Published in

Creager, Angela N.H., and Jean-Paul Gaudillière, eds. *Risk on the Table: Food, Health, and Environmental Exposure*. New York: Berghahn Books, 2021.

Chapter 6

Contaminated Foods, Global Environmental Health, and the Political Recalcitrance of a Pollution Problem. PCBs from 1966 to the Present Day

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Pre-print version

Abstract: Based on different types of archives and documents, and interviews, this chapter examines the role food risk issues have played in the political trajectory of the PCB (polychlorinated biphenyls) problem. Moving from a transnational perspective to the Rhône River (France), it recalls how food risk issues turned PCBs into a global environmental health problem in the late 1960s and describes how they brought it back on political agendas at different times and on different scales. It highlights that food has not only been a target for risk management but also an indicator of the limits of technical and political devices dealing with PCB pollution.

Keywords: environmental health; food risks; PCBs; problems; production of knowledge; public action; transnational government.

PCBs (polychlorinated biphenyls) are among the very few chemicals whose uses have been progressively banned at the global scale for environmental and sanitary reasons after many decades of industrial production and ubiquitous usage.[1] Used mainly in capacitors and electrical transformers, but also in hydraulic systems, cooling systems, heat transfer systems, in sealants and coatings, inks, paints, adhesives, plasticizers and many other products and devices, this family of substances has become present in all living and working spaces, inside and outside factories, in technoindustrial equipment and infrastructures as well as in offices and households.

At the end of the 1960s, these substances began to be considered—by many scientists as well as many political authorities—as major environmental pollutants and potential hazards for public health. They became the subject of several waves of recommendations and decisions promulgated by international and supranational organizations, as well as states, from the 1970s. During this decade, regulatory foundations were laid for transnational political initiatives to combat the problem of PCB pollution through restriction of their uses and management of the disposal of many products and articles containing them. The global level of PCB production began to decrease at the end of the same decade. However, environmental pollution by these substances and a large range of problems associated with them, far from disappearing from political agendas, have kept reemerging over the last few decades and remain unresolved.

The purpose of this chapter is to highlight to what extent food risk issues have impacted the trajectory of the PCB problem—on various scales—from the late 1960s to the present day. I will expose how studying the place of food issues in the history of PCBs illuminates what I call the *political recalcitrance* of this problem. This expression highlights the conundrum encountered when trying to control certain persistent, toxic contaminants: even though from the late 1960s to the present day PCBs have been the subject of a succession of increasingly radical regulatory measures, the problems associated with these substances have not disappeared, with the consequence that public affairs and controversies continue to crop up.[2]

Many countries enacted regulatory measures to limit the environmental dispersal of PCBs in the early and mid-1970s, just a few years after scientists began documenting the extent, behavior, and dangers represented by this pollution. Since then, other regulatory measures have been promulgated, with the same objective of lowering the level of environmental pollution and contamination of living organisms. More broadly, since the beginning of the 1970s, various national and international public policies have gradually restricted their use, organized their disposal, and imposed ways of managing the waste, the environmental media, and the food contaminated by these substances.[3] PCBs are thus listed among the first twelve pollutants covered by the Stockholm Convention, an international agreement that was adopted in 2001 and ratified by 152 countries before it came into force in 2004. The Convention has been amended several times since, with the same aim of reducing and eventually eliminating releases of “persistent organic pollutants” into the environment.[4] Today however—about fifty years after the first transnational actions were initiated—PCBs are still used in some countries, and the elimination goal has not yet been achieved.[5] The Stockholm Convention requires the phase-out of PCB use by 2025 and “the environmentally sound management of PCB waste” by 2028.[6]

The *recalcitrance of the PCB problem* refers not only to the present but is also a critical historical fact. From the early 1970s to the present, many problems linked to the production and circulation of PCBs have emerged. As the following examples show, these problems have often appeared as food issues. Urs K. Wagner (ETI Environmental Technology Ltd.), whom the secretariat of the Stockholm Convention presented as an international expert on PCBs, pointed in 2010 to the continuing contamination problems in Europe:

> In Switzerland, the consumption of certain fishes from specific rivers was forbidden in the spring of 2010 due to PCB concentrations far above the allowed maximum levels in Europe. Recently, it has been reported that 90 percent of German sheep livers have concentrations of PCBs above accepted levels. High PCB concentrations originating from a transformer treatment plant have recently made vegetables inedible in a big German city.[7]

In France, for similar reasons of regulatory threshold values being exceeded, authorities banned fishing or consumption of river fish in many areas of the country between 2005 and 2013 (see below for more details), and in 2011, farmers located in the vicinity of a PCB disposal facility saw their contaminated herds slaughtered.[8]

Looking at how food risk issues have impacted the political trajectory of the PCB problem offers three analytical advantages. First, it sheds critical light on the ways in which PCB problems have been put on political agendas at different times and at different scales. Second, it helps to clarify how food—and more specifically actors who have addressed food risk issues—have contributed to making environmental and health-related hazards (more) visible. And third, because food risks have provided the language for managing the environmental and health risks the persistence of PCBs creates, looking at “PCBs on the table” confirms the analytic perspective offered by Soraya Boudia and Nathalie Jas on the various “modes of government” of dangerous substances and their deleterious effects deployed since 1945.

This chapter makes use of different disciplines and approaches, including science and technology studies, microhistory, environmental history, history of health, and the sociology of public problems. Thus, I speak of a “problem” only when actors have defined a situation as problematic, and I speak of a “public problem” only when actors have succeeded in giving a certain publicity to the problematization they propose.[9] From this perspective, it is also important to explore how the actors involved in a given situation understand the behavior and effects of the contaminants, and how this plays into the ways in which they understand the problematic character of the situation. In other words, I am interested in the events, actors, actions, arguments, and social dynamics that result in global and national definitions of PCB problems, but also in specific, local definitions of PCB problems.[10]

Such perspective immediately brings in the question of materiality.[11] Looking at the way actors consider the materiality of the pollution not only is important to understanding how they define the problems, but also appears crucial for the social scientist who tries to understand the peculiar *recalcitrance of the PCB problem*. Indeed, PCBs have been used because of their high physical and chemical “stability”. They have also been described since the late 1960s as “persistent” pollutants, in the sense of *biochemical* persistence. As the science advisor and specialist on pollutants Mitchell D. Erickson has written: “[PCBs] are highly chemically stable and resist microbial, photochemical, chemical, and thermal degradation. They are physically stable with very low vapor pressures and water solubility. Thus, PCBs do not readily degrade in the environment and are lipophilic. As a result, they persist and tend to bioaccumulate.”[12] This knowledge about the material tendency of PCBs to persist and bioaccumulate has been scientific consensus for several decades. Their ability to persist in the environment and in the tissues of living organisms played a central role in the consensus that led states and international and supranational organizations to promulgate the regulatory measures mentioned above.[13] Biochemical persistence is, of course, a factor contributing to recalcitrance. However, as the second and third parts of this chapter will show, biochemical persistence is only one element among others explaining the *political* recalcitrance of the PCB problem.

Based on existing literature as well as archival documents, the first part of this chapter describes how the status of PCBs has changed in the 1960s from miracle product to global environmental health problem. Using the same kind of sources, the second part specifies how our knowledge about the effects of PCBs, and the regulations concerning them, evolved over the next two decades. In the third part, drawing on scientists', associations', and political authorities' archives and interviews I conducted, the chapter explores two affairs that occurred in France between the mid-1980s and today, focusing on the role that food risks played in the re-emergence of the PCB problems.

From Miracle Product to Global Environmental Health Problem

The Industrial Success of PCBs

"Polychlorinated biphenyls" or "PCBs" are a family of synthetic chemicals theoretically comprised of 209 molecules. What are commonly called "PCBs" are mixtures of various compounds of the PCB family, which look like fluids of a more or less oily or resinous appearance. These mixtures are also known by various trade names, including Arochlor, which is probably the most known at the international level.[14]

Industrial production of PCBs began in 1929 in Anniston (Alabama, USA).[15] These molecules were mass-produced in the most industrialized countries primarily between the 1930s and 1980s, and in a particularly massive way after the mid-1950s. As summarized in a recent report of the International Agency for Research on Cancer (IARC): "Production peaked in the 1960s and 1970s, and had ceased in most countries by the end of the 1970s or early 1980s."[16] According to data collected by the scientific community and various international organizations, the countries and companies that produced them most (far ahead of the others) were the United States, Germany, the USSR and France, by, respectively, the firms Monsanto, Bayer, Orgsteklo and Prodelec (see table 6.1). "Estimates of the total cumulative worldwide production of PCBs indicate that 1 to 1.5 million tonnes (or more) of commercial PCB products were manufactured," as also mentioned in the IARC report quoted above.[17]

Table 6.1. Volume and duration of PCB production in countries with known production (by production volume). Adapted from IARC, *Polychlorinated Biphenyls* (2016), 72.

Producer	**Country**	**Duration**		**Volume (metric tons)**	**Reference** (for complete references, see IARC, *Polychlorinated Biphenyls* (2016), 72.
		Start	**Stop**		
Monsanto	USA	1929*	1977	641,246	de Voogt & Brinkman (1989); Spears (2014)
Bayer AG	Germany, western	1930	1983	159,062	de Voogt & Brinkman (1989)
Orgsteklo	Russian Federation	1939	1990	141,800	AMAP (2000)
Prodelec	France	?**	1984	134,654	de Voogt & Brinkman (1989)
Monsanto	United Kingdom	1954	1977	66,542	de Voogt & Brinkman (1989)
Kanegafuchi	Japan	1954	1972	56,326	Tatsukawa (1976)
Orgsintez	Russian Federation	1972	1993	32,000	AMAP (2000)
Caffaro	Italy	1958	1983	31,092	de Voogt & Brinkman (1989)
2.8 Vinalon and the Sunchon Vinalon Complex	Democratic Republic of Korea	1960[a]	2012[b]	30,000[c]	NIP Korea DPR (2008)
SA Cros	Spain	1955	1984	29,012	de Voogt & Brinkman (1989)
Chemko	Former Czechoslovakia	1959	1984	21,482	Schlosserová (1994)
Xi'an	China	1965	1980	10,000	Jiang et al. (1997); NIP China (2007)
Mitsubishi	Japan	1969	1972	2,461	Tatsukawa (1976)
Electrochemical Co.	Poland	1966	1970	1,000	Sułkowski et al. (2003)
Zaklady Azotowe Tarnow-Moscice	Poland	1974	1977	679	Sułkowski et al. (2003)
Geneva Industries	USA	1972	1974	454	EPA (2008b)
Total		1929	2012	1,357,810	

* According to the historian Ellen G. Spears (2014), the Swann Chemical Company began production of PCBs in 1929 (in Anniston, Alabama, USA), and it was acquired by Monsanto Chemical Company in 1935.

** During the 1930s or during the 1940s; sources disagree (see Bletchly, *Report*, Annex 1, p. 1; Fournié and Peyrichou, "L'emploi," 14; Meunier, *Rapport*, 15–16).

a. During the 1960s.

b. "The Ministry of Chemical Industry will, by 2012, take measures to dismantle the PCBs production process and establish a new process of producing an alternative."

c. Estimated from Republic of Korea 2008, National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants.

Although only a dozen countries have produced PCBs, these substances have been used virtually all over the world. Moreover, since the 1930s, PCBs have been present in innumerable places through the multiplicity of their usages—and correlatively the multiplicity of spaces, objects, and products into which they have been put. Indeed, their high thermal and chemical stability, their nonflammability, and the fact that they constitute a very good electrical insulator led to their use in many technoindustrial applications. PCBs were first employed as dielectric fluids in capacitors and transformers, and this, according to many sources, was their predominant use. They have also been used in hydraulic systems, cooling systems, and heat transfer systems (especially in the food industry), and as a major component in various sealants and coatings (on account of its plasticizing and flame-retardant properties). Finally, they have also been included in inks, paints, adhesives, plasticizers, and rubber products; in cutting and lubricating oils and as immersion oil for microscopes; in fluorescent lamp ballasts; as pesticide extenders; for wire and cable insulation; and for the “microencapsulation” of dyes used in carbonless copy papers.[18]

As early as the 1930s, in the United States, medical surveys and industrial hygiene research were conducted to study the health problems faced by workers regularly exposed to PCBs. Their results revealed the toxicity of PCBs in animals and humans. However, these findings did not achieve public visibility. They were discussed in a few private meetings and remained confined to a few documents, often classified as confidential in companies that had financed the studies.[19]

Foodstuffs and the Making of a Public Environmental Health Problem

During the second half of the 1960s, the status of PCBs changed from miracle product exploitable in innumerable technical applications to environmental and health nightmare; food risks were central to this shift.

In 1966, Sören Jensen, a Danish chemist conducting ecotoxicology research in the Stockholm archipelago, first identified PCBs among organochlorine contaminants found in the bodies of wild animals.[20] Expanding his investigations, he found PCBs not only in pike, eagles, and seals, but also in his own hair and in that of his wife and his five-month-old daughter. In a text he published that year, he suspected food to be a relatively important route of contamination, and given the age of his child, he assumed that PCBs could also be transmitted through breast milk.[21] Subsequent scientific work confirmed these hypotheses.

Two years later, in 1968, in Japan, approximately 1,600 people were intoxicated when they consumed rice oil contaminated with PCBs used as a heat transfer agent during oil processing. Five deaths were immediately associated with this contamination, along with severe skin problems known as “chloracne,” sometimes going so far as to cause disfigurement. “Follow-up studies in the 1970s revealed birth defects in babies born to mothers who had been exposed to contaminated rice oil,” writes historian Ellen G. Spears.[22]

Sören Jensen's discoveries and this mass intoxication, commonly referred to as the "Yusho incident," came at a time when questions relating to the harmful effects of chemicals were capturing the attention of the scientific community, the public, politicians, and authorities. The atmospheric fallout of nuclear tests, particularly in the form of strontium-90, the contamination by pesticides of fruits such as cranberry, and the devastating birth defects caused by prenatal use of thalidomide all contributed to public debates on the toxicity of certain chemicals, including the invisible dispersion of toxicants in the environment and the seeming inability of authorities to protect public health.[23] Jensen's discoveries and the Yusho incident came just a few years after Rachel Carson's best-selling *Silent Spring* sounded an alarm concerning the health and environmental effects of certain chemicals dispersed in the environment, at the forefront of which was DDT (dichloro-diphenyl-trichloroethane), a substance which, like PCBs, belongs to the family of chlorinated hydrocarbons. Like radioactivity from fallout ending up in milk, Jensen's discoveries showed that PCBs could end up in both human and animal bodies.[24] More specifically, by making highly visible the toxicity of PCBs for humans and the role food can play, the Yusho incident contributed to turning the problem of global environmental pollution by PCBs into an environmental health problem.

Knowledge Production and the Transnational Management of the PCB Problem

Scientific Knowledge about the Critical Role of Dietary Exposure and PCBs' Toxicity

After 1966, scientific studies on PCB pollution and its (eco)toxicological effects multiplied. They continued to show these substances as an omnipresent and chronic threat. By the late 1960s, PCBs had been described as "bioaccumulative" for their ability to accumulate in the tissues of living organisms and particularly in fat.[25] During the 1970s, investigations that found PCBs in the Arctic—that is to say, in a place particularly far-removed from the areas of production and use—and other similar studies strengthened the thesis of PCB's ubiquity in the environment. In the same decade, other scientific works began to document the toxic effects of their bioaccumulation.[26] This knowledge became even more important as scientists came to consider food to be the most important exposure pathway for the general population due to the conjunction of two properties of the PCB molecules: persistence (or virtual nondegradability) and liposolubility.[27] Two phenomena result from the conjunction of these properties. First, PCBs accumulate in fats *throughout the life* of an organism (this is a long-term corollary of the notion of "bioaccumulation"). Second, the higher an organism is located in a food chain, the more it accumulates PCBs because it collects the PCB burden of every other organism it eats. Scientists call this phenomenon "bioamplification" or "biomagnification."[28] As humans are one of the highest organisms in food chains, they are among those who are the most exposed to PCBs.[29]

Over time, the scientific community has attributed to PCBs many different toxic effects in mammals, including in humans. These effects range from carcinogenicity, immunotoxicity, and neurotoxicity to reproductive, developmental, and neurobehavioral effects.[30] Since the 1970s, PCBs have also climbed up the World Health Organization's classification of carcinogenic substances. In 1978, the International Agency for Research on Cancer stated that PCBs "should be regarded as if they were carcinogenic to humans."[31] When the classification was defined in 1979, PCBs were categorized as "possibly carcinogenic to humans" (Group 2B), after which they were included in Group 2A ("probably carcinogenic to humans") in 1987, and finally one congener (PCB-126, which belongs to the congeners known as "dioxin-like") was listed in Group 1 ("carcinogenic to humans") in 2012.[32] In addition, because of their ability to influence hormonal mechanisms, PCBs are also to be found among the substances that formed the basis for the endocrine disruptors hypothesis developed in the early 1990s.[33]

First Signs of Political Recalcitrance

In the 1970s, many countries started to regulate the use of PCBs, or even to ban their production. The objects and schedules of these prohibitions were different, however, depending on the country. While Japan banned production and new uses of PCBs in 1972, many countries, including France, chose to restrict applications by forbidding their use in so-called "open systems,"—that is to say, in applications that were considered to allow direct diffusion of PCBs into the environment, such as paints, caulk, glues, etc.[34] Chronologically, several waves of regulation can be distinguished, which more or less correspond to transnational steps in the mounting restriction of PCB use.[35]

Finland, Sweden, Norway, Switzerland, and Germany banned PCB use in "open systems" in 1971 and 1972, and a 1973 OECD decision required all member states to enact similar restriction.[36] This decision was made "considering the use of [PCBs] should be controlled by international action in order to minimize their escape into the environment pending the realization of the ultimate objective of eliminating entirely their escape into the environment."[37] Among other things, the OECD guidelines also required the control of production and import and export flows, and demanded that the articles, products, and devices containing PCBs be labeled so as to indicate the presence of these substances. In short, these measures were supposed to give member states the capacity to control their PCB releases into the environment. The first PCB regulatory measure promulgated in France, in 1975,[38] enforced OECD injunction, as did the first European regulation in 1976.[39]

A second wave of regulation was initiated in the mid-1980s. In 1985, a European directive prohibited the selling of "closed systems" containing PCBs (such as transformers or capacitors). It stated that "despite the restriction on the use of PCBs and PCTs introduced by Directive 76/769/EEC . . . , as last amended by Directive 83/478/EEC . . . , there is generally no indication that pollution of the environment by PCBs and PCTs has lessened significantly."[40] European norms were transposed into French law in 1986 and 1987. That year, the OECD published a "decision-recommendation" that formulated the same argument and the same requirements as the European directive.[41] The supranational and international organizations who pushed for a second regulatory step in the mid-1980s thus recognized the failure of the first wave of transnational measures taken in the 1970s.

Moreover, various affairs and controversies had occurred between these two waves, proving that the first regulatory step—focused on production, use, and disposal—was not a sufficient response to deal with the diversity of PCB problems and hazards. In France, in the mid-1980s, associations, scientists, and authorities addressed at least four types of PCB problems: (1) safety and public health hazards related to explosions and fires of PCB-containing transformers (incidents resulting in the release not only of PCBs but also of other toxic substances, including dioxins and furans); (2) PCBs as an environmental health hazard not only for the general population but especially for babies (knowledge about PCB body burden being partly transferred to the child via breast milk had become public, and raised questions about the balance between the benefits and risks of breastfeeding); (3) a problem of toxic waste management; (4) an abnormal local pollution on the Rhône River.[42]

These examples not only show that the first step of regulation was not enough to get the PCB problem under control, but also underline the extent to which food issues contributed to making the PCB pollution more visible and of greater concern. First, the issue of PCBs in breast milk transformed the average level of contamination in adults and the practice of breastfeeding into potential health hazards for babies.[43] Second, in certain places, the establishment of plants for the disposal of PCB-contaminated wastes caused many actors to fear the local contamination of land, water, and agricultural products. Third, the "abnormal" local pollution on the Rhône River mentioned here had been revealed through the discovery of high PCB contamination levels in fishes. Focusing on this last problem, which first arose in the mid-1980s and then resurfaced in the mid-2000s, the rest of the chapter discusses more precisely the role that food risk controversies played at two different moments in putting the problem of river pollution by PCBs on the local, regional, and national political agendas.

Food Risks, the French Rhône River, and the Multiple Emergences of PCB Problems

In 1985, France had not yet regulated the presence of PCBs in food.[44] While in other countries such as the United States, PCB limit values had been promulgated for various food products, in France, such regulatory thresholds did not yet exist.[45] The first decree to remedy this situation in France was adopted in 1988, providing an administrative response to one among the many questions the affair described below brought to light.

Episode 1 (1985–1990)

In 1985, ecotoxicologists participating in a multidisciplinary research program on the ecology of the Rhône River found particularly high concentrations of PCBs in the fish of one of the areas under study, upstream of the city of Lyon and downstream of a PCB disposal facility.[46]

Even if at that time there was no threshold in France beyond which fish were considered unfit for human consumption, the ecotoxicologists considered these concentrations to be abnormal for several reasons. First, they were ten times higher than those reported in the scientific literature for fish caught in Lake Geneva and in American rivers. Second, they were higher than regulatory thresholds already existing in other countries, namely in Switzerland and in the United States.

Along with other scientists with whom they were collaborating, the group of ecotoxicologists alerted national authorities in charge of environmental issues (Ministère de l'Environment) and the local/regional administration in charge of health (Direction Départementale des Affaires Sanitaires et Sociales de la Préfecture du Rhône). In their report, the researchers explained that these levels of PCBs made them fear “problems for public health and risks for fish populations.”[47] They feared not only that the maintenance of fish populations and the balance of the entire local ecosystem would be at risk, but also that people consuming fish from this area would be particularly exposed to health hazards associated with PCBs.

The scientists were particularly concerned about one specific community they had heard about. A professional fisherman who worked in this area, whom they knew well because he sometimes collaborated in their research, had informed them that among his clients were many people of Asian origin, whose consumption of fish from the contaminated area was particularly high. The researchers called for further studies to be launched in order to better diagnose the pollution and better analyze the risks faced by fish populations and fish consumers. They also proposed a way to investigate the considerable difference between the levels of PCB measured in the zone deemed to be problematic and those of other nearby areas they had studied. They measured PCB concentrations in freshwater mollusks upstream and downstream of the effluent discharge point of an industrial zone where a PCB disposal facility was located. These analyses revealed much higher rates downstream than upstream, leading the ecotoxicologists to formulate (in this same report) the hypothesis that the PCB disposal plant might be responsible for the contamination found in fish. At the same time, a regional federation of environmental associations and the above-mentioned professional fisherman (who had stopped selling fish immediately after being informed by the scientists of the contamination) asked the prefecture to take charge of the problem, and brought the case to court.

The prefecture organized several meetings, bringing together some of the researchers who had sounded the alert and several of its services. They finally set up a technoscientific and administrative plan to monitor the river's PCB contamination levels in the area where the problem had arisen. Regular analyses began in 1988 and continued until 1999. In response to the researchers' concerns about a possible health risk for the fisherman's customers, the local authorities conducted a study that did not confirm the hypothesis that the amount of contaminated fish eaten by these persons could expose them to health risks. However, these conclusions were highly contested: the researchers, as well as the professional fisherman, strongly criticized the conceptual framing and the methods used in the study.

In February 1988, one and a half years after the researchers had sent their report to the authorities, the French Ministry for Agriculture and Food promulgated a decree fixing a threshold above which fish were considered unfit for human consumption (2 milligrams per kilogram of fresh weight). The contamination level that was initially considered abnormal by the ecotoxicologists thus became officially higher than the regulatory threshold. Fishing was prohibited in the area concerned and the professional fisherman who used to work in this area moved and found work elsewhere, without assistance from the authorities.

The case following the complaints made by the regional federation of environmentalist associations and the professional fisherman was dismissed an additional eighteen months later. "The order notifying dismissal of the case is based on the fact that although the pollution certainly exists, it was not possible to determine who was responsible, and the waste-disposal plant . . . in question has since improved its facilities," reported a newspaper.[48] However, the problem of Rhône River pollution and fish contamination by PCBs got back on the agenda of the local authorities some fifteen years later, and then became a problem that concerned all the river basins of the national territory.

Episode 2 (2005 to the Present Day)

Between 1990 and 2005, the regulatory and administrative context changed significantly. Condemned in 2002 by the European Court for failing to fulfill its obligations in regard to controlling PCBs, France took what can be considered a third step toward the elimination of objects containing these substances.[49] In 2003, the government published a "national plan" defining a schedule for the decontamination and elimination of equipment containing PCBs.[50] At the same time, a new European directive concerning the presence of PCBs in food was in preparation. Its aim was to "[set] maximum levels for certain contaminants in foodstuffs," and the "contaminants" concerned were dioxins and certain types of PCBs ("dioxin-like PCBs").[51] The directive was promulgated in February 2006—that is, after the events described below started.

By the time of this second affair, France also had for some years a new administrative body specializing in food risk issues. At the end of the 1990s, following several "health crises," France, like other European countries, set up several health security agencies, including a French Food Safety Agency created in 1999. In 2005, this public body was working under the authority of three ministries (agriculture, health, and consumer affairs), with several missions in the field of animal health and food hygiene (risk assessment, scientific and technical support to administrations, and research).[52]

The PCB pollution problem reappeared in the Rhône River in 2005 when high levels of PCBs were measured in fish caught in an area very close to the one where the ecotoxicologists had found abnormal contamination in 1985.[53] The French Food Safety Agency, to whom the local authority transmitted the analysis results, recommended further investigation on the pollution extent and pointed out that the consumption of fish contaminated at such levels could present a health risk. The prefecture prohibited the consumption of fish from the concerned area and launched the investigation suggested by the agency. Research was carried out in that area and gradually moved away toward others. For two years, more and more prohibitions on fishing and eating fish were enacted in new areas along the Rhône River as the results of analyses became available.

Several elected representatives and various environmental associations mobilized to urge the state to accelerate investigations into the scope of the contamination and to evaluate and manage the health risks to which the population was exposed with regard to fish consumption. With these mobilizations reaching national proportions toward the end of 2007, a three-year "action program" was set up at a regional level by the prefecture in charge of the French Rhône River basin, from the border with Switzerland to the Mediterranean Sea. A few months later, the ministries in charge of fisheries and agriculture, environment, and health launched a similar national "action program."

From 2005 to 2013, approximately 140 areas throughout France were the object of local regulatory measures prohibiting fishing and fish consumption (sometimes specific species only, sometimes all species). The first of these measures, in September 2005, was introduced in accordance with the precautionary principle and with the opinion of the French Food Safety Agency. Then, from February 2006, the fishing and fish consumption prohibitions were promulgated in accordance with the European directive mentioned above, which set thresholds for dioxins and "dioxin-like PCBs" in foodstuffs, including fish.[54] Investigations based on the analysis of sediment cores also confirmed that the PCB incineration plant located on the Rhône riverside (or at least the industrial zone where it stands), already suspected circa 1985, had played an important role in the pollution of this area.

These events also compelled the French authorities to introduce a new way of managing the sanitary risks. In 2008, two national health agencies (respectively in charge of food safety and public health monitoring) began a PCB-contamination study among freshwater fish consumers. They took blood samples from more than six hundred fishermen or members of their household. The results showed that the PCB contamination of some fish consumers exceeded the critical contamination values defined by the WHO, even if their consumption of highly bioaccumulative fish was below the general recommendations for fish consumption. Finally, three years after the beginning of the study, the agency in charge of food safety issued recommendations (more specifically maximum frequencies) to "enable consumers to eat strong PCB bio-accumulator fish without risks in the long term," to quote the agency.

Thus, in these two episodes of a (re-)emerging contamination problem in the Rhône River, the authorities concluded that sanitary requirements were not being met: the PCB levels found in fish in 1985 and in 2005 exceeded the regulatory threshold values set by the French government in 1988 and by Europe in 2006. From a more general perspective, the two cases revealed—at two different times—that the technical and political devices designed by Europe and the French government to bring PCB pollution levels under control had not worked.

Conclusion: Food Risks, the Government of PCBs, and Political Recalcitrance

Food risks have played an important role in the political trajectory of the PCB problem: they contributed to spotlighting a global environmental health problem at the end of the 1960s and then brought it back to the authorities' attention on many occasions over the years. The 1968 mass intoxication in Japan alerted the international community to certain health risks associated with exposure to these substances. In France, first in 1985 and then again in 2005, in an area of the Rhône River slightly upstream of Lyon, PCB levels measured in fish and considered abnormal were a warning signal that led scientists and the authorities to work on what they agreed to define as a problem of contamination of the river environment and its biota. Furthermore, after the 2005 alert in France, the gradual expansion of the analysis campaigns, initially in the Rhône Basin and then at national level, revealed the extent (nationally at least) of freshwater fish contamination in multiple areas that exceeded European regulatory thresholds. In all three incidents, food security concerns highlighted the situation as a problem in the eyes of many actors. They also played an important role in making the problem legitimate in the eyes of the authorities, to the extent that they have undertaken various actions to manage it.

Faced with more and more difficulties—or, in other words, faced with the recalcitrance of the PCB problem—the authorities over time reinforced existing actions and introduced new ways of dealing with the PCB pollution. As illustrated above with the mention of the first two steps of transnational regulation and a third one in France, many countries phased out PCBs use in several stages. In fact, others have followed. In France, evolution of the regulation that has restricted uses and has implemented the phasing out of PCB-containing objects can be schematically broken down into four steps: (1) the use of PCBs in "open systems" was prohibited in 1975; (2) selling new equipment containing PCBs was banned in 1987, but the use of devices already in service remained authorized; (3) a program to decontaminate and dispose of PCB-containing devices was introduced in 2003, setting deadlines to end the use of most equipment by 2010; and (4) new deadlines were promulgated in 2013 to oversee the disposal of equipment containing quantities of PCB lower than those that had been the subject of the 2003 phase-out program. Moreover, regulations on the use and disposal of PCBs were not the only normative measures put in place by the public authorities to try to manage the PCB pollution problem. Over time, environmental and health requirements led to the definition of regulatory thresholds, such as levels of PCB not to be exceeded in industrial facility effluents, or maximal concentrations above which a foodstuff is considered unfit for consumption.[55] In this context, foodstuffs have played a central role not only in the (re)emergence and (re)definition of the issues, but also as a target of risk management. Both emergences of the pollution problem on the Rhône River via the abnormal level of fish contamination, and the subsequent ban on catching and eating fish, embody these two dimensions—food as an indicator and as a target for risk management.

The changing ways in which public authorities have addressed the PCB pollution problem illustrates perfectly a dynamic that Soraya Boudia and Nathalie Jas have discussed in their work about expertise on and regulation of toxicants.[56] As they suggest, different "modes of government" have been developed over time to deal with the problems posed by toxicants, but these various modes have been implemented successively (and now coexist) without fully resolving issues. Eventually, as problems have appeared increasingly difficult to manage—and sometimes impossible to solve—tools and ways of managing hazards have been developed not only to try to control the pollution problem, but to live *with* the contamination.

PCBs have been the subject of a mode of action that remains rare in the regulation of toxic substances: the implementation of phasing out, which has involved the progressive ban of certain uses and the planning on an international scale of the disposal of products and appliances containing the substance. But the management of the problems posed by this family of chemicals has also been carried out through the other "modes of government" discussed by Boudia and Jas: management by control, by risk, and by adaptation.[57] As regulations organizing the phase-out of PCB-containing objects were moving forward, norms were introduced, defining, for example, the levels of PCB content at which objects had to be processed or eliminated, or fixing authorized PCB concentration levels in emissions from waste-disposal facilities. All of these norms aimed to take control of the pollution problem (by controlling PCB releases into the environment). Other regulatory measures promulgated at a later date aimed to regulate the management of the "quality" of environmental media and foodstuffs, and these were the embodiment of a government by risk. Threshold values were defined on the basis of tools for assessing and managing environmental and health risks; when contamination levels exceeding these thresholds were detected, this required action by administrations in charge of managing the dangers that contaminated media or foodstuffs represent. Finally came government by adaptation, which does not consist of regulatory measures, but of sanitary authorities publishing recommendations concerning foodstuff consumption frequencies, as in other long-term polluted areas such as Chernobyl or the French Indies (particularly polluted by chlordecone, an insecticide, miticide, and fungicide). Authorities have issued information that is supposed to "enable" people to deal with risk-taking at an individual level.

Thus, the political trajectory of PCB problems is part of a broader history in which the different "modes of government" implemented to deal with environmental (health) problems have neither fully resolved them nor prevented new problems from arising. Nevertheless, there are also specificities that help account for the particular recalcitrance of the PCB problem. As mentioned above, certain physical and chemical properties of PCBs and the resulting environmental behavior provide some explanatory answers—and this is knowledge about PCBs that has been the subject of a very broad consensus within the scientific community for decades. These molecules are persistent and semi-volatile. Consequently, PCBs in the environment circulate for decades in air, soil, living tissues, etc. Moreover, many places known to be particularly polluted have not been cleaned up, and thus constitute particularly important PCB reservoirs.[58] More broadly, global contamination has been around for decades. These "background levels" also constitute a PCB reservoir, which is far more diffuse but still omnipresent and more or less circulating from one environmental medium to another.

Furthermore, by detailing *how* PCB problems have re-emerged and analyzing the political responses to recurring affairs, this chapter shows that *political recalcitrance* is not a mere translation of "biochemical persistence." As explained, the notions of "biochemical persistence," "bioaccumulation," and "biomagnification" are important to take into account in order to understand why food issues played a critical role in making the PCB pollution (periodically) visible. Nevertheless, this chapter highlights—in three respects—that it is also crucial to consider sociopolitical context, structures, and dynamics to understand why the PCB problem has kept reemerging over the last five decades through food issues. First, according to scientists, international organizations, and the public authorities involved, the first international step taken to regulate PCB use proved to be ineffective with respect to its stated objective, which was to reduce the level of environmental contamination. In addition, the ban of many different uses of PCBs as well as the phase-out of products and equipment that contain them have been very slowly implemented in many countries. The legal disposal of objects representing potential sources of PCB releases into the environment has lasted for more than forty years and still goes on.[59] Second, the elements presented above concerning the two cases in France also show that the recalcitrance of the PCB problem is linked to the evolution of health risk assessment tools and food safety requirements. In these cases, new tools and requirements have contributed to a broader relegitimization of the contamination problem of the river environment and its biota in the eyes of the authorities. Third, this chapter also shows the importance of the mobilization of actors external to the administrative and regulatory arena, who have helped define problems and present them to other actors, whether in the late 1960s with Sören Jensen, or later on the researchers studying fish populations in the Rhône River in the mid-1985s. In sum, both the importance and the recalcitrance of PCBs as an environmental (health) problem are entangled with the detection and management of food risks.

Acknowledgments

Special thanks for helpful comments and suggestions go to Angela Creager, Jean-Paul Gaudillière, Soraya de Chadarevian, and Xaq Frohlich. The French Région Île-de-France supported part of the research for this chapter under the PhD thesis project "Le problème PCB (polychlorobiphényles) des années 1960 à 2010: enquête socio-historique sur une pollution visible, massive et durable." This thesis was carried out at the CERMES3 (Centre de recherche, médecine, sciences, santé, santé mentale, société) and the EHESS (École des Hautes Études en Sciences Sociales).

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Notes

1. Koppe and Key, "PCBs"; Eckley and Selin, "All Talk"; Féron, "Persistance."

2. This notion of *political recalcitrance of a problem* could be discussed in relation to the notion of "wicked problems," which is widely used in political science. (See Peters, "What is So Wicked," for an example of a recent discussion of this notion.) This would, however, take us away from the purpose of this chapter. In short, I use the phrase *political recalcitrance* to insist on the distinction between this notion and that of "biochemical persistence" and because my primary purpose in this chapter is less to contribute to policy analysis than to present a sociohistorical investigation.

3 . For texts summarizing the regulatory measures for PCBs, see, for example, IARC, *Polychlorinated Biphenyls* (2016); and Meunier, "Réglementation."

4. SSC, *Stockholm Convention*.

5. Wagner, "Inventories."

6. SSC, *Stockholm Convention*.

7. Wagner, "Inventories," 9.

8. INERIS, *Tierce expertise*, 9.

9. See for example Gusfield, *Contested Meanings*; Gusfield, *The Culture*; Gilbert and Henry, *Comment se contruisent les problèmes*.

10. By "*global* definitions of PCB problems" I refer here to the way in which international and supranational organizations define these problems.

11. For a recent essay that suggests considering "residues," including PCBs, as both material and political entities, see Boudia et al., "Residues."

12. Erickson, "Introduction," xxvii.

13. See Eckley and Selin, "All Talk," especially 88; Féron, Persistance, 135–65.

14. Spears, *Baptized in PCBs*; IARC, *Polychlorinated Biphenyls* (2016); Koppe and Keys, "PCBs"; Amiard et al., *PCB*.

15. Spears, *Baptized in PCBs*.

16. IARC, *Polychlorinated Biphenyls* (2016), 71.

17. Ibid., 70–74

18. Spears, *Baptized in PCBs*; IARC, *Polychlorinated Biphenyls* (2016); Koppe and Keys, “PCBs”; Amiard et al., *PCB*.

19. Spears, *Baptized in PCBs*, 66–74; Rosner and Markowitz, “Persistent Pollutants.”

20. Spears, *Baptized in PCBs*, 133–35; Jensen, “The PCB Story”; “Report,” 612.

21. “Report,” 612.

22. Spears, *Baptized in PCBs*, 139–40; Kuratsune et al., “Epidemiologic Study on Yusho.” For the broader history of public health problems in Japan due to industrial pollution, see Walker, *Toxic Archipelago.*

23. Spears, *Baptized in PCBs*, 131–33.

24. See de Chadarevian, “Radioactive Diet,” this volume.

25. Koppe and Keys, “PCBs.”

26. Ibid.

27. Amiard et al., *PCB*, 3, 463; IARC, *Polychlorinated Biphenyls* (2016), 90.

28. This phenomenon had been demonstrated first in radioactive waste; Creager, *Life Atomic*, 368–77.

29. Ibid., 424; Amiard et al., “Expositions.”

30. Koppe and Keys, “PCBs”; Dargnat and Fisson, *Les PolyChloroBiphényles*; Amiard et al., *PCB*.

31. IARC, *Polychlorinated Biphenyls* (1978), 84.

32. IARC, *Polychlorinated Biphenyls* (2016), 34 (table 1); Lauby-Secretan et al., “Carcinogenicity.”

33. Krimsky, *Hormonal Chaos*; Langston, *Toxic Bodies*; Gaudillière and Jas, “Introduction.”

34. Kim and Masunaga, “Behavior”; Meunier, “Réglementation,” 89; Eckley and Selin, “All Talk,” 86.

35. In the United States, very little time elapsed between the two *steps of restriction* distinguished here with regard to transnational regulation: with the Toxic Substances Control Act promulgated in 1976, “PCBs could only be manufactured, processed, distributed and used in a ‘totally enclosed manner,’” and only eighteen months later “all manufacture, processing and distribution of PCBs was prohibited” (with exemptions on a case-by-case basis). Koppe and Keys, “PCBs,” 67. See also McGurty, “Transforming Environmentalism,” 26; and Spears, *Baptized in PCBs*, 163, 167.

36. Meunier, “Réglementation,” 89; Eckley and Selin, “All Talk,” 86.

37. OECD, *Decision of the Council*.

38. MIR, "Arrêté du 8 juillet 1975. Inscriptions"; MIR, "Arrêté du 8 juillet 1975. Conditions."

39. CEU, "Council Directive 76/403/EEC"; CEU, "Council Directive 76/769/EEC."

40. CEU, "Council Directive 85/467/EEC."

41. OECD, *Decision–Recommendation*.

42. Féron, "Persistance."

43. See Langston, "Toxic Bodies" (preface), which relates the experience of an American woman confronted with these issues with even more concern because she grew up along the Fox River in Wisconsin, an environment particularly polluted by PCBs.

44. In 1985, in France as in many other countries, the use of PCBs in "open systems" had been banned for about ten years, and (as mentioned above) the European Community promulgated new regulatory measures regarding the use, sale, and disposal of PCBs, which were transposed into French law in 1986 and 1987. However, these regulatory measures did not address the issue of PCBs in food.

45. Meunier, "Réglementation," 108–9.

46. This section (*Episode 1*) is based on archives of two scientists (Gilles Monod, Henri Persat), a nonprofit organization (FRAPNA), and local authorities (Archives Départementales de l'Ain, 426W52), as well as interviews conducted with various actors.

47. *Contamination du Rhône par les PCB. Problèmes pour l'Hygiène Publique et Risques pour les Populations Piscicoles*, November 1986, Gilles Monod's archives and Henri Persat's archives.

48. "La FRAPNA Arrête son Action en Justice sur la Pollution du Rhône par les PCB," *Le Monde*, 9 April 1990, Gilles Monod's archives; translation from French to English by the author.

49. European Court, "Judgment."

50. MEDAD and ADEME, *Plan National*.

51. CEC, "Commission Regulation."

52. Besançon, "L'institutionnalisation."

53. This section (*Episode 2*) is based on various documents (reports, press release, regulatory measures, etc.) collected on official websites of authorities (Agence de Bassin Rhône-Mediterranée, www.pollutions.eaufrance.fr; Office National de l'eau et des Milieux Aquatiques, www.onema.fr; Agence Française de Sécurité Sanitaire des Aliments, www.anses.fr) and nonprofit organizations (Robin des Bois, robindesbois.org; France Nature Environnement, www.fne.asso.fr; WWF France and Association Santé Environnement France, www.stopauxpcb.com), as well as interviews conducted with various actors.

54. CEC, "Commission Regulation."

55. Meunier, "Réglementation," 98–153.

56. Boudia and Jas, *Toxicants*; Boudia and Jas, *Powerless Science*; Boudia and Jas, *Gouverner*.

57. Ibid.

58. In France, for instance, knowing river sediments to be an important PCB reservoir contributing to the contamination of freshwater fish, the government funded research (carried out in partnership with private companies) on their depollution, but at the end no solution was considered to be appropriate.

59. In addition, many actors have subsequently emphasized the amount of equipment that has escaped the legal disposal pathway—that is to say, disposal in authorized facilities (through accidents with and vandalism of transformers, in service or stored; equipment abandoned “in the wild”; illegal discharges, etc.). Féron, “Persistance.”

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