein crop sector

Above all, the Avril Group controls **two key players in the industry:** Saipol, which transforms seeds into oils and oilseed meal, and Sanders, which markets animal feed (while also having processing capacity, albeit to a lesser extent).

Saipol, an acronym for *"Société agro-industrielle de patrimoine oléagineux"* (Agro-industrial oilseed heritage company), is the French leader in oilseed processing, mainly focusing on rapeseed and sunflowerl[207]. It was created in 1983 through a partnership between Sofiprotéol, Lesieur and the multinational Bunge[208]. Saipol produces oil for human consumption and industrial uses, as well as agrofuels[209], The company operates five crushing sites in France: Grand-Couronne, Le Mériot, Sète, Lezoux and Bordeaux-Bassens, **making it by far the leading player in the sector.**

Sanders (formerly Glon Sanders) is a long-standing player in animal nutrition. The group produces feed for most farm animal species[210] (cattle, pigs, poultry, etc.). Sanders currently holds a 14% share of the animal nutrition market and has announced its ambition to reach 20% through acquisitions[211].

Unlike other major players in the crushing industry operating in France or importing oilseed meal into the country (Cargill, Archer Daniels Midland, Bunge), **Avril also controls numerous consumer brands** such as Vivien Paille (dried vegetables), Italians do it better (sauces), the iconic Lesieur brand, including Puget (oils), La Compagnie des Saveurs, HARi&Co. The acquisition of **Lesieur** and **Puget** significantly strengthened the group's position in the consumer market, making Avril **the leading player in vegetable oils in France**[212].

Avril accounts for 22.9% of the market share, if we include the 41% of total oils on the market sold under private labels[213] ("distributor brands"), **or 39% of the market share excluding private labels.** A study of the sector states: "The edible oil manufacturing sector is characterised by a very high degree of concentration. **It is dominated by the Avril Group, which is involved in both the production of crude oils** (Saipol) **and refined oils** (Lesieur), and markets its products to large retailers as well as professionals. [...] Avril's subsidiaries, which are leaders in the sector, accounted for nearly 65% of the panel's turnover [XERFI] in 2022[214]."

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207 Avril, "Présentation de Saipol." https://www.avril.com/groupe/filiales-et-marques/saipol

208 https://questions.assemblee-nationale.fr/q9/9-53451QE.htm; In 2010, Bunge sold its 33.3% stake in Saipol. https:// www.cfnews.net/L-actualite/M-A-Corporate/Operations/Minoritaire/Bunge-se-separe-de-Saipol-74750

209 Diester and Oléo100 brands.

210 Sanders, "Nos chiffres clés." https://www.sanders.fr/fr/nos-chiffres-cles

211 "Sanders vise 20 % de parts du marché de la nutrition animale en France", *Réussir*, 2023. https://www.sanders.fr/fr/nos-chiffres-cles

212 Avril, "Rapport annuel 2023", p. 11.

213 "La fabrication et le marché des huiles alimentaires", XERFI, June 2024.

214 *Ibid.*

3. Seed processing and oilseed meal marketing are at the heart of Avril's interests

In 2024, **46% of Avril's turnover** was generated by its "Primary Processing and Renewable Energy" division, which mainly comprises **Saipol; 27% by the "Agricultural Solutions" division,** which encompasses activities dedicated to the livestock sector, in particular **Sanders**; 22% by the "Consumer Products" division (Lesieur, Puget, etc.); and 12% by the "Specialities" division (production of specific industrial ingredients)[215].

In 2024, animal feed (2.7 million tonnes) and oilseed meal (2 million tonnes) were Avril's main industrial products, ahead of biodiesel (1.4 million tonnes) and oils in all their forms (0.9 million tonnes[216]**). The manufacture of oilseed meal and animal feed is therefore at the heart of Avril's operations.**

> In 2024, animal feed (2.7 million tonnes) and oilseed meal (2 million tonnes) represented the main industrial products sold by Avril.

The majority of the seeds required for these products are processed by Saipol. In total, Saipol processes 3 million tonnes of rapeseed and sunflower seeds each year[217] (nearly 50% of the total volume in France)[218].

Avril also has a highly effective sales tool. The *"feedmarket"* platform allows users to purchase oilseed meal directly online on its website. Feed manufacturers and farmers who produce their own feed can choose the type of oilseed meal they want to use and purchase it 24 hours a day at "factory prices[219]." Delivery is easily arranged from the various Saipol sites.

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215 Avril, "Rapport annuel 2024" https://www.avril.com/rapport-annuel-integre-2024. It should be noted that the sum is greater than 100% because eliminations are removed from the calculation of the group's turnover. If these are re-included, Avril's turnover is broken down as follows between its main divisions: Primary Processing (41%), Agricultural Solutions (25%), Consumer Products (20%), Specialities (11%).

216 *Ibid.*

217 Saipol website. Saipol website. https://www.saipol.com/. Note that Saipol does not process soybeans. Sanders, on the other hand, does process soybeans in its factories, but on a smaller scale.

218 See Methodology. Please note that the capacities of the Boulazac factory, operated by Sanders Périgord, are missing due to the unavailability of data.

219 Feedmarket oilseed meal purchasing platform. https://www.oleomarket.fr/feedmarket

> In total, Saipol processes 3 million tonnes of rapeseed and sunflower seeds every year.

The marketing of oilseed meal is therefore the core business of the Avril group. **Consequently, the group has a particular interest in increasing livestock farming.** As reported by ***Reporterre***: "Sofiprotéol [...] is now establishing its power in the agricultural world through livestock farming. Capitalising on the milk crisis, it has positioned itself as the leader in animal feed. **And it is promoting the development of factory farms to sell off its stocks**[220]."
The acquisition of Glon Sanders, the leading animal feed company, has also provided Avril with an effective way of marketing the oilseed meal produced by Saipol.

> The marketing of oilseed meal is the core business of the Avril group. The group therefore has a particular interest in increasing livestock farming.

Today, *through* Sanders, **Avril directly finances livestock farms** and offers services to facilitate the creation or transfer of farms, as well as their "modernisation[221] ." Avril is particularly active in the development of pig farming, *through* the So'Porc financing solution, created in 2019 with **the Fipso cooperative**[222], the main pig producer in the former Aquitaine, Midi-Pyrénées and Languedoc-Roussillon regions[223]. So'Porc **offers farmers "wishing to embark on new livestock farming projects" to finance their buildings.**

It should be noted, however, that Sanders does not only market the oilseed meal produced by Saipol, but also has seven of its own crushing sites: Saint-Gérand, Bretteville, Oleosyn Bio in Thouars, Chalon-sur-Saône, Boulazac and Sojalim in Vic-de-Bigorre[224] and, more recently, Rethel[225].

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220 "Comment les agrocarburants ont conduit aux fermes-usines", *Reporterre,* 2015. https://reporterre.net/ENQUETE-4-Comment-les

221 Avril, "Annual Report 2024", op. cit.

222 "Fipso s'adapte à la demande des marchés", *Réussir,* 2019. https://www.reussir.fr/porc/fipso-sadapte-la-demande-des-marches

223 Competition Authority, decision no. 13-DCC-102 of 26 July 2013 on the creation of a joint venture by Glon Sanders Holding and the Euralis group. https://www.autoritedelaconcurrence.fr/sites/default/files/commitments//13DCC102decision_version_publication.pdf

224 Press release: "Sanders se mobilise en faveur du développement de la protéine végétale française", 2021. https://www.sanders.fr/sites/default/files/communique_presse_sanders_15092021.pdf

225 Nealia, "Our locations." https://www.nealia.fr/nos-implantations

Similarly, although Saipol is not involved in soybean crushing, Sanders is still active in this sector through its own crushing operations **and, above all, the marketing of animal feed products, including those made from imported soybeans.** Approximately **44% of soybean meal is consumed by broilers and laying hens (mainly broilers[226])**, 36% by dairy and dual-purpose cattle, 8% by beef cattle and 6% by pigs. For example, up to 27% of poultry feed is composed of soybean meal[227].

In 2015, Sanders entered into an alliance agreement with the LDC group[228], which controls 40% of the French poultry market[229]. LDC is omnipresent in this sector: it owns farms, slaughterhouses, animal feed factories, processing plants, import-export subsidiaries, etc. **The stated objective of this partnership is to develop French poultry production[230],** which obviously serves Avril's interests as a producer of animal feed.

226 "Utilisation de soja dans l'alimentation animale en France : la filière porcine peu dépendante !", *3trois3*, 2021. https://www.3trois3.com/articles/utilisation-de-soja-dans-l%E2%80%99alimentation-animale-en-france-la-filiere_15304/

227 "En France, les animaux d'élevage sont nourris avec du soja issu de la déforestation, VRAI ou FAUX ?", The Animal Welfare Chair, 2022. https://chaire-bea.vetagro-sup.fr/*en*-france-les-animaux-delevage-sont-nourris-avec-du-soja-issu-de-la-deforestation-vrai-ou-faux/

228 Press release: "Finalisation de l'accord d'alliance entre les groupes Avril et LDC", 2015. https://presse.avril.com/finalisation-de-laccord-dalliance-entre-les-groupes-avril-et-ldc/?lang=fr

229 "LDC se montre prêt pour de nouvelles acquisitions", *LSA-Conso*, 2019. https://www.lsa-conso.fr/ldc-se-montre-pret-pour-de-nouvelles-acquisitions,320042 ; "Le groupe agroalimentaire LDC négocie le rachat du producteur de produits traiteur Pierre Martinet", *Usine nouvelle*, 2024. https://www.usinenouvelle.com/article/le-groupe-agroalimentaire-ldc-negocie-le-rachat-du-producteur-de-produits-traiteur-pierre-martinet.N2213635

230 Press release: "Finalisation de l'accord d'alliance entre les groupes Avril et LDC", 2015. https://presse.avril.com/finalisation-de-laccord-dalliance-entre-les-groupes-avril-et-ldc/?lang=fr

B. Avril, at the heart of agro-industrial inertia surrounding hexane

1. Hexane extraction, the cornerstone of Avril's business

Avril's business is heavily dependent on the use of hexane, as this solvent plays a **key role in the activities of its subsidiary Saipol, and the oilseed meal obtained from hexane processing** play a central role in the raw materials sold by Saipol directly to farmers or incorporated into animal nutrition products, particularly those of Sanders.

> However, Avril has based its industrial operations on the use of hexane.

Today, **most crushing plants** in France **do not use this solvent** but extract oil from oilseed meal by pressing. **However, Avril has based its industrial operations on the use of hexane** for the vast majority of its oil and oilseed meal production[231]. Saipol factories, which only produce this type of oilseed meal, **account for half of all seed processing capacity in France.** Several of these factories are also aiming to increase their production capacity[232].

There are currently around 35 oilseed crushing plants in France[233] producing oils and oilseed meal (as well as other products, such as agrofuels).

231 See Methodology. Please note that the capacities of the Boulazac plant, operated by Sanders Périgord, are missing due to the unavailability of data.

232 "Oléagineux. Comment Saipol va accroître ses capacités de trituration à Sète et Lezoux", *Réussir*, 2024. https://www.reussir.fr/ladepeche/colzatournesol-les-details-de-la-hausse-des-capacites-de-trituration-des-usines-de-sete-et-lezoux

233 Figure obtained from the map of the main crushing sites (2023), published online by Terres Univia, with the addition of two plants that have since been inaugurated. https://www.terresunivia.fr/cultures-et-utilisations/utilisations/alimentation-animale/tourteaux-oleagineux/

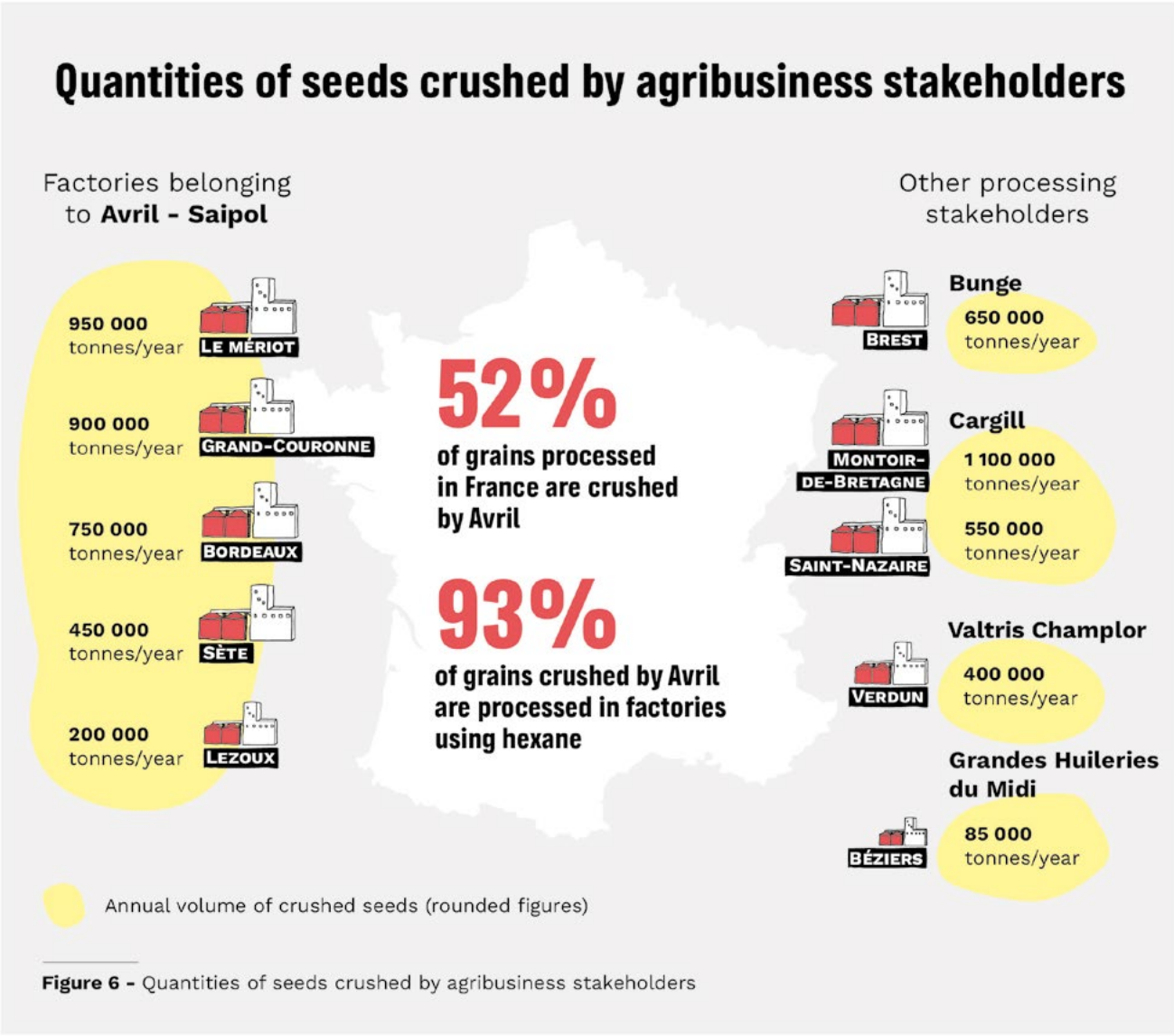

Figure 6 - Quantities of seeds crushed by agribusiness stakeholders

Of these 35 factories, according to research carried out by Greenpeace[234], **only 10 use hexane: all five Saipol factories** (Grand-Couronne[235], Sète[236], Lezoux[237], Le Mériot[238] et Bassens[239] operated with Lesieur), two Cargill factories (St Nazaire[240] et Montoir[241]), the Bunge factory in Brest[242], the Valtris-Champlor factory in Verdun[243] and the Grandes Huileries du Midi factory in Béziers[244]. These are **the largest crushing plants in mainland France.**

234 See Methodology. Please note that the capacities of the Boulazac factory, operated by Sanders Périgord, are missing due to the unavailability of data.
235 Prefect of Seine-Maritime, DREAL Normandie, decree of 6 August 2021 regulating the activities carried out by Saipol in Grand-Couronne, PGS, Saipol Grand-Couronne, 2024.
236 Prefect of Hérault, supplementary prefectural order no. 2011-I-2544, Saipol. PGS, Saipol Sète, 2024.
237 Prefect of Puy-De-Dôme, DREAL Auvergne-Rhône-Alpes, report by the Classified Facilities Inspectorate, inspection visit on 10 October 2024.
238 Prefect of Aube, DREAL Aube – Haute Marne Departmental Unit, report by the Classified Facilities Inspectorate, 23 April 2023, PGS Saipol Le Mériot, 2024.
239 Prefect of Gironde, DREAL Nouvelle-Aquitaine, report by the Classified Facilities Inspectorate, inspection visit on 31 October 2024, PGS, Saipol Bassens, 2024.
240 DREAL Pays-de-la-Loire, area study on the CARENE territory, Phase 1, Annexes, Cargill Saint-Nazaire, pp. 65–69.
241 Prefect of Loire-Atlantique, Order No. 2018/ICPE/088, Cargill Montoir-de-Bretagne, 14 June 2018.
242 Prefect of Finistère, Order No. 01-2020 of 15 January 2020.
243 Technical data sheet on crude rapeseed oil, Champlor, 17 November 2020.
244 Prefecture of the Languedoc-Roussillon region, Prefecture of Hérault, DREAL, decree no. 2010-I-2037. PGS Grandes Huileries du Midi, 2024.

As for Saipol, in 2024 these factories processed nearly 950,000 tonnes/year at the Mériot plant[245], 900,000 tonnes/year at the Grand-Couronne plant[246], 750,000 tonnes/year at Bassens[247] (operated with Lesieur[248]), 450,000 tonnes/year at Sète[249], and 200,000 tonnes/year at Lezoux[250]. Among the plants using hexane, those of Cargill (approximately 550,000 tonnes/year in Saint-Nazaire[251] and 1,100,000 tonnes/year in Montoir in 2024[252]) and Bunge (650,000 tonnes/year in Brest in 2024[253]) also have very significant industrial capacities. Next come the Valtris-Champlor plants in Verdun (400,000 tonnes/year[254]) and the Grandes Huileries du Midi plant (approximately 85,000 tonnes/year[255]).

Only one factory that does not use hexane is capable of producing volumes of this magnitude: **Centre Ouest Céréales in Chalandray,** which processes approximately 247,500 tonnes/year of rapeseed (240,000 tonnes/year), sunflower (5,500 tonnes/year) and soya (2,000 tonnes/year[256]), obtaining oils and oilseed meal solely through mechanical pressing[257].

A processing industry fuelled by hexane, under the leadership of Avril[258]

Although less than a third of French oilseed processing plants use hexane, the fact that these are the largest plants means that **nearly 90% of seeds processed in France are processed in plants that use hexane.**

In total, **Avril processes around 3.6 million tonnes of seeds per year in France, representing 52% of all seeds processed in the country.** It is by far the leading player in the processing of oleaginous and protein crops in the country. In fact, **its subsidiary Saipol** alone **accounts for nearly half** of all seeds processed by factories located in France.

245 Saipol Le Mériot, "Plan de gestion des solvants", 2024.
246 Saipol Grand-Couronne, "Plan de gestion des solvants", 2024.
247 Saipol Bassens, "Plan de gestion des solvants", 2024.
248 Saipol, "Nos implantations" : https://www.saipol.com/nous-connaitre/nos-implantations/
249 Saipol Sète, "Plan de gestion des solvants", 2024. Saipol, "Actualités", 3 octobre 2022. https://www.saipol.com/actualites/saipol-fait-lacquisition-de-centre-grains-sur-le-port-de-sete-34-avec-le-rachat-des-parts-daxereal-et-des-actionnaires-minoritaires/ ; Saipol, "Nos implantations", *op. cit.*
250 Saipol, "Visite du site : Saipol, groupe Avril, usine de Lezoux." https://cgenial-connect.fr/profentreprise/838
251 Cargill Saint-Nazaire, "Plan de gestion des solvants", 2024. "À Saint-Nazaire, l'américain Cargill mise sur le tournesol", *Les Échos*, 2018. https://www.lesechos.fr/2018/01/a-saint-nazaire-lamericain-cargill-mise-sur-le-tournesol-966788
252 Cargill Montoir, "Plan de gestion des solvants", 2024. Cargill, Montoir-de-Bretagne : https://www.cargill.fr/fr/montoir-de-bretagne
253 Bunge Brest, "Plan de gestion des solvants", 2024. Prefect of Finistère, DREAL of Brittany, report of the Inspection of Classified Facilities, inspection visit of 24 May 2024.
254 Champlor, "Qui sommes-nous ?" https://champlor.com/qui-sommes-nous/
255 Grandes Huileries du Midi (GHM), "Plan de gestion des solvants", 2024.
256 "Centre Ouest Céréales : l'usine de Chalandray (86) produit désormais de l'huile alimentaire", *Agro matin*. https://www.agromatin.com/reference-agro/cooperatives-negoces/centre-ouest-cereales-lusine-de-chalandray-86-produit-aussi-de-lhuile-alimentaire.html
257 COC Group, "Processus de l'usine Chalandray", https://groupecoc.fr/processus-de-l-usine-chalandray/
258 Methodology. Please note that the capacities of the Boulazac factory, operated by Sanders Périgord, are missing due to the unavailability of data.

Avril is the leading agro-industrial user of hexane in France. Each year, the group processes **3.3 million tonnes of seeds in factories using hexane, representing 54%** of the total volume of seeds processed in France using hexane.

However, Avril only processes **2.4 thousand tonnes** of seeds per year using mechanical pressing, which means that **more than 90% of the seeds processed by Avril involve the use of hexane.**

2. A solvent whose appeal lies solely in its cost-effectiveness

However, viable alternatives to hexane do exist. Given this, why does the Avril Group refuse to abandon hexane and continue to take such risks with the health of consumers, workers and livestock? The transition to other methods is not impossible: other industries are making significant efforts to ban hexane, particularly because of its toxicity[259]. Worse still, why are the Avril Group and the major oilseed crushers seeking to increase the capacity of their hexane-using factories, even though alternatives exist?

The answer is technical and economic: **hexane is effective and profitable.** However, for the industrial group, the logic of productivity prevails over health considerations and the precautionary principle. The use of a solvent to extract oil and produce oilseed meal results, **a calculation aimed at maximising return on investment by minimising energy expenditure and plant maintenance costs[260].**

Hexane is by far the most widely used solvent in the world for extracting oilseeds because it has very interesting technical properties for extracting oil and thus producing oilseed meal. **The use of hexane makes it possible to obtain oil yields of over 95%, compared to 89% for mechanical pressing alone**[261]. Its boiling point is low (around 68°C[262]), which means that the crude oil does not need to be heated too much in order to recover some of the hexane and thus preserve some of the oil's properties. It is entirely possible to mix parts of this solvent into the oil, as it is selective of lipids[263] and therefore does not extract impurities with the oils. Finally, another very good point in favour of hexane's profitability is that it mixes very little with water, unlike acetone or alcohol. When in contact with water, its effectiveness in extracting lipids is not affected, and it dissolves only fats, not other compounds, which facilitates the separation process. The pure oil is easily isolated, without any loss of lipids.

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259 "“Le remplacement de l’hexane dans nos extractions est un vrai enjeu”, selon Robertet", *Usine nouvelle*, 2023. https://www.usinenouvelle.com/article/le-remplacement-de-l-hexane-dans-nos-extractions-est-un-vrai-enjeu-selon-robertet.N2149752

260 Jean Laisney, *L’Huilerie moderne, art et techniques*, Compagnie française pour le développement des fibres textiles, 1984.

261 Fine F. *et al*, "Les agro-solvants…", *op. cit.*

262 INRS, "Fiche toxicologique de l’hexane", *op. cit.*

263 *Ibid.*

Furthermore, hexane is easy to recover (at least in part), is not very expensive and, although it is not renewable, it is abundant. Petrochemical groups have huge reserves of low-cost hexane, as it is a by-product of naphtha refining.

The issue of profitability is central to the use of hexane. The solvent is used after initial pressing to extract every last drop of oil. This is why strong regulation is necessary. This is also what several researchers, some of whom work in the industry, wrote in 2013: "Overall, one might think that most of the barriers to the use of agro-solvents for oilseed extraction can be overcome through research and development. However, **it is likely that the final cost of the technology will be higher than that of the hexane process, which is unlikely to encourage crushers to voluntarily make the technological leap without strong incentives from public authorities,** whether financial or regulatory[264]."

As mentioned in the introduction, a report written on behalf of a chemical company by a researcher working within institutions in the sector (ITERG and Terres Inovia) lists ways of assessing the technical and economic feasibility of a production method that no longer uses hexane. It is clear that **hexane is still the benchmark on the extraction solvent market, mainly, if not exclusively, for purely economic and productivity reasons, thus ruling out possible less harmful alternatives.**

Hexane extraction is therefore extremely cost-effective because it ensures a very high extraction yield at low cost, with properties that are particularly suited to oil. This is the main reason why this solvent is preferred today, **despite its health risks.**

Furthermore, as Avril enjoys a dominant economic position in the oilseed market in France, **it also has the economic power to influence market prices, thereby making alternative practices more difficult.** Although the oilseed meal market in France is not based on a single price, it gives large industrial players a prominent position. It is based on several reference prices, specialised according to product: Montoir – ex-works for soya meal; **Rouen – delivered for rapeseed meal;** Saint-Nazaire – delivered for sunflower meal[265]. **These daily quotations serve as the base price for the entire French market.** For rapeseed meal, this means **The Avril plant in Grand-Couronne** (Rouen) **is a prime example.** Furthermore, economies of scale structurally favour large industrial facilities. For small oil producers selling their oilseed meal to farmers, **the competitive disadvantage is real and persistent:** their crushing costs are higher, as are their transport costs, proportionally, due to insufficient volumes to optimise logistics.

264 Fine *et al.*, "Les agro-solvants…", *op. cit.*
265 Agri Mutuel, "Alimentation animale." https://www.agri-mutuel.com/cotations/alimentation-animale/

Crushing using hexane, an economical solvent, in a sector where the entire chain is controlled by a group in a particularly dominant position, **is ultra-competitive.** This makes thedevelopment of hexane-free alternatives extremely difficult.

3. Alternatives to hexane exist and are viable

Oilseed crushing companies have the technology to produce oil and oilseed meal without hexane. Over the past twenty years, many crushing plants have been built in France and operate in this way. **Organic farming specifications also prohibit the use of this solvent.**

Traditional farming and artisanal techniques of ”cold” pressure extraction

In the small-scale production units used by artisan oil producers and farmers, who are generally organised into CUMA[266], cooperatives, the most commonly used crushing method is **pressing**. The extraction of vegetable oils by cold pressing is an ancient process: the seeds are dusted, sorted and then introduced into the "cold" press (i.e. at room temperature[267]).

Pressure techniques are less profitable than hexane extraction, but they are viable.
They are obviously better for health and the environment and promote a small-scale farming model. One example is the Adour Protéoïl CUMA with its Oléandes oil mill; which brings together around 100 farmers from the Landes region and produces conventional and organic sunflower and rapeseed oils, as well as cold-pressed oilseed meal[268]. The crushing unit can process 1,500 tonnes of rapeseed and sunflower seeds per year (2013 figures[269]). The Oléandes website states that its aim is to increase the protein self-sufficiency of farmers in the Landes region, generate better margins for oilseed producers and encourage producers to introduce crop rotation into their crop patterns[270].

Similarly, in 2013, the Val-de-Gascogne cooperative group opened an oil mill, Presse de Gascogne, specialising in the organic oil and oilseed meal market. Annual oil production exceeds one million litres, and oilseed meal production is around 2,500 tonnes. The oil mill promotes the local production of sunflower and rapeseed from the Gers region and extracts its oils by cold pressing[271]. With an annual crushing capacity of 2,000 tonnes of seeds, it aims to increase this to 6,000 tonnes[272].

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266 Agricultural equipment cooperatives.
267 Les Champs de Julien: cold pressing. https://www.leschampsdejulien.com/huiles-de-premiere-pressions-a-froid/
268 Presentation of SARL Oléandes: https://www.oleandes.fr/huiles-et-tourteaux/
269 "Aquitaine : Les agriculteurs font leur huile", *Usine nouvelle,* 2013. https://www.usinenouvelle.com/article/aquitaine-les-agriculteurs-font-leur-huile.N192307
270 https://www.oleandes.fr/la-sarl-oleandes/
271 Presentation of the organic oil business of the Gascogne press. https://www.valdegascogne.coop/huilerie/
272 "“Un outil qui va nous permettre de multiplier par trois les volumes produits” : Val de Gascogne s’implante à Gimont", *La Dépêche,* 2024 : https://www.ladepeche.fr/2024/01/18/un-outil-qui-va-nous-permettre-de-multiplier-par-trois-les-volumes-produits-val-de-gascogne-simplante-a-gimont-11702360.php

Usines de trituration des graines oléagineuses en France

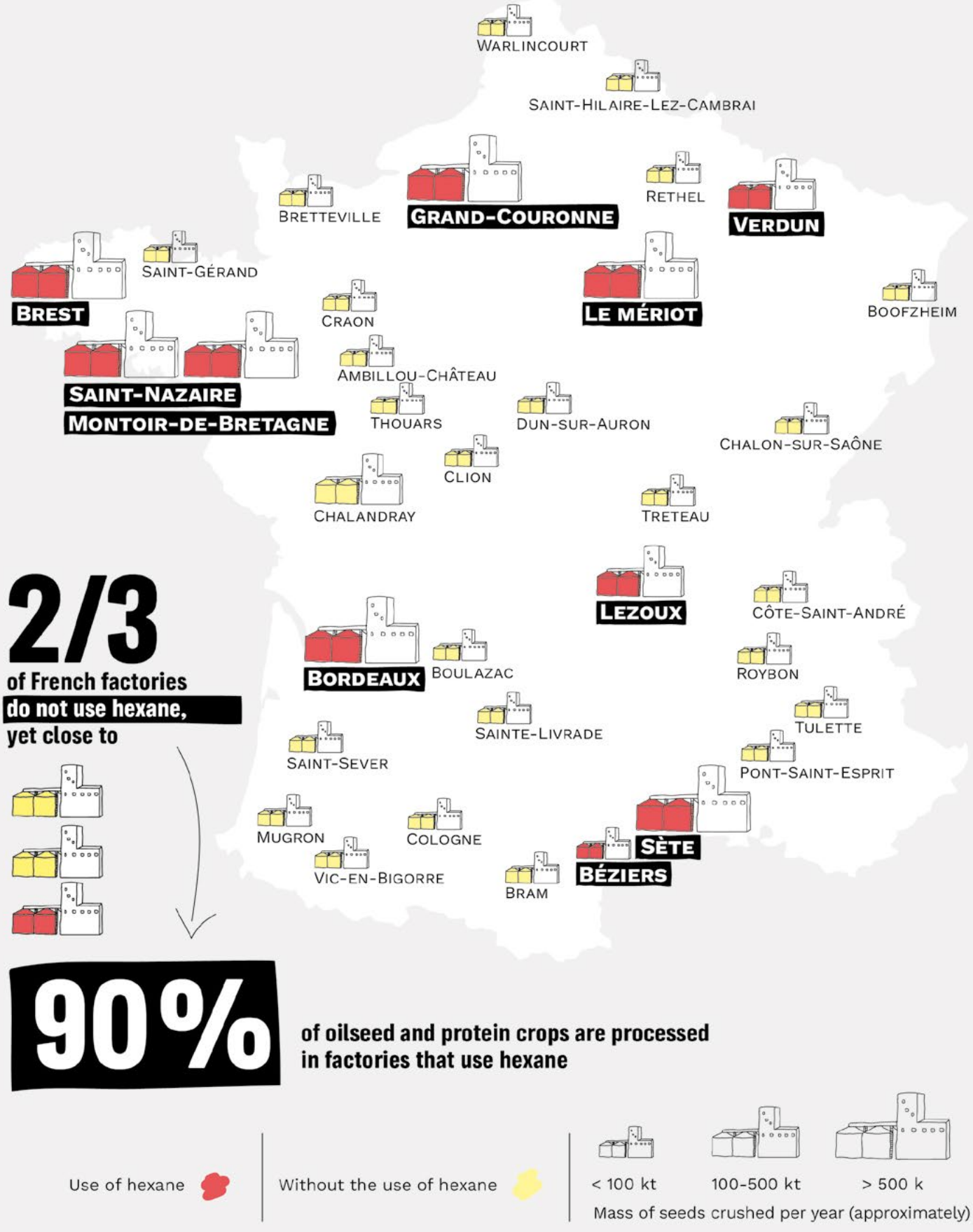

Figure 7 - Oilseed crushing plants in France

Map inspired by the map of the main crushing sites published online by Terres Univia, 2023., www.terresunivia.fr/cultures-et-utilisations/utilisations/alimentation-animale/tourteaux-oleagineux

Hexane-free industrial techniques: heating and pressure

Traditional methods maintain a low temperature throughout the extraction process in order to preserve the nutritional and taste qualities of the oils. However, this results in lower yields. This is why most industrial units that do not use hexane employ mechanical extraction with hot pressing[273]. The oilseeds are heated and then subjected to high pressure to extract the oil. This method does not use solvents, making it more environmentally friendly and healthier, and it offers satisfactory results while being suitable for larger production volumes than simple pressure extraction.

> Hexane-free oilseed meal is perfectly suitable for farm animals, as hexane is mainly used for its cost-effectiveness by large-scale factories that supply industrial livestock farms.

Julien-Boris Pelletier, director of Moulin Marion, miller and manufacturer of organic animal feed, points out: *"In terms of protein, we obtain similar qualities for oilseed meal whether it is organic or non-organic. It is entirely possible to produce oilseed meal without hexane for animals. The main advantage of hexane is that it is cheaper, at the expense of health and the environment, but in terms of nutritional quality and protein, the results are identical*[274]." **Hexane-free oilseed meal is** therefore **perfectly suitable for farm animals,** as hexane is mainly used for its cost-effectiveness by large-scale factories that supply industrial livestock farms.

Many French crushing plants use this process, enabling them to produce large quantities of oil and oilseed meal. Some are founded by cooperative groups, such as SojaPress, Terres du Sud, and Maïsadour, which specialises in the production of oilseed meal and oil by crushing organic, non-GMO soybeans of French origin. It crushes 14,000 tonnes of seeds per year using a purely mechanical cooking-pressure process, without any chemical solvents[275].

Finally, some of these factories achieve industrial scale volumes. For example, Centre-Ouest Céréales (COC) in Chalandray, in the Vienne department, brings together nearly 2,000 farmers within a limited radius, thus guaranteeing local and traceable production, while using only pressure methods[276].

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273 https://www.farmet.cz/fr/pression-a-chaud, "Pression à chaud."

274 Interview by Greenpeace France with Julien-Boris Pelletier, 26 june 2025.

275 "Soja Press, usine de trituration de soja bio ou non OGM", Terres du Sud. https://www.groupe-terresdusud.fr/acteur-economie-locale/nos-marques/soja-press

276 COC Group, factory Chalandray process. https://groupecoc.fr/processus-de-l-usine-chalandray/

However, it processes nearly 250,000 tonnes of rapeseed, sunflower and soya beans per year, producing 90,000 tonnes of oil[277] and 132,000 tonnes of oilseed meal, making it one of the largest processing plants in France[278].

It should also be noted that although Avril is France's leading user of hexane for processing oilseeds, the group also has **purely mechanical crushing plants.** The main one is Extrusel, which has several cooperatives among its shareholders, as well as **Sanders[279],** and crushes 87,400 tonnes of rapeseed and soya beans per year. In total, Avril directly owns six purely mechanical crushing plants in the country, largely owned by Sanders, either partially or entirely (Extrusel, Sojalim, Oleosyn Bio, Aliane, and several wholly-owned Sanders plants). This is what enables the group to showcase its supposedly virtuous projects, **as shown by the communication on site that ignores the use of hexane in the extraction process[280].** Added to this are **the mechanical pressing plants financed by Sofiprotéol (Soja Press, owned by** Terres du Sud[281], Graines d'Alliance de Vivadour[282], and the recent Oxyane plant[283]) which are contributing to the increase in hexane-free crushing capacity.

> Solvent-free extraction is very much in the minority in Avril's processing facilities.

However, the volumes show[284] that in reality, solvent-free extraction is very much the minority situation in Avril's processing facilities. The group's economic power is based on the use of hexane.

277 Nearly 100 million litres. Converter: https://www.20cleng.com/t-en-l/

278 "Chalandray (86) : la coopérative Centre Ouest Céréales se lance dans l'huile alimentaire", France info, 2018. https://france3-regions.franceinfo.fr/nouvelle-aquitaine/vienne/poitiers/chalandra-86-cooperative-centre-ouest-cereales-se-lance-huile-alimentaire-1543588.html

279 Extrusel, SIREN 344 188 271, SCICAA, articles of association updated on 27 June 2018.

280 See next section: "Une communication mensongère qui passe complètement sous silence l'usage de l'hexane."

281 "Sofiprotéol accompagne le groupe Terres du Sud dans ses projets de développement "Développeur de terroirs"", 2022. https://www.sofiproteol.com/sofiproteol-accompagne-le-groupe-terres-du-sud-dans-ses-projets-de-developpement-developpeur-de-terroirs/

282 "Sofiprotéol accompagne Vivadour dans le déploiement de son plan stratégique", 2024. https://www.vivadour.coop/actualites/sofiproteol-accompagne-vivadour-dans-le-deploiement-de-son-plan-strategique

283 "Oxyane inaugure son usine de trituration du soja", *Tema Agriculture*, 2024. https://www.tema-agriculture-terroirs.fr/circuits-culture/cooperatives-negoces/oxyane-inaugure-son-usine-de-trituration-du-soja-908387.php

284 Methodology. Note that the capacities of the Boulazac plant, operated by Sanders Périgord, are missing due to the unavailability of data.

C. The lack of transparency surrounding the use of hexane is exacerbated by Avril's omnipresence within the oilseed and protein crop sector

In addition to the lack of transparency and information surrounding hexane today (in terms of the risks it poses to human health and its presence in food products in the absence of labelling), there is also a lack of transparency regarding its use by manufacturers.

Indeed, as we shall see in this section, this lack of transparency is compounded by a lack of communication regarding the use of this petrochemical solvent in extraction processes. **This silence is sometimes accompanied by misleading messages, which contributes to this lack of transparency.**

However, while the Avril group is economically dependent on the use of this petrochemical solvent (see IV-B above), Greenpeace highlights its omnipresence in the industry and its governing bodies.

1. An industry built around Avril

The reorganisation of Avril in 2015 was accompanied by a reorganisation of other bodies in the sector: the inter-professional organisations ONIDOL (Organisation nationale interprofessionnelle des graines et fruits oléagineux) and UNIP (Union nationale interprofessionnelle des plantes riches en protéines) merged to become **Terres Univia**. The sector's technical centre (CETIOM) merged with the UNIP technical department and renamed **Terres Inovia**, and **Terres OléoPro** was created to bring together the players in the sector (including Avril[285]) under a common brand.

However, in this new form, the French oilseed and protein crop sector is completely dominated by the Avril group, which **"sets the pace for its organisation"** and **"has the greatest influence on the strategic direction** of the entire French sector[286] ." As we shall see, Avril **wears many hats** within the sector's governing bodies, as well as within the majority agricultural union, with Arnaud Rousseau as president of the FNSEA[287], in order to promote its interests.

As Guillaume Assogba writes, the inter-professional organisations whose role is to coordinate and promote compromise **are dominated by the Avril group**[288], which is also one of the main financiers of the sector. Indeed, *through* Sofiprotéol, **Avril** "finances actors from upstream to downstream and tries to secure sourcing and outlets[289] ." Avril is thus presented in communications as "the industrial and financial player in the vegetable oils and proteins sector[290]", eclipsing any possible alternative players. This dependence is openly acknowledged: all of the above-mentioned bodies are located at 11, rue de Monceau, Paris, the address of Avril's headquarters.

More broadly, **Arnaud Rousseau**, chairman of Avril's board of directors, is also head of **the powerful agricultural union FNSEA.** His predecessor at the helm of Avril, Xavier Beulin, was himself president of FNSEA from 2010 until his death in 2017.

Avril's shareholding structure reflects the group's privileged position in the French agro-industry. The group is owned by the Interprofessional Development Fund for the Oilseed and Protein Crop Sector (FIDOP) and the French Federation of Oilseed and Protein Crop Producers (FOP), a trade union association specialising in the FNSEA. Since 2014, the Avril Foundation has also been one of the group's shareholders[291]. **This shareholder structure raises questions about the close relationship between a private structure, the Avril group,**

285 "Au-delà des nouveaux noms, quelle ambition ?", *Tema Agriculture,* 2015. https://www.tema-agriculture-terroirs.fr/cultivar-grandes-cultures/actualites/au-dela-des-nouveaux-noms-quelle-ambition-867665.php
286 Assogba, "Les dynamiques...", *op. cit.*
287 The National Federation of Farmers' Unions.
288 Assogba, "Les dynamiques...", *op. cit.*
289 *Ibid.*
290 Terres OléoPro, "Organismes fondateurs", *op. cit.*
291 Avril, "Qui sont les actionnaires d'Avril ?." https://www.avril.com/article/qui-sont-les-actionnaires-davril

and bodies that are supposed to represent the agricultural world as a whole, such as the FOP, which receives public funds for this purpose[292]. Indeed, as Avril has repeatedly pointed out, most of the added value generated by the group is returned to "the oilseed and protein crop sector[293]." **This means that both the FOP and the FIDOP have an interest in ensuring that the group is as profitable as possible.** However, in the case of hexane, which is central to Avril's economic activity, **this profitability conflicts with the public interest** and creates a particularly uncompetitive situation for players who do not use this chemical solvent.

This raises the question of what role these manufacturers play in promoting a harmful system, to the detriment of more virtuous actors such as the FIDOP, which the FOP is also supposed to represent.

The FOP fully acknowledges its links with Avril: its website states that its role is to "**reconcile the growth of the Avril group's industrial activities** with the return of added value to producers"[294] . The industrial development of Arnaud Rousseau's group is therefore central to the FOP's activities, even though it is a trade union association that is supposed to represent the broader interests of its members.

Moreover, **all four presidents and vice-presidents of the FOP** are directors of Avril[295] – and other members of the board are involved in the group, such as the president of the Avril Foundation[296]. The honorary president of the FOP is also the long-standing president and co-founder of Sofiprotéol.

Avril also wields considerable power over the sector due to Sofiprotéol's control of **the French Oilseed Strategic Action Fund** (FASO). The FASO is used to finance studies, promotional and communication activities for the sector and its products, as well as innovation and research projects. It is rather questionable that a fund financed by CVOs, levied on producers[297], should be managed by a private actor. This **could enable Sofiprotéol to influence the sector's research and communication activities.**

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292 Court of Auditors, 2002 Annual Public Report, Part 2e: "Observations des juridictions financières - L'utilisation de "cotisations volontaires obligatoires" prélevées sur les producteurs d'oléo-protéagineux"; FOP, "Missions et fonctionnement", https://www.fopoleopro.com/la-fop/missions-et-fonctionnement/

293 Avril, "Rapport annuel intégré", 2023.

294 FOP, "Missions et fonctionnement" (Missions and operations), op. cit.

295 FOP, "Organisation." https://www.fopoleopro.com/la-fop/organisation/

296 "Guillaume Chartier, nouveau président de la fondation Avril", *Réussir*, 2024. https://www.reussir.fr/ladepeche/guillaume-chartier-nouveau-president-de-la-fondation-avril

297 Terres Univia, "Cotisation volontaire obligatoire. À quoi sert-elle ?" https://www.terresunivia.fr/fichiers/publications/cotisation-volontaire-obligatoire.pdf

Avril's central role is not without consequences for farmers.

Faced with increasing internationalisation and the trading of raw materials on stock exchanges, **farmers find themselves doubly disadvantaged** in their relationships with seed producers, traders and the Avril Group. On the one hand, they have to accept the prices imposed by seed producers, who often have a monopoly on certain varieties; on the other hand, they have to adapt the selling price of their crops to that of the financial markets (which may be lower than the break-even point for their farms[298]). This leads to a significant drop in margins for farmers, **under pressure in particular from industrial users such as Avril, France's leading oilseed crushing company,** which seeks to buy raw materials at lower prices[299].

As a result, farmers have become dependent on processors to sell their crops, due to specialisation in rapeseed and sunflower (supported by the CAP to reduce protein dependence on the United States) and the promotion of diester use[300]. Due to Avril's presence throughout the oilseed and protein crop chain (agricultural production, traders, primary processing, secondary processing), the group is **able to make farmers dependent on the outlets it offers them. However, Avril's strategic choices can also lead to difficulties for other players in the sector,** as the example of diester[301] has shown.

2. Avril is at the heart of all decision-making bodies in the sector

As such, Avril is now at the heart of strategic decisions relating to processes, directions and opportunities in this sector. Here again, the group plays a **special role in maintaining an industrial system based on hexane,** about which consumers are not informed.

However, as an operator of hexane plants, Avril is well aware of its toxicity – the impact of which on workers has been documented for decades. **So how can we explain that not only does Avril continue to use hexane extensively, but also that organisations in the sector are not taking action to ensure greater transparency around the use of this solvent?**

While researchers from various industry institutes explain in articles the industrial and economic reasons why it is difficult to do without hexane, comparing the solvent to other potential chemical solvents[302], **it is undeniable that mechanical crushing is a well-developed technique,** even on a relatively large scale. One of the main limitations of its use, compared to hexane extraction, **is that it is less profitable.** Today, however, given the lack of transparency surrounding extraction with hexane, consumers cannot know that they may be consuming

298 Assogba, "Les dynamiques...", *op. cit.*
299 *Ibid.*
300 *Ibid.*
301 *Ibid.* ; "L'incroyable rente des agrocarburants", *Reporterre*, 2015. https://reporterre.net/ENQUETE-3-L-incroyable-rente-des-agrocarburants
302 Carré *et al.*, "Solvent Solutions...", *op. cit.*, "Part I: Physical Properties."

potentially toxic residues and therefore have no incentive to switch to products obtained without the use of hexane. This raises questions about the role of industry institutions in the lack of transparency surrounding this product.

Furthermore, these organisations are responsible for research and development in the oilseed and protein crop sector. The current inter-branch plan, approved in June 2024[303], includes among its key actions "studies of processing methods with a view to improving yields and product quality."

There are no further details on this subject, so it is difficult to say whether this action covers the development of alternatives to hexane, **but it is certain that the inter-professional organisation could play a central role in this area if it chose to make it a strategic priority.** Moreover, among the interprofessional organisation's objectives in terms of research, innovation and transfer for post-harvest and market opportunities, we also find "supporting regional stakeholders in the **establishment of primary processing units[304]**."

The example of the development of a recently authorised alternative solvent, méthyloxolane[305] **also raises questions about the industry's commitments.** This solvent, recently authorised as a processing aid by the European Union and considered a viable environmental and economic alternative to hexane[306], **was initially identified in a thesis carried out by Terres Inovia and Saipol,** who were therefore aware of its potential. However, it was a chemical company, Pennakem, a subsidiary of Minafin, that **took over this work and submitted the authorisation application to the EFSA**[307]. This appears to be a missed opportunity for the oilseed and protein crop sector to develop an alternative solvent to hexane.

The sector's authorities work closely with Avril, which plays a leading role in their strategic orientations. As we shall see, the Public affairs organisations, communications agencies and technical institutes working on the issue of oilseed processing **are also infiltrated by Avril.** While it is normal for its subsidiaries to be represented there as economic players, it is impressive to see how omnipresent the group **is, systematically benefiting from several seats and management positions** wherever strategic decisions are made in the sector.

303 Terres Univia, "Cotisation volontaire obligatoire…", *op. cit*.

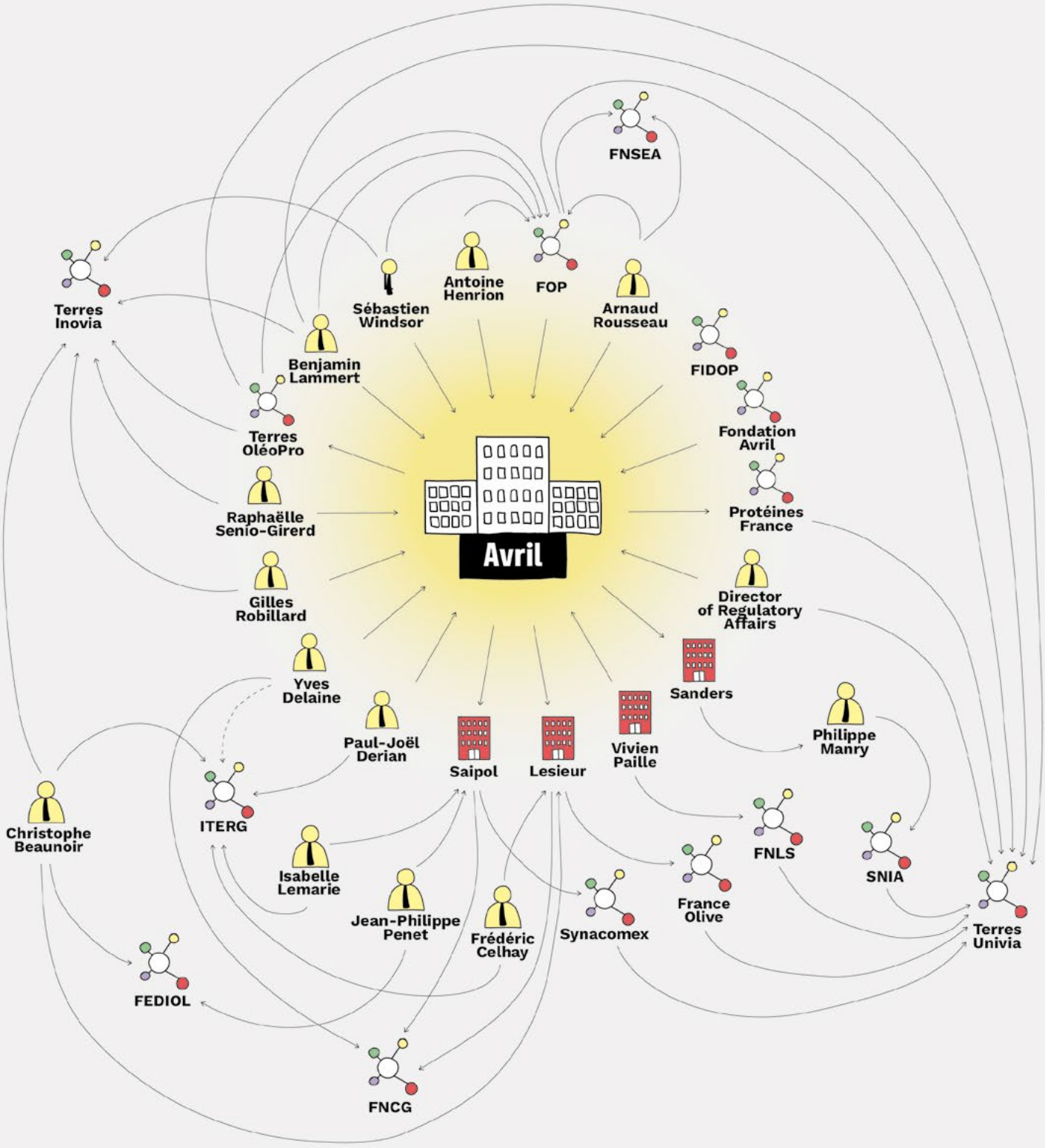
304 Terres Univia, "Le plan d'action 2024-2026 de la filière des huiles et protéines végétales", 2023. https://www.terresunivia.fr/fichiers/publications/le-plan-d-action-2024-2026-C.pdf

305 2-Methyloxolane was authorised by the European Union in 2023 for use as a processing aid. It is a solvent produced from agricultural by-products such as sugar cane bagasse.

306 Rapinel *et al.,* "2-Methyloxolane (2-MeOx) as Sustainable Lipophilic Solvent to Substitute Hexane for Green Extraction of Natural Products. Properties, Applications, and Perspectives", *Molecules*, 28 July 2020: https://doi.org/10.3390/molecules25153417

307 Terres Inovia, "L'EFSA donne son feu vert au solvant EcoXtract®", 2022. https://www.terresinovia.fr/-/l-efsa-donne-son-feu-vert-au-solvant-ecoxtract

Avril, at the heart of all decisions concerning oilseed and protein crop



Terres Inovia: Technical institute for oilseed and protein crops
Terres Univia: Interprofessional organisation for vegetable oils and proteins
ITERG: Technical Institute for Fats
FOP: FNSEA specialist association
FEDIOL: European vegetable oils and proteins industry
FNCG: National Federation of Fats
Terres OléoPro: the sector's label

Figure 8 - Avril, at the centre of all decisions in the oilseed and protein crop sector

→ **Terres Inovia:** an inter-professional technical centre for oilseeds, protein crops and hemp, Terres Inovia's mission is to optimise seed production and diversify its outlets (oil, oilseed meal, etc.).

Terres Inovia is currently chaired by a director of Avril Industrie, a subsidiary dedicated to acquiring financial stakes in animal nutrition and health companies[308]. Furthermore, **the board of directors of Terre Inovia[309]** includes at least **four directors or executives from the Avril Group** (group directors[310], director of Lesieur[311], director of innovation[312]). **No other economic player is as well represented:** Saipol's competitor Cargill has a seat on the board of directors of Terres Inovia. The Avril Group is also on **the Institute's scientific council,** with a seat dedicated to Saipol.

→ **Terre Univia:** an interprofessional organisation for vegetable oils and proteins, it brings together the main professional associations and federations involved in the production, marketing, processing and primary use of oilseeds (rapeseed, sunflower, soya, flax, olive, etc.). It is a **lobbying** organisation responsible for identifying opportunities for the oilseed and protein crop sector.

Terre Univia is **chaired by the president of the FOP, who is also a director of the Avril Group**[313]. Other members of the board in 2023[314], include the then director of regulatory affairs for the Avril Group[315].

In addition, **the board of directors is composed of organisations from the sector divided into three groups:** the production group, the marketing group and the processing and packaging group. **Avril is omnipresent in all three,** due to its economic involvement at all stages of the value chain. In the production group, Avril is a member of the **France Olive**[316] board *via* Lesieur, or the **FOP**, which has particularly close ties with Avril (see above). In the marketing group, Avril is represented in **Synacomex** via *via* Saipol[317]. In the processing and packaging group, the National Federation of Dried Vegetables (**FNLS**) includes Vivien Paille, a brand belonging to the Avril group; Avril is also one of the founding members of **Protéines France**[318] and finally, the National Union of Animal Nutrition Industry (**SNIA**) counts the managing director of Sanders[319] among its two vice-presidents.

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308 Avril Industrie, SIREN 498 808 278, registered on 12 August 2022.
309 Terres Inovia, Composition of the Board of Directors and Scientific Council, December 2023. https://www.terresinovia.fr/documents/41383/152520/CA-CS-2024.pdf/e050cfaa-c743-a3a1-c40c-d85e2ab3ead5?t=1732633075957
310 Avril, "Modèle et gouvernance." https://www.avril.com/groupe/modele-et-gouvernance
311 Christophe Beaunoir's LinkedIn profile. https://www.linkedin.com/in/christophe-beaunoir-3526206/?originalSubdomain=fr
312 Raphaëlle Senio-Girerd's LinkedIn profile. https://www.linkedin.com/in/rapha%C3%ABlle-senio-girerd-504351111/
313 Avril, "Modèle et gouvernance", *op. cit.*
314 Terres Univia, 2022 Activity Report. https://www.terresunivia.fr/fichiers/publications/rapport-d-activite-2022.pdf
315 Kristell Guizouarn's LinkedIn profile. https://www.linkedin.com/in/kristell-guizouarn-b68a39128/?originalSubdomain=fr
316 Guillaume Assez's LinkedIn profile. https://www.linkedin.com/in/guillaume-assez-8b5b1754/?originalSubdomain=fr
317 Presentation of the professions represented by the union. https://synacomex.com/les-sections
318 http://www.proteinesfrance.fr/fr/membres
319 Presentation of the professions represented by the union. https://nutritionanimale.org/en/le-snia/

Avril is thus present in all the groups that make up the governance of Terres Univia, which is responsible for promoting the interests of the sector to political decision-makers, as well as directly in the organisation's office. **This privileged position offers Avril the opportunity to steer the sector's strategic projects to its advantage.**

→ **Terres OleoPro:** Brand launched in 2014 via the economic interest group (EIG) Terres de Communication, bringing together FOP, Terres Univia, Terres Inovia, Avril and Sofiprotéol.

Avril is thus directly involved in public **communication projects** for the oilseed and protein crop sector as **the founder of Terres OléoPro.** Avril and Sofiprotéol each have a seat on the economic interest group (EIG) leading the project. The links between the various organisations in the sector are so close that Arnaud Rousseau sits on the board of directors for both Sofiprotéol and FIDOP[320]. Avril is **also the main source of funding for Terres OléoPro:** the group has contributed more than 60% of the consortium's expenses over the last four years[321].

This communication label aims to "popularise and make accessible to as many people as possible the professions of each, from research and varietal innovation **to the stages of processing [of] seeds** (rapeseed, sunflower, soya, peas, field beans, pulses[322]...)." However, as we shall see, **Terres OléoPro's promotional materials never mention hexane**, suggesting that the products processed by industry players are the result of a purely mechanical process.

→ ITERG, the Industrial Technical Centre for the Fats and Related Products Industry, **works directly on the issue of extraction solvents** and **the optimisation of extraction and refining processes**[323], particularly on behalf of oilseed crushers.

However, Avril is particularly influential at ITERG. The **Institute's vice-president** is also the **director of Innovation & Sustainable Development at the Avril group.** In addition to the latter, the Institute's board of **directors also includes the director of Lesieur and a representative of the Avril group.** Similarly, of the ten members of the ITERG scientific committee, **Avril occupies two seats** via Lesieur and Saipol, alongside other industrial players such as St Hubert, Cargill, Bunge and ADM[324].

Furthermore, the president of ITERG, who is now also president of the National Federation of Fats (**FNCG**), **worked for 35 years at the Avril Group,** notably as managing director in charge of the group's processing activities[325]. He is therefore very familiar with the issue of hexane.

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320 Terres de Communication, minutes of deliberations, General Meeting of 30 June 2021.
321 Terres de Communication, internal regulations, amended and updated following the decisions of the Joint General Meeting of 26 June 2024.
322 Terres Oléopro, "Organismes fondateurs", *op. cit.*
323 ITERG, "Rapport d'activité 2024", https://iterg.com/wp-content/uploads/2025/04/Rapport-dactivite-2024.pdf
324 *Ibid.*
325 Presentation by Yves Delaine. https://www.ceo2ceoconsulting.com/fr/nos-senior-advisors/yves-delaine

An expert interviewed by Greenpeace confirms that **ITERG is thus heavily controlled by Avril,** due to the group's position in research centres (funding, strategic decisions) and on the board of directors.

Given its role in the ITERG's office and scientific council, **Avril is therefore in a privileged position to influence the institute's research priorities,** including the issue of alternatives to hexane. The fact that an economic actor plays such a central role in the technical institutes of the sector, which it also controls, can only lead to **economic interests being prioritised at the expense of the general interest,** particularly public health.

→ Avril is widely represented in other interprofessional organisations whose activities may overlap with its own, such as the **FNCG**, whose members include Lesieur and Saipol, and whose president is also the president of the ITERG and a former senior executive at Avril. For its part, the **National Union of Animal Industry** (SNIA) has as its vice-president the **managing director of Sanders**[326].

→ In the EU, FEDIOL **represents oil and oilseed meal producers.** Out of the **Five seats** on its board of directors are **Five seats** on its board of directors are occupied by economic stakeholders, **two of which are reserved for Avril subsidiaries:** one for Saipol and one for Lesieur, whose director is also chairman of the board of directors of FEDIOL[327].

> Avril is at the heart of agro-industrial inertia surrounding hexane.

Avril is at the heart of agro-industrial inertia surrounding hexane: the solvent is a cornerstone of its economic toolkit, allowing the group to profit from its profitability while making alternatives difficult, especially since the group occupies a central position in the industry.

326 Home page of the National Union of Animal Nutrition Industries. https://nutritionanimale.org/en/le-snia/

327 FEDIOL, "The executive board." https://www.fediol.eu/web/codes%20of%20practice/1011306087/list1187970091/f1.html

3. Misleading communication that completely ignores the use of hexane

Terres OléoPro, a communication label for the industry, mainly funded by Avril, is a prime example of this code of silence: **the term "hexane" is never used in videos showing how seeds are crusheds**[328]. According to these videos, rapeseed and sunflower seeds are simply "pressed and heated[329] ", and possibly "refined[330] ." In a video specifically presenting the activity of a Saipol factory, a group manager informs us that "the seeds will be preheated, they will be made into small flakes, they will be pressed. We will **extract the solid part from the liquid part.** The liquid part that interests us is what is known as crude oil[331] [...]." The processes of deodorisation and decolourisation during refining are also mentioned. However, **no details on extraction methods are ever mentioned.**

Avril and Saipol contribute significantly to the lack of transparency surrounding the subject of hexane. They present themselves as players strongly committed to sustainable development. In their communications, they state that they are participating in the environmental transition, in particular by "replacing fossil fuels with bio-based solutions that can help solve part of the carbon equation[332] ." Saipol has even launched initiatives such as OleoZe[333] to promote the reduction of greenhouse gas emissions by encouraging farmers to adopt a low-carbon approach. However, **hexane is derived from petroleum refining.** The solvent essential to the crushing process, and therefore **the group itself, is heavily dependent on fossil fuels.**

More generally, **Saipol presents a truncated picture of its extraction methods.** The company states: "Rapeseed edible oils are produced **by pressing and extracting the seeds,** followed by food-grade refining (bleaching with bleaching earth and deodorisation with steam) which preserves the properties of the oil while optimising its shelf life[334]", without specifying to readers the use of a chemical solvent, **thus concealing the use of hexane.**

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328 Terres OléoPro, "De la graine à la salle de bain : la glycérine présente dans la fabrication du dentifrice." https://www.youtube.com/watch?v=HUggQGGODBM&list=PLApmxcQFge0_0aH7VhzB0BgIwm5AZzp8N&index=3

329 Terres OléoPro, "De la graine à l'étable : Les tourteaux (alimentation du bétail)." https://www.youtube.com/watch?v=jV6YxC87RrY&list=PLApmxcQFge0_0aH7VhzB0BgIwm5AZzp8N&index=2

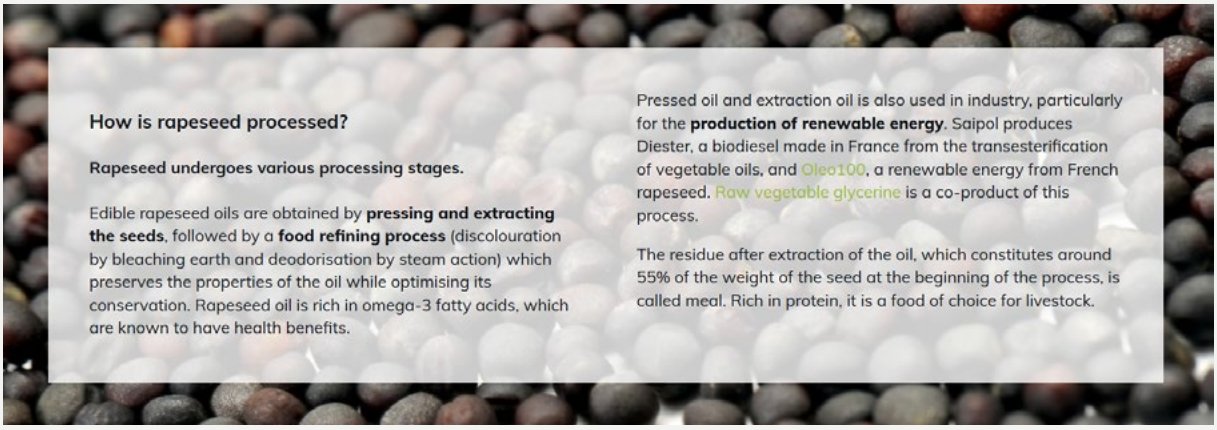
330 Terres OléoPro, "De la graine à l'huile : bienfaits des huiles, fabrication des huiles." https://www.youtube.com/watch?v=PYFah-UTSv0&list=PLApmxcQFge0_0aH7VhzB0BgIwm5AZzp8N&index=1

331 Terres OléoPro, "Je découvre la pression de l'huile de colza." https://www.youtube.com/watch?v=CwUeefrJ-Jo

332 Avril, "Énergies renouvelables." https://www.avril.com/activites/energies-renouvelables

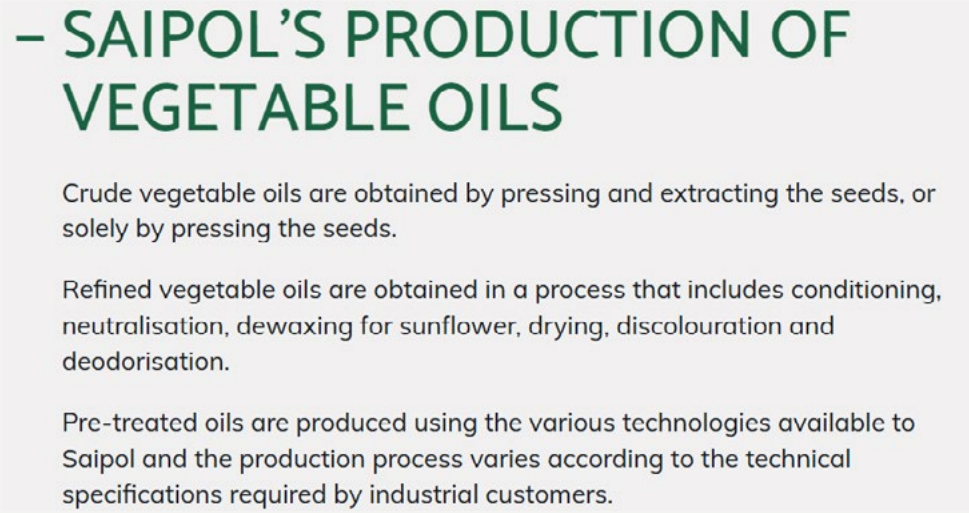
333 OleoZE seed sales platform. https://www.oleomarket.fr/oleoze

334 Saipol, Presentation of activities related to rapeseed. https://www.saipol.com/des-graines-aux-produits-finis/graines-de-colza/



Excerpt from the Saipol website (June 2025)

The same applies to other communications on the website[335]: "Vegetable oils are obtained by pressing and extracting seeds, or solely by pressing seeds." As with the Terres OléoPro communication, no details on extraction methods are ever mentioned. It is therefore very difficult to assume from reading these lines that the oils are extracted using a chemical compound, which is not derived from petrochemicals.



Excerpt from the Saipol website (June 2025)

335 Saipol, Presentation of the range of vegetable oils. https://www.saipol.com/nos-solutions/huiles-vegetales/

Thus, while Avril's communication highlights the fact that the group's activities aim to "serve the Earth" by emphasising local production and the decarbonisation of transport[336], **the group makes no mention whatsoever of its massive use of a neurotoxic solvent suspected of being reprotoxic.** Worse still, the group claims to produce "high-quality food[337]" – **even though hexane residues can be found in the products in question.**

Above all, the group presents itself as a committed player in the field of high-quality food, particularly in its role as a processor, stating that "Avril's contribution to better nutrition for humans begins with the processing of rapeseed and sunflower seeds, **when vegetable oil and oilseed meal for animal feed are extracted from the seeds.**" Avril thus claims to offer "safe and traceable food, produced with respect for the environment and those who contribute to it[338]."

This is a lie on several levels: first, Avril is fully aware of the toxicity and potential health impacts of hexane, but above all, the group knows full well that the traces present in oilseed meal are not taken into account by the regulations. Furthermore, as mentioned above, Saipol was convicted in early 2025 of manslaughter alongside SNAD, with the court noting that they had "deliberately violated the specific provisions applicable to explosive atmospheres[339]" in connection with the explosion at the Dieppe factory, which killed two people. Under these circumstances, communicating about the company's respect for its employees seems inappropriate.

Outside of its website, Avril's communications are equally problematic. This is particularly true of the use of Saipol's slogan "**from seed to oil naturally**", which is displayed prominently at some of its factories, according to images available online[340]. **Avril's use of the term "naturally" is particularly dishonest,** as it suggests that no chemicals are involved in Saipol's activities.

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336 Avril, "Solutions pour agir." https://www.avril.com/solutions-pour-agir

337 Avril, "Servir la Terre, de la raison d'être à la raison d'agir : alimentation durable et énergies décarbonées", 2024. https://www.avril.com/article/servir-la-terre-de-la-raison-detre-a-la-raison-dagir-alimentation-durable-et-energies-decarbonees

338 Avril, "Grande consommation." https://www.avril.com/activites/alimentation-humaine#:~:text=La%20contribution%20d%E2%80%99Avril%20%C3%A0,destin%C3%A9s%20%C3%A0%20l%E2%80%99alimentation%20animale

339 "Explosion de Saipol à Dieppe : 7 ans après la mort de deux employés de la Snad, les deux sociétés condamnées pour homicide involontaire", France Info, 2025. https://france3-regions.franceinfo.fr/normandie/seine-maritime/dieppe/explosion-de-saipol-a-dieppe-7-ans-apres-la-mort-de-deux-employes-de-la-snad-les-deux-societes-condamnees-pour-homicide-involontaire-3117601.html

340 "Neuf sites classés Seveso dans l'Hérault", France Bleu, 2019. https://www.francebleu.fr/infos/environnement/neuf-sites-classes-seveso-dans-le-departement-de-l-herault-1569515393

FEEDING PEOPLE SUSTAINABLY

Avril's contribution to better nutrition for mankind begins with the processing of rapeseed and sunflower seeds, when the vegetable oil and the oilcake for animal feed are extracted from the seed. The Group capitalizes on this expertise thanks to an integrated organization and a presence upstream in the value chain. This expertise enables Avril to offer a safe and traceable food product, produced with respect for the environment and those who contribute to it.

Excerpt from the Avril website (June 2025)

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Visit to the new Saipol Mériot factory in Aube on 6 February 2009.

© Greenpeace France

Saipol Bassens factory in Bordeaux on 26 July 2025.

Conclusion and recommendations

With this report, **Greenpeace France wishes to alert the public and consumers to the presence of hexane in many of their everyday food products** and to sound the alarm on health issues. We also wish to call on the relevant public authorities, in particular the Ministries of Health, Ecological Transition, Agriculture and Food Sovereignty, as well as the competent health authorities, namely EFSA and ECHA, to ensure that everyone assumes their responsibilities and takes seriously the risk of exposure of the French and European population to hexane and the associated health consequences.

Greenpeace France is calling for a ban on hexane due to its proven health effects and in accordance with the precautionary principle, as well as a ban on the importation of products containing hexane, particularly given the lack of data on the risks of chronic exposure to low doses through daily consumption of common food products. Although its use is prohibited in organic farming specifications, this measure remains insufficient to fully protect consumers. Only a general ban would prevent the risks of cross-contamination, which could affect the entire food chain. Furthermore, in a context of growing precariousness, where eight million French people live in a situation of food insecuritye[341] (including at least two million who depend on aid), a large part of the population cannot afford to turn to safer organic products. It is therefore imperative to guarantee fair health protection for all by banning the use of this harmful substance in food for the entire population.

341 Secours catholique, réseau CIVAM, Solidarité Paysans, Fédération française des diabétiques, "L'injuste prix de notre alimentation", September 2024.

In addition, further measures are needed:

- **Further research into the chronic toxicity** of hexane and **documentation by the competent authorities** of the exposure of the European and French populations to this solvent;
- **The obligation to list processing aids** on food labels to guarantee consumers' right to information;
- **Support for the organic sector, which, due to the strict ban on hexane in its specifications,** must be supported, strengthened and protected in order to guarantee its non-contamination;
- **The reassessment of current exposure limits** for workers in industries that use hexane and the introduction of better protection for them against the risk of explosion in crushing and extraction plants;
- **Support for innovations and other hexane-free extraction methods,** including artisanal cold-pressing techniques and industrial mechanical extraction and hot-pressing techniques.

Methodology

Production of the report

This Greenpeace France report is based primarily on a **review of scientific and institutional literature** on hexane, its regulation and its health risks. In addition, **research** was conducted **using open sources** (administrative documents, professional databases, press, industry presentations, websites), as well as **documents obtained through requests for information** from various prefectures (in particular, to obtain solvent management plans from factories using hexane).

In addition, the preparation of this report involved **interviews with experts from various sectors** (scientific, academic, industrial, commercial, etc.). It is nevertheless important to note that the individuals cited in the report may not necessarily have been able to review the entire report, apart from their own comments.

Testing

These tests were carried out with the Joint Measurement Centre at the University of Littoral-Côte d'Opale (ULCO). This laboratory was selected in particular because it has a method for detecting hexane in foodstuffs, which had already been tested on behalf of other parties.

Selection of samples

For the tests carried out, which consisted of detecting hexane residues, **9 to 10 samples were tested per product** (with the exception of oilseed meal), including **2 to 3 samples per brand** in each case. Greenpeace selected two main criteria for testing for the presence of hexane:

- **Market share in France**. Using the latest available data, Greenpeace selected the products with the highest market share to ensure that they are widely consumed on a daily basis by French people. Among these, and to ensure a wide variety of brands, Greenpeace took care to purchase and test products from both large corporations and retailer brands. In addition, Greenpeace sought to obtain products with different use-by dates wherever possible, in order to diversify the production chain.

- **Availability in stores**. Products were purchased based on a list of those ranked by market share, but also taking into account whether or not they were available in the supermarkets visited at the time of testing. As a result, depending on the retailer and its product restocking on the day of purchase, some brands at the top of the ranking are not included in our analysis results.

Note: Among private label products, most items came from Leclerc and Carrefour supermarkets, which are the market leaders in terms of market share[342]. In order to diversify the products once again, and to take into account availability and geographical proximity to the laboratory, Monoprix's own-brand products were also tested.

Purchasing method and delivery to the testing laboratory

In order to limit the risk of external contamination, breaks in the cold chain or unreliable results, Greenpeace followed a meticulous purchasing protocol in consultation with the laboratory that carried out the tests:

- In-person purchase in two to three different supermarkets and delivery to the laboratory within one hour of purchase;
- Purchase of several products of the same type with different use-by dates or best-before dates;
- For meal cakes, packaging of the product in an airtight box and shipment to the laboratory on the same day.

Laboratory detection methodology

The aim of the study was to measure the levels of *n*-hexane and its main isomers (2-methylpentane and 3-methylpentane) in product samples provided by Greenpeace.

The analysis was performed using gas chromatography coupled with headspace mass spectrometry (HS-GC/MS). As the details of the method vary for each matrix analysed, Greenpeace is available to provide additional information on each matrix.

Finally, a calibration range was established before each series of analyses for the quantification of hexane, and at least three replicate analyses were performed.

In the case of chicken, the analysis specifically focused on samples of fat and chicken taken from the following products.

Analysis of results

For all of the products tested, the laboratory provided Greenpeace with the results for the presence of *n*-hexane and its main isomers mentioned above. The raw results were provided for each replicate of each product. An average, standard deviation and relative standard deviation were also calculated for the three replicates of each product in order to smooth out any discrepancies in the raw results.

342 "Grande distribution : E.Leclerc, Intermarché, U, Carrefour... Qui sont les gagnants et perdants des parts de marché sur cinq ans ?", *LSA Conso*, 2025. https://www.lsa-conso.fr/grande-distribution-e-leclerc-intermarche-u-carrefour-qui-sont-les-gagnants-et-perdants-des-parts-de-marche-sur-cinq-ans,460730

In addition, for each type of product tested, the results are shown with varying degrees of precision depending on whether or not they exceed the detection and quantification limits. To put it simply, the detection limit is the limit at which *n*-hexane is detected: 0.01 mg/kg, for example. The quantification limit is the limit at which it is actually possible to accurately quantify the amount of *n*-hexane present in a sample: 0.02, for example. Thus, some of the results given in the table below appear as "<0.0X mg/kg" because they do not exceed the limit of quantification.

The laboratory's limits of detection (LOD) and quantification (LOQ) for the analyses performed, by product type, are as follows:

Milk → LOD: 0.005 mg/kg / LOQ: 0.01 mg/kg;

Oil/butter → LOD: 0.005 mg/kg / LOQ: 0.01 mg/kg;

Chicken → LOD: 0.01 mg/kg / LOQ: 0.02 mg/kg;

Eggs → LOD: 0.01 mg/kg / LOQ: 0.02 mg/kg;

Meal → LOD: 5 mg/kg / LOQ: 10 mg/kg.

Analysis and comparison of factory processing capacities

Research to assess, analyse and compare the processing capacities of each French factory, as well as whether or not they use hexane, was carried out by Greenpeace France, based on the following public sources:

- Prefectural authorisation decrees for the various factories and any changes thereto;
- Inspections carried out by environmental authorities;
- Solvent management plans (SMPs) for factories, obtained through requests for information from prefectures;
- Company communications;
- Local and national press;
- Professional and commercial databases.

To perform this calculation, the **processing capacities of the factories, expressed in tonnes of crushed seeds per year,** were taken into account. In most cases, this was the unit used in the above-mentioned sources; in a very small number of cases, only the daily processing capacities of these factories were expressed, and it was therefore necessary to convert them. It is important to note that in the case of eight of the ten French plants using hexane, Greenpeace France was able to obtain the PGS, which specifies, among other things, the volume of seeds processed for the year 2024 by the plant in question. Thus, when Greenpeace had this data available, the decision was made to give it priority over the data relating to theoretical processing capacities. This choice, which was

made with the aim of being as close as possible to the actual volumes processed by the largest French factories, leads to a slight underestimation of the volume of these factories using hexane, compared to those not using it, for which the theoretical processing capacity was used.

This distinction does not apply to the Saipol plant in Lezoux and the Valtris Champlor plant in Verdun: although these plants use hexane, the authorities did not provide Greenpeace with the requested PGS. For these plants, the theoretical processing capacity was used for the calculation.

Overall, this method of analysis may be biased due to the fact that a plant's theoretical processing capacity may differ slightly from the actual mass that the plant processes. Nevertheless, this bias applies to each of the plants identified except those using hexane, for which Greenpeace was able to obtain the PGS. Consequently, it is more accurate to consider the results obtained, and the calculations derived from them, **as estimates.**

Furthermore, in the case of one of the 35 factories – Sanders Périgord, located in Boulazac and operated by Sanders[343] –, Greenpeace France was unable to find any data on processing capacity. This is therefore missing data, which could potentially increase Avril's share of metropolitan seed processing, but slightly decrease the use of hexane in Avril's overall share of factories. Nevertheless, this difference would in reality be very small, as Saipol's plants (which use hexane) process on average 10 to 15 times more seeds than Sanders' plants.

343 Presentation of Sanders Périgord. https://interbionouvelleaquitaine.com/members/sanders-perigord/

Appendix 1: The stages of crushing

The stages of crushing: from oilseeds to edible oil and oilseed meal

Step 1: seed preparation

In order to optimise oil extraction, the seeds are prepared to maximise yield: they are first cleaned, then they may be hulled (their outer shell is removed) to increase the protein content and concentration in the meal. Finally, they are flattened to increase their contact surface area, which facilitates oil extraction.

Step 2: First mechanical pressing

The seeds undergo an initial mechanical pressing, which removes some of the oil before solvents are used. This stage also produces a partially defatted oilcake.

Step 3: chemical extraction with hexane

The next step is to extract the residual oil from the pressed seeds. This is done using a chemical solvent, hexane, a petroleum derivative; the process therefore involves ***extraction with hexane***. In practical terms, the seed flakes (or press cake) are washed with hexane in a counter-current process: this solvent dissolves the remaining oil, allowing almost all of it to be recovered.

Step 4: Separation of the oil and removal of the solvent

OIL

a) Distillation of the miscella

The oil-solvent mixture obtained, called "miscella", contains between 70 and 80% hexane by weight[344]. To separate the oil from the solvent, the miscella is then distilled in a desolventiser. It is heated to temperatures above 100°C and brought into contact with steam, which allows the solvent to evaporate. At the end of this operation, manufacturers are left with a fraction of liquid oil and solvent vapour. At this stage, the crude oil still contains hexane.

OILSEED MEAL

b) Processing of oilseed meal

De-oiled oilseed meal still contains 30 to 35% hexane. It passes through a device called a DTDC (de-solventisation, toasting, drying, cooling) which raises its temperature to around 100°C. This makes the oilcake more suitable for animal feed and removes most of the hexane remaining in the oilcake. However, some hexane is still lost.

At the end of the distillation process, the crude oil and oilseed cake are recovered and most of the hexane is recycled for the next extraction.

344 "L'extraction d'huile par solvant." https://www.bestoilmillplant.com/solvent-oil-extraction/

Step 5: hexane recycling

The hexane vapours produced during distillation are sent to condensers, where they are cooled and converted into liquid (liquid condensates). The hexane recovered in this way is reinjected into another extraction process.

Step 6: refining of crude oil

Crude oil must undergo "degumming" and additional refining steps before it can be used for food:
Demucilaginisation removes raw mucilage and lecithin using water, enzymes or acid;
Neutralisation, specific to chemical refining, treats the oil with an alkaline solution to remove free fatty acids;
Decolourisation reduces pigments and removes various impurities by absorption.
Crystallisation crystallises and removes waxes to prevent cloudiness at low temperatures.
Deodorisation, carried out under vacuum at high temperature, aims to remove volatile compounds and residual traces of hexane in accordance with current standards.

At the end of this process, three products are obtained: 1/ a table oil ready for consumption; 2/ protein-rich oilseed meal for feeding livestock; 3/ a recycled solvent that can be reused in the next process.

Products	Number of products tested	Average *n*-hexane content per product 1 (mg/kg)	Average *n*-hexane content per product 2 (mg/kg)	Average *n*-hexane content in product 3 (mg/kg)	Mean *n*-hexane content in product 4 (mg/kg)	Existing standards for this product category
Edible oils						
Rapeseed oil (Lesieur)	3	0.04	0.04	0.05	/	< 1 mg/kg
Sunflower Heart Oil (Lesieur)	3	0.04	0.05	0.05	/	< 1 mg/kg
ISIO 4 oil (Lesieur)	2	0.06	0.08	/	/	< 1 mg/kg
Simply Sunflower Oil (Carrefour)	2	0.05	0.07	/	/	< 1 mg/kg
Butters						
Gourmet butter - Semi-salted (Président)	2	0.03	0.03	/	/	No existing regulations
Gourmet butter - Mild (Président)	1	0.03	/	/	/	No existing regulations
Moulded butter - Mild (Paysan Breton)	2	0.02	0.03	/	/	No existing regulations
Soft butter - Mild (Elle & Vire)	2	0.04	0.04	/	/	No existing regulations
Soft butter - Semi-salted (Elle & Vire)	1	0.06	/	/	/	No existing regulations
Butter from Brittany - Mild (Les Croisés - Leclerc's own brand)	2	0.02	0.02	/	/	No existing regulations
Liquid milk						
Semi-skimmed milk (Lactel)	3	<0.01	0.01	0.01	/	No existing regulations
Semi-skimmed milk (Délisse - Leclerc's own brand)	2	<0.01	0.01	/	/	No existing regulations
Blédilait milk for children aged 1 to 3 (Blédina)	1	0.02	/	/	/	No existing regulations
Growth milk for ages 1 to 3 (Gallia)	1	0.02	/	/	/	No existing regulations
Powdered milk						
Blédilait powdered milk for 6 to 12 months (Blédina)	3	0.04	0.04	0.05	/	No existing regulations

Products	Number of products tested	Average *n*-hexane content per product 1 (mg/kg)	Average *n*-hexane content per product 2 (mg/kg)	Mean *n*-hexane content in product 3 (mg/kg)	Mean n-hexane content in product 4 (mg/kg)	Existing standards for this product category
Oilseed meal						
Rapeseed meal (Saipol)	4	19.9	20.1	20.6	21.1	Insufficient regulation for hexane, limit of 1000 mg/kg as a chemical impurity
Soybean meal (processor not identified)	3	65.1	69.7	81.6	/	Insufficient regulation for hexane, limit of 1000 mg/kg as a chemical impurity
Poultry						
Whole chicken - (Les Fermiers de Loué)	2	<0.02	<0.02	/	/	No existing regulations
Whole chicken (Le Bon Poulet - Lionor)	2	<0.02	<0.02	/	/	No existing regulations
Chicken thighs (Le Gaulois)	3	<0.02	<0.02	<0.02	/	No existing regulations
Chicken thighs (Monoprix)	2	0.04	<0.02 with *traces	/	/	No existing regulations
Eggs						
Carrefour Original eggs (box of 6)	2	<0.02	<0.02	/	/	No existing regulations
Eggs from our Villages (box of 6)	2	<0.02	<0.02	/	/	No existing regulations
Matines eggs (box of 6)	3	<0.02	<0.02	<0.02	/	No existing regulations
Loué Label Rouge eggs (box of 6)	3	<0.02	<0.02	<0.02	/	No existing regulations

Appendix 3: Different types of oilseed meal

Several types of oilseed meal are used to feed farm animals, depending on various criteria:

"Farm-produced" or ***"fat-farm-produced"*** oilseed ***meal*** is produced directly on the farm, often on a small scale. The oilseeds, which are generally grown on site, are cold-pressed mechanically. This oilseed meal retains a relatively high fat content and is therefore beneficial for certain types of livestock, particularly ruminants, as it provides an additional source of energy.

Expeller meal is also produced by mechanical pressing, but using heat rather than chemical solvents. The seeds are heated before being pressed in order to extract some of the oil while retaining residual fat in the meal. This method can be carried out on an industrial scale, as is currently the case in regional factories developed by cooperatives or private operators.

Industrial "48" or "extraction feed" oilseed meal is produced using chemical methods. The oil is extracted by pressing and then treated with a solvent, **hexane**, which extracts almost all of the fat and produces a meal that is highly concentrated in protein. The number 48 refers to the high protein yield (46%) and low-fat content (2%). These are the most widely used oilseed meals in the animal feed industry, feeding ruminants, pigs, chickens and fish. Organic farming prohibits their use[345] (see Part I).

345 INAO, *Reading Guide, Appendix II, Part V, Production of processed animal feed: "2.2: The processing of any raw material for animal feed used or processed in organic production using synthetic solvents is prohibited. Organic and non-organic second-press oilseed meal and higher must not have been treated with chemical solvents (in particular hexane)."*

GREENPEACE