

ALUMINIUM SMELTERS AND INDUSTRIAL HAZARDS IN THE MAURIENNE VALLEY. EXPERTS, REFORMERS AND LOCAL RESISTANCE (1892-1939)

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Abstract: This article offers a historical perspective on the interplay between pollutants, environment and health in the Alps of Savoy during the Second Industrial Revolution. At the turn of the 19th century, Savoy's Alpine valleys were radically transformed by a large-scale gold rush to exploit its hydroelectric potential for use by a growing electrochemical industry. More particularly, we look at the Maurienne Valley where six aluminium production factories built between 1892 and 1906 were among the earliest implementations of a newly discovered electrochemical process to manufacture large quantities of the metal. We show how, along with modernity narratives, hitherto unknown pollution effects raised unprecedented questions about the toxicity of air emissions. We then discuss how the impacts of industrial pollution on the agricultural economy fuelled a growing mobilisation of farmer unions led by a prominent pharmacist in the region. We show how the latter single-handedly attempted to merge the grievances of disaffected local communities throughout Savoy into a transregional reform movement to campaign for legislative change and tighter control of polluting industries. We also look at the large range of issues it brought up, such as worker and public health along with the long-term impacts of pollutants on the valley's ecology. In parallel, we explore the ambivalent work of administrative experts and their role in enforcing the view that air emissions were innocuous. Lastly, we look at the role of firms after the war in pro-

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viding social amenities and easing the transition from a predominantly rural to an industrial society.

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In 1913, Chambéry's Chamber of Commerce wrote a column in Savoy's regional paper *Le Radical des Alpes*. The piece forcefully denounced the Ministry of Beaux Arts' move to push forward legislation protecting landscapes of aesthetic value. Unsurprisingly, the change was regarded by its members as a major obstacle to industrial progress in a region which offered considerable opportunities for large-scale hydroelectric development to supply the colossal energy needs of electrometallurgical factories. Nonetheless, Savoy's *député* Antoine Borrel was not impressed. Writing in the same paper, he accused the Chamber of Commerce of defending the private interests of a few factory owners against the greater public good and criticised industrialists for their careless attitude towards local communities in the region. He protested that decades of intensive industrial development in Savoy had left parts of the agricultural economy in ruins and the sheer number of factories belching smoke in the region had reduced efforts to establish a tourism industry to no more than a fool's errand. While acknowledging the industry's economic contribution to regional development, Borrel could not resist being ironic:

“Scientific processes are available to reduce emissions, I want these to be installed; and when fields near factories are not made sterile anymore, farmers will be free to alienate their independence, their freedom and their life in the open air to enrol in factories; they will – if they so desire – expose themselves to numerous occupational illnesses, mistreat their body on overheated ovens and work in chlorine, phosphorus and sulphur atmospheres”.¹

In one stroke, Borrel summarised the issues of a fast-growing controversy on the industry's attitude towards local communities in the region. As one of the founding members of a growing reform movement against industrial pollution, Borrel appealed to largely shared concerns over the sanitary risks and economic consequences of “noxious fumes”. But while complaints abounded from people living in the vicinity of electrochemical and electrometallurgical factories established throughout the Alps, six aluminium smelters built in the Maurienne Valley at the turn of the nineteenth century played a leading role in stirring up regional resistance against industrial pollution.

All through its nearly two centuries of existence, the aluminium industry has been widely accused of generating extensive environmental degradation and exposing workers

1. AD Savoie, 96 PER3 - *Radical des Alpes*

along with populations to health hazards. In 1854, the discovery of a chemical process to refine bauxite ore into aluminium marked the start of production on an industrial scale. But while its potential applications fascinated the likes of Jules Verne, who imagined using aluminium to build a space capsule, the metal remained overly expensive and was used mainly in jewellery-making. In 1886, the discovery of an electrochemical process to produce aluminium in quantities large enough to rival with other metals led to the birth of a handful of vertically integrated, capital-intensive industries fortified by monopolies, in-house scientific research and technological development. From the start, aluminium firms had vital economic and strategic incentives to achieve vertical integration by expanding operations towards mineral-rich regions and establishing production factories in remote locations with high energy-resource potential. The strategic importance of aluminium in warfare (INGULSTAD, 2012) and in key sectors of industrialised countries has compelled firms – in close cooperation with their respective nation-states – to develop colonial and neo-colonial trade links in a global race for minerals and energy sources (BARHAM *et al.*, 1994) (HACHEZ-LEROY, 1999) (EVENDEN, 2011) (GENDRON *et al.*, 2013). Its industry has therefore played a critical role in establishing global networks while simultaneously pushing the frontier of resource exploitation and industrial hazards further into the territories of remote regions (KHAGRAM, 2004) (EVENDEN, 2011) (PADEL & DAS, 2010) (GENDRON *et al.*, 2013). But, despite its global dynamics, responses to the industry's environmental impacts have largely been rooted in site-specific histories, cultural backgrounds and social relationships (DALMASSO & MORISSET, 2014) and its development has often generated resistance from marginalised populations living on its territories.

Because aluminium smelting required extraordinary amounts of electric power, its development was closely interdependent on advances in hydroelectric technology. From their infancy, both industries kept within close range of each other. In 1887, France's first aluminium factory was established in the small town of Froges, merely a stone's throw away from earlier experiments in Lancey where turbines were installed under water chutes to power paper mills on the foothills of Grenoble's mountain ranges. Both industries' surprisingly fast coeval development at the end of the 19th century marked the starting point of a general move to take over the Alps' most promising valleys to harness the *houille blanche*.² The electricity generated powered the highly energy-intensive development of electrometallurgical and electrochemical factories located on the valley floors at the crossroads of energy sources and transport networks (PARENT & MORSEL, 1991). The magnitude of industrial activities radically transformed the landscape. Along with industrial take-off and capital-intensive economic development, the aluminium factories introduced a wide variety of grime, pollutants and chemicals into the atmosphere.

2. *The Houille blanche* (white coal) as opposed to *the houille noire* (coal) refers the froth of cascading waters as a metaphor for hydropower.

The fact that the Alps were the birthplace of “perhaps the most distinctively neotechnic” metal has attracted the scrutiny of a considerable number of historians of the industry.³ This is perhaps not surprising considering the fact that the science and technology behind the emergence of the aluminium industry is substantially rooted in French history and highly emblematic of the Second Industrial Revolution. Nonetheless, a lot has also been written on more than a century of environmental degradation in the valley. In 1980, journalist Anne Guerin-Henni wrote a chapter of her book on France’s main polluting industries entitled “A century of pollution in the Sabaudian Valley”. Her historical approach on the issue epitomised years of militant criticism on health hazards inside factories and acute environmental degradation in France’s industrial districts. In fact, her book attributed the bulk of these issues to Pechiney’s chemical and aluminium⁴ activities and widely contributed to its notoriety as “France’s biggest polluter” (BOULLET, 2000).

Because the aluminium industry was first out of the blocks in being confronted with environmental issues, historians faced a long trail of environmental degradation and controversies very early on. In 1986, the creation of the Institute for the History of Aluminium along with a dedicated scientific journal (*Journal for the History of Aluminium*) helped build an early interest in the history of industrial nuisances after historians Alain Corbin and André Guillerme pioneered the topic in the 1980’s (CORBIN, 1982) (GUILLERME, 1983). Early contributions ranged from science and technology studies (MENEGOZ, 1991) (MENEGOZ, 1997) (GRINBERG, 1997) and research into the industry’s social and environmental impacts (GRINBERG & MIOCHE, 1996) (GRINBERG, 1997) (BOURGUINAT, 1993) (LE ROUX, 2003) (VINDT, 2006), to the firm’s paternalist and CSR policies (BOULLET, 2000) (BOULLET, 2006) (LOISON & PEZET, 2006) (LOISON & PEZET, 2010) (MIOCHE, 2011). But perhaps one of its most important contributions were studies of the social and environmental impacts of the Italian aluminium industry during the interwar years. In 1997, Guido De Luigi and Andrea Saba brought attention to a little-known case of violent local resistance against aluminium smelters during the Interwar Years (DE LUIGI *et al.*, 1997) in the province of Trento and called on environmental historians to address this particular episode of history (SABA, 1997).

While France is generally considered a latecomer to the field of environmental history (MASSARD-GUILBAUD, 2002) (LOCHER & QUENET, 2009), its historians have since conducted numerous studies on the environmental impacts of industrial pollution.⁵ In particular, burgeoning research at the intersection of health and environmental history has profoundly renewed our understanding of the interplay between changing conceptions of pollutants and medical aetiologies (MASSARD-GUILBAUD, 2010) (LE ROUX, 2011)

3. MUMFORD, L. (1934), *Technics and Civilization*, New York, Harcourt, Brace & Company Inc.

4. Pechiney was a French industrial group with activities in the aluminium, chemical and nuclear sectors. Previously named Alais Froges et Camargue until 1950, it was absorbed in 2003 by Alcan.

5. See the bibliography at the end for references.

(RAINHORN, 2014) (BLUMA & RAINHORN, 2016). These groundbreaking studies have also offered historians new perspectives to study the construction of knowledge on industrial hazards and health risks in the aluminium industry (PERCHARD, 2013) (HACHEZ-LEROY, 2013) (HACHEZ-LEROY, 2016).

The Maurienne valley in Savoy has figured prominently among both science and technology studies of the aluminium industry and acute popular examples of one of France's worst century-old case of environmental degradation. With only a handful of historical studies on the latter (LE ROUX, 2003) (HACHEZ-LEROY, 2016), historians have not fully addressed local perceptions nor the wider regional political context in which these issues were construed. As such, we will firstly discuss how the impacts of factory emissions on the agricultural economy emerged as a particularly acute source of conflict during the early stages of industrial development in the alpine valleys. We will also examine how local protests against industrial pollution were framed by a translocal reform movement and address the role of official and lay expertise in producing knowledge on the issue. Finally, we will discuss various reasons as to why the issue of industrial pollution vanished from public discussions in the interwar-years. In doing so we analyse the role of experts and hygiene inspectors in closing the controversy and we argue that pollution was a far less contentious issue, mainly because the industry filled the role left vacant by public authorities which had failed to provide the social and economic infrastructures and the conditions for economic development in these remote mountain regions.

Industrial pollution and the competing narratives of local development

Although the lower portion of the Maurienne valley had played host to a wide web of small-scale ironworks, which stretched out to Annecy and prospered well into the nineteenth century, its production system was considered by many economic observers as utterly archaic and out of touch with England's large factories (JUDET, 2015). To many observers, its past economic activities were therefore in stark contrast to the region's radical transformation into a bustling industrial centre at the end of the nineteenth century. Hydroelectricity along with electrochemical and electrometallurgical industries prevailed as the backbone of the Alps' industrial development and set a previously remote mountain region at the forefront of the Second Industrial Revolution. The size and scale of infrastructures erected in the Maurienne Valley were unprecedented. Between 1892 and 1906, no less than six aluminium smelters were built within spitting distance of each other along a stretch of the Arc River extending from Modane to Saint-Jean-de-Maurienne. Their location on the foothills of the Vanoise and Grandes Rousses mountain ranges thus allowed factories to exploit the valley's formidable hydropower potential and international railroad lines which provided access to an interregional commodity chain of minerals and chemicals.

Before electric transmission allowed firms to build factories further away from energy sources, hydroelectric potential entirely dictated factory location. Aluminium production was, to a large extent, the main tributary of the Maurienne Valley's rivers and chutes from

which it secured access to hydropower and converted it into large quantities of electrical power to supply the extremely energy-intensive electrolysis process of aluminium smelting. Its dependence on freshwater availability commanded the production capacity of factories which was therefore subjected to wide seasonal variations throughout the year.

In 1892, Les Produits Chimiques d'Alais et de la Camargue (PCAC) – a French alkali firm which had pioneered the chemical process to produce aluminium in 1854 – paved the way. That year, PCAC built the small factory of Calypso and was closely followed by the Société électro-métallurgique française (SEMF), which built La Praz the following year. PCAC then built a small factory (Saint-Felix) in 1902 but closed it in 1910. Since both companies were constrained by space and limited access to hydropower potential, the SEMF built a larger factory in La Saussaz (Saint-Michel-de-Maurienne) in 1905 and the following year PCAC built an even larger factory in Saint-Jean-de-Maurienne. On top of that, the Société d'électrochimie, d'électrometallurgie et des aciéries électriques d'Ugine produced aluminium in Prémont's factory from 1907 to 1950.

In only a few decades, the Maurienne valley became the main powerhouse of the Alps' industrial development. Its booming industry kindled the interest of capitalists, scientists and governments from all over the industrial world as opportunities for exploiting the metal in a variety of downstream activities were unfolding. The sheer size of industrial constructions and the radical transformations of the valley's landscape stunned observers.⁶ A newspaper in Paris marvelled at a "young industry, full of youth" [whose] "chimneys radiate over the world" (...), "which has subdued the mountain with monstrous steel pipes" (...) and "produces aluminium for half of the world".⁷ In parallel, local papers spoke proudly of their valley as the "country of aluminium" and the birthplace of a "revolutionary metal".⁸

Industrialists grandiosely celebrated their industry's position at the forefront of science and technology and put forward its promethean achievements as the embodiment of human progress. In 1905, the SEMF's executive director Émile Vielhomme wrote to the préfet that "we were the first ones in France to use the *houille blanche* industrially, as hydroelectricity. We have paved the way for the new industry in Froges in 1888, and many have followed since (...) In a country where the land is arid and where rocks abound more than anywhere else, we have initiated a source of revenue and well-being for less fortunate regions".⁹

6. AD Savoie, 39J - Fonds de l'usine de la Praz.

7. AD Savoie, 60 PER12 - *Le savoyard de Paris*, "La vallée de l'aluminium. Les usines de Maurienne", *L'indicateur de la Maurienne*, 24th Sept. 1910

8. AD Savoie, 60 PER13 - DELÉGLISE, A., "A propos de la création d'une école pratique professionnelle à Saint-Jean", *Le progrès de la Savoie*, 18th Nov. 1911

9. AD Savoie, M909 - Société électro-métallurgique française "La Saussaz" 1905-1910, Saint-Michel-de-Maurienne. Soc. électro-métallurgique française PP 1910. Letter from Émile Vielhomme to the Préfet. Demande d'autorisation de l'usine de la Saussaz le 15 juillet 1905.

Hydroelectricity was deeply entangled in the politics of regional development. Calls for harnessing the hydropower potential of the Alps raised considerable hopes of bringing technological development to allegedly primitive mountain communities. The rationale behind such ambitions were widely informed by the era's scientism and promoters displayed considerable confidence in the ability of burgeoning new industries to foster economic and social progress (DALMASSO, 2008).

However, extensive hydroelectric constructions on the Arc River and water chutes profoundly modified the valley's ecology and greatly increased flood risks. In 1897, decrees forbidding hard-material construction on the Arc were overturned following intensive discussions between La Praz's director Paul Hérault and the Préfecture's civil engineering service. While hard dams – as opposed to temporary washable constructions – were essential to sustain industrial activities, they also led to debris accumulation in their reservoir and therefore reduced the river's debit and capacity to wash away accumulated deposits. In the event of floods, such constructions also magnified the potential damage of bursts.

The outcome would not significantly be felt until the 24th of September 1920. When on that day the Arc flooded into nearby villages, the eerie resemblance with a similar event which had occurred on the 24th of September 1866 made the comparison obvious in local newspapers. But as geographer François Gex pointed out: the previous flood had been “less brutal, a simple single wave (...), the flood only toppled a few constructions. It did not wipe out a prodigious industrial organisation installed on the Arc to harness the power of the *houille blanche*”. As Gex pointed out nearly all the dams built on the river had ruptured and the debris of destroyed bridges, roads and railroads had greatly added to the amplitude of the disaster.¹⁰

But the hazards of hydroelectric development generated very few complaints in comparison with the variety of pollutants emitted by factories. The smelting process of refining alumina into aluminium in an electrolytic bath was powered through carbon anodes made out of coke, pitch and graphite. These chemicals along with fluorides and molten cryolite added to facilitate the electrochemical reaction were responsible for emitting a substantial quantity of waste as gases and particulates. Their highly corrosive action had very visible effects in the immediate vicinity of factories. In 1895, farmers sent letters to the director of La Praz's factory – months only after its opening – to complain that their crops had been “burnt by the gases” and their cattle's health had been affected by “noxious fumes”. Two years later, a group of landowners from the vicinity of La Praz's factory took the Société électro-métallurgique française (SEMF) to court over the destruction of their crops, vineyards and fruit trees. Factory director Paul Hérault and his lawyer Antoine Deléglise defended their case by asserting that the factory “emits a lime dust which, far from being

10. GEX, F. (1920), “L'inondation du 24 septembre 1920 en Maurienne et dans les Alpes occidentales”, *Journal of Alpine Research*, VIII, 3, 487-533.

prejudicial to agriculture, is absolutely beneficial". On the 23rd of June 1899, the court embraced this opinion under the authority of Botanist Perrier de la Bathie and Geologist Dieudonné Hollande. By establishing that "the earth was neither exhausted nor altered by the various emissions of the factory – dusts and gases – which tend to be rather favourable to it" the tribunal declared that the plaintiffs' demands for compensations were "considerably exaggerated".¹¹

With the opening of larger factories in Saint-Michel-de-Maurienne and Saint-Jean-de-Maurienne, complaints were registered in 1905 and 1906 as part of the administrative authorisation procedure. The opinions registered by local landowners displayed a fairly common sensorial experience of pollution throughout the area. Ubiquitous among complaints were descriptions of the impact of air emissions on vineyards, trees and crops. Farmers described their harvests as "grilled by the gases", covered in black soot and reported finding dead bees in the polluted area. Plaintiffs also expressed concerns that their cattle's health was affected by the fumes, although symptoms were not specifically described. This, along with the sensation that the air had become unbreathable and imbued with a foul smell, made a substantial number of claimants suspicious that air emissions were detrimental to public health. Plaintiffs therefore called for a scientific enquiry into the impacts of aluminium production on public health and demanded that the opening authorisation be given only on the condition that anti-pollution technology was installed and regularly inspected by the sanitary and health authorities. The people living in the area were however not opposed to both factories opening on two explicitly-stated conditions: firstly, factories were to compensate farmers for the destruction of their crops; and secondly, they should be immediately closed down if ever proven to be detrimental to public health.¹²

The politics of expertise and the growing controversy on air pollution

From its early years, the aluminium industry generated mixed feelings. While promoters envisioned hydroelectricity and industrial activity as the powerhouse of economic progress and regional development, the changing olfactory world fuelled collective fears that the air had become toxic. By and large, the importance of the agricultural and cattle economy in the polluted area accounted for the way the issue was framed in the public sphere. With phrases such as "L'usine contre la terre" being a favourite during election campaigns, newspaper headlines were explicit. In 1905 and 1906, farmers established unions against industrial pollution in Saint-Michel-de-Maurienne and Saint-Jean-de-Maurienne to collectively ask for compensations.

11. AD Savoie, 3U52 - jugement du 18 juin 1899.

12. AD Savoie, M909 - Dossier des établissements classés, "Enquête de commodo et d'incommodo". AD Savoie, M807 - Dossier des établissements classés, "Enquête de commodo et d'incommodo".

On the 2nd of January 1908, César Rochet faced a gathering of farmers in his capacity as president of Saint-Michel-de-Maurienne's union. He appealed to his audience's broadly shared concerns about the predicament of agriculture in the region by proclaiming that "the development of one industry should not be made at the expense of another". César Rochet outlined the plight of farmers in the valley as no less than a Hobson's choice between industry or agriculture. The meeting was held under police surveillance as tensions were high and farmers threatened to use violence against the factories: "Many of you, maybe even the majority, suggest taking action to close the factories on the 1st of April if they do not give us satisfaction, (...) We could leave the factories running during the winter as they cause no prejudice during this time of the year and we could have the rest of the year to enjoy the fresh air".¹³

To draw attention to their grievances, farmer unions actively concentrated their efforts on blocking the administrative procedures granting aluminium factories the authorisation to operate. They sent letters of complaint to newspapers, Mayors, Préfets and held public meetings in an attempt to force the aluminium industry to reduce its air emissions and pay compensations for the damage done to their crops. But préfets had very few options to intervene in the way factories were operated. Even though industries which were considered dangerous, likely to discharge sewerage or emit air pollution had to obtain the consent of the préfecture to operate ; and while authorisations were granted under explicitly written conditions forbidding any type of air or water pollution, such rules had no means of being enforced. In fact the Préfet was uncertain of the extent of his power to compel firms to reduce air emissions until the issue was somewhat clarified. An administrative injunction compelling La Volta's alkali factory to modify its anti-pollution installation was appealed by the firm to the *Conseil d'état* and judged in 1910 in favour of the latter. The ruling thereafter made it clear that, with very little credible power to force factories to install anti-pollution devices, the only option Préfets felt they were left with was to shut factories down.¹⁴

Meanwhile the judiciary procedures undertaken by increasingly impecunious farmers were met with constant appeals and delays from the industry's lawyers. The latter questioned accusations that emissions had a detrimental impact on plants and accused pests along with bad farming practices of yielding poor harvests. César Rocher therefore felt compelled to enter the fray of expert debates by hiring a chemist or else he believed farmers would be "crushed by science".¹⁵ In fact shortly before the meeting Rocher had hired Paul Hollande, a young pharmacist from Chambéry, to act as their representative against the

13. AD Savoie, M909 Société électro-métallurgique française "La Saussaz" 1905-1910, plaintes 1905-1908, Rapport du commissariat spécial de Modane.

14. AD Savoie, M908 - Dossier des établissements classés, Saint-Marcel : Fabrication de soude et de chlore soc. "La Volta", plan, photos (1899-1917).

15. AD Savoie, M909 - Société électro-métallurgique française "La Saussaz" 1905-1910, plaintes 1905-1908, Rapport du commissariat spécial de Modane.

industry's experts. In addition to his assignment, Hollande's wide-ranging scientific interest in the issue compelled him to investigate the air around factories on his own. Through painstaking experiments he discovered the presence of hydrofluoric acid in the air around the factories and proceeded to extensively demonstrate its corrosive effects on a large range of cattle and plants raised in the polluted area.¹⁶ As such his work was highly instrumental in extending the range of species eligible for compensations and made it more difficult for the industry's experts to refute farmers' claims.

It was only a couple of years before Hollande became the leading voice of farmer unions. Despite having no ties with the region, he put a lot of energy into this "rightful cause" and claimed that it was an "honour to have given (his) time and money to support these claims".¹⁷ Hollande had harsh words against the aluminium industry's attitude. He compared industrialists to "feudal lords" and derided "factories that only do good to their shareholders while they live off our prosperity and water chutes".¹⁸

But in spite of his radical rhetoric, he opposed requests to shut down factories and strove to reconcile the aluminium industry with other economic activities in the region. As such he widely campaigned for the installation of anti-pollution systems and publicised the case of a Swiss aluminium factory in Neuhausen where air emissions had successfully been reduced as early as 1892 to meet administrative requirements. Indeed, four years after the factory opened, the director had equipped production units with a wet scrubber. The device consisted of large fans pumping particulate matter and gaseous pollutants out of the pot room and into a spray tower where they were captured by liquid droplets into a water solution. The system was probably efficient enough for the small production capacities of the era and was highly praised by the administrative authorities although the toxic waste liquor unloaded into the Rhine River would have caused acute pollution problems. Nevertheless, Hollande made the blueprints widely available and encouraged firms to adopt similar devices.¹⁹

However, later attempts in the Maurienne valley to collect emissions were restricted to small production units in factories such as Prémont or Chedde in Haute-Savoie. In 1905 Saint-Michel-de-Maurienne's larger factory made a half-hearted attempt to install a similar system but due to the insufficient power of fans to pump out gases into the scrubber, fumes were trapped inside the workshop and experiments were quickly abandoned. In a later reunion at the Préfecture, La Saussaz's director's Henri Vielhomme was upfront about the extensive costs of such devices. He argued that while their installation on smaller units was

16. IHA, collection de planches (dessin, photos, herbier...) du docteur Paul Hollande.

17. AD Savoie, 61 PER3 - *L'écho de la Maurienne*, 1st Feb. 1908.

18. AD Savoie, 60 PER14 - *Progrès de la Savoie*, 12th Jul. 1913.

19. HOLLANDE, P. (1910), *Usines électrochimiques d'aluminium et agriculture. Pathologie végétale de l'acide fluorhydrique*, Chambéry, Chambaz.

achievable, equipping larger production units such as Saint-Jean-de-Maurienne was cost prohibitive and would necessitate reconstructing and remodelling the entire factory.²⁰

Hollande's considerable interest in the scientific aspect of the issue led him to further explore the wider effects of pollutants in the valley. He warned that the impacts of hydro-fluoric acid emissions might lead to the acute devastation of forest covers which stabilised mountain slopes, therefore causing soil erosion, dry-season water shortages and exposure to natural risks such as avalanches, landslides and increased torrential activity.²¹ With the help of Saint-Michel-de-Maurienne's Mayor, he pressured the Water and Forestry Service into sharply increasing the amount of payments due by the industry for the impacts of air emissions on forests. Both argued – albeit to little avail – that the compensation schemes established by the Water and Forestry Service were ill-adapted to the forest's predicament. They defended the view that compensations would progressively dwindle along with the reduction of forest covers up to the point where the town would be entirely robbed of its forest revenues and its protection against natural risks. But despite Hollande's efforts to push this issue, claims that trees could be decimated in the foreseeable future were unheeded by foresters, who were confident in their ability to regrow forest covers with pollution-resistant species.²²

As one of Chambéry's prominent public figures, Hollande also played a leading administrative role as the secretary of Savoy's Hygiene Board, an institution which advised the Préfet on matters of sanitary risks and industrial hazards. Chaired mainly by prominent members of the medical and engineering community, its role regarding the surveillance of polluting industries is the subject of much debate among historians. While some have argued that hygiene boards were instrumental in neutralising critics and fabricating consensus in order to accustom populations to the rapidly expanding hazards of the industrial revolution (FREZZOZ, 2012), others have underlined examples of its members taking proactive measures, issuing injunctions, and conducting crucial health surveys in polluted areas (MARSARD-GUILBAUD, 2010).²³

20. AD Savoie, 14M18 - Délibérations du Conseil départemental d'hygiène de la Savoie.

21. AD Savoie, 60 PER10 - *L'indicateur de la Maurienne*, "Agriculteurs et usines. Conférence à Saint-Martin-la-Porte par M. le docteur Paul Hollande, chimiste", 19th oct. 1907

22. AD Savoie, M 909, Saint-Michel-de-Maurienne Soc., plaintes 1905-1908, Délibération du Conseil municipal de Saint-Michel-de-Maurienne, 1er mars 1908.

23. The Hygiene Board's role in determining industrial risks and hazards was based on a legislative apparatus to regulate polluting industries established in 1810 during the Napoleonic Empire. The decree marked a fundamental shift in the conception of the relationship between pollutants and health. While in the Old Regime public authorities had relied on criminal justice and the local police to identify industrial risk and pathogenic factors in the atmosphere of cities, the rise of hygienist paradigms pushed conceptions away from fears of stench and miasma to an understanding of medical aetiologies based on the social conditions and morals of the working classes. With the rise of capital-intensive chemical industries and its crucial role

Throughout its history, the aluminium controversy turned out to be one of the most divisive issue the Hygiene Board of Savoy had to face. Since the issue had very few precedents, its members created an Aluminium Commission in 1907 to study the matter but restricted its mission to finding out whether anti-pollution technology was available.²⁴ The commission spent most of its time studying the electrochemical process of aluminium smelting at the Préfecture and visited factories in the Maurienne Valley during the winter season when production was reduced and air emissions were low.

Most of its members quickly made up their mind after having talked to a few workers and discussed the matter with factory directors. They observed only minor pollution impacts and quickly concluded that a trip to Neuhausen to observe anti-pollution devices was unnecessary. However, Paul Hollande went on the offensive against every other member of the Hygiene Board. After the visit, he spontaneously submitted a lengthy report which summarised his previous scientific work on hydrofluoric acid's corrosive effects. In addition Hollande looked into the possibility that air emissions might have an impact on public health and that food produced in the polluted area could be poisoned by hydrofluoric particulates. He also underlined the epistemic uncertainties regarding the impacts of toxicants on public health and concluded that there was an urgent need to scientifically investigate these issues pending the administrative process.

Hollande also stepped out of the Hygiene Board's administrative jurisdiction – which had no authority over worker health and hygiene inside factories – to address the effects of air emissions inside workshops. He described work conditions inside factories where visibility was greatly reduced by thick tar fumes and temperatures rose up to 60°C. Hollande confronted the widely publicised idea that small doses of hydrofluoric acid had a beneficial role on tuberculosis, with medical scientists who found no correlation. Instead he reviewed the medical literature on a wide range of toxic gases found inside potrooms. He also collected material on workers who had left factories because of health problems and described the main clinical symptoms (loss of appetite, contractions, pneumonia...). Using his data, he estimated that a third of the pot room workers were affected by toxic gases and dust. Hollande also suspected the existence of an occupational illness related to work in the pot rooms and predicted the emergence of a new form of pneumoconiosis – an occupational lung disease caused by dust inhalation – he named “aluminosis”.²⁵

during the Napoleonic wars, the decree of 1810 also sought to protect industries from citizen complaints. While the police had been vested with the right to fine and to displace factories to less populated areas and even close factories down, the decree sought to protect capital-intensive factories by moving polluting industries from the penal to the administrative justice system. Citizens could no longer demand that a noxious factory be closed down but only ask for compensations through civil procedures (MASSARD GUILBAUD, 2010) (LE ROUX, 2011) (FRESSOZ, 2012).

24. AD Savoie, 18MI4 - Registre des délibérations du Conseil départemental d'Hygiène, séance du 15 novembre 1907.

25. AD Savoie, M915 - Rapport du Dr Paul Hollande à la Commission de l'aluminium, le 11 mars 1908.

Despite Hollande's work, the Hygiene Board unanimously voted to adopt the conclusions of Antoine Badoureau, its mining engineer. The latter proclaimed that the Hygiene Board's role was "to protect an industry which consumes French minerals and French energy from water chutes in the Alps and which has already transformed alpine valleys by bringing life, prosperity and well-being".²⁶ He also expressed admiration for its putative aesthetic value by praising the SEMF for being the instigator of the "magnificent development of an electric industry in the Alps and other mountain regions". In his mind, economic issues were at stake and efforts to curb industrial pollution were equated with efforts to shut down factories. Although Badoureau did admit that there was some damage in the vicinity of factories he declared that air emissions were innocuous – if not beneficial – to public health by denying the possibility that hydrofluoric acid could be emitted during the electrolytic process on account of Lavoisier's principle of mass conservation.²⁷

From 1907 onwards, Hollande gave a number of public conferences in the valley and encouraged farmers to mobilise collectively against industrial pollution. He extensively toured the region urging Chambéry's fishing associations to create a regional organisation against poaching and water pollution.²⁸ He also engaged widely with other local communities in the vicinity of electrochemical and electrometallurgical industries throughout Savoy's mountain regions. Outside the Maurienne valley, the thermal industry in the adjacent Tarantaise Valley was sharply critical of its neighbouring carbide calcium industry whose factories in La Bâthie, Notre-Dame-de-Briançon and Le Villard de Planay emitted large quantities of thick smoke that drove tourists off. Near Moutiers, La Volta's alkali factory in Saint-Marcel and Cognet's phosphorus factory at Pomblière faced near-unanimous opposition for their acute impact on public health.

Even though the many pollutants released in the atmosphere by various industrial processes had varying site-specific consequences, there were more than a few common threads between pollution cases to allow Hollande to publicly frame the issue in terms which found a large audience throughout increasingly marginalised rural regions.

From 1910 onwards, farmer unions increasingly pushed the issue into the political sphere. During the April 1910 legislative elections, their members repeatedly accused one of the candidates, Antoine Deléglise – the aforementioned lawyer of the SEMF and a shareholder of the aluminium industry – of working against them. But Deléglise won the election, albe-

26. AD Savoie, M915 - Rapport de l'ingénieur en chef des mines, secrétaire de la Commission de l'aluminium, le 26 novembre 1908.

27. AD Savoie, 18M29 - surmortalité : enquêtes triennales.

28. HOLLANDE, P. (1907), "Du rôle social, économique et pratique d'une société de pêche et de pisciculture", Chambéry, unpublished manuscript.

it by a narrow margin, and acknowledged the plight of farmer unions.²⁹ Shortly after, he pushed the issue in the Chamber of Deputies along with Antoine Borrel, the freshly-elected Deputy of the Tarantaise valley. On the 6th of December 1910 both intervened in the Chamber of Deputies to ask the Minister of Commerce for a new legislative framework to regulate polluting factories. Antoine Borrel described how the existing legislation was inefficient for public authorities to regulate the industry: *Préfets* were powerless to intervene and left with the only option of shutting down polluting factories – a decision they were largely unwilling to take. He also emphasised how the legislation forced increasingly impecunious farmers to undertake expensive judiciary procedures to obtain compensations for damage. Speaking after him, Antoine Deléglise warned that “a war between the farmers and the industry” had been declared and reminded the Chamber that complaints had been growing in intensity.³⁰

However, a month only after the case was put to the Chamber of Deputies, Savoy’s newly elected *Préfet*, Joseph Giraud, granted the opening authorisation to the factories of Saint-Jean and Saint-Michel-de-Maurienne.³¹ The move robbed authorities of an important leverage to curb factory emissions. Antoine Deléglise wrote a seething letter to the *préfet*. He expressed his anger for not having been informed of the decision and reminded him that by granting the authorisation without sufficient guarantees, he was condemning farmers to continuously employ costly judiciary means against factories. He ended his letter with a warning that populations might even “give way to excesses”.³²

Nonetheless, on the 11th of April 1911, the minister of Commerce responded to Borrel and Deléglise’s request and ordered a general survey of Savoy’s electrochemical industry. The task was entrusted to the *Comité consultatif des arts et des manufactures (CCAM)*, an institution whose role was to assist the Ministry of Commerce with technical and scientific expertise on polluting industries, patents as well as barriers and tariffs. Experts of the CCAM visited the industrial valleys of Savoy and spent two days in the Maurienne Valley. Most likely because of its potential to aggravate tensions in the affected areas, the final report submitted on the 6th of December 1911 remained anonymous and confidential. The CCAM attributed complaints against industrial pollution to two incidents: chlorine leaks at La Volta’s factory in 1902-1903 and hydrofluoric acid emissions in 1897-1898 at the Calypso factory. It then stated that “since these events took place, populations have tended to attribute bad harvests to the gas, smoke and dust emitted by factories”. It went on to state

29. AD Savoie, 60 PER12 - *L'indicateur de la Maurienne*, 2nd April 1910 ; AD Savoie, 60 PER 12 - *L'indicateur de la Maurienne*, 23rd Apr. 1910.

30. Bibliothèque et archives de l'assemblée nationale, Journal officiel de la République française. Débats parlementaires. Chambre des députés : compte rendu in-extenso le 6 décembre 1910.

31. AD Savoie, M 807 - Arrêté préfectoral (soumis au visa le 7 janvier 1911).

32. AD Savoie, M915 - Lettre du *préfet* Antoine Deléglise au *préfet* de la Savoie Ernest Moullé, le 21 janvier 1911.

that a “preconceived idea about so-called hydrofluoric emissions during the electrolytic production of aluminium came to the same result. It has been systematically employed against aluminium factories since 1905”. Although the CCAM acknowledged some damage to plants in the vicinity of factories, its report declared that farmers’ claims were “highly exaggerated” and attributed most of the damage to atmospheric conditions, pests and negligence. They were also startled by the allegations of special illnesses that killed bees and cattle in the Maurienne Valley and scoffed at popular superstitions which claimed the existence of an “illness of the factories”.

But whereas the CCAM report was clearly hostile towards farmers, it displayed surprising confidence that industrialists would spontaneously adopt anti-pollution technology whenever it would be made available to them. In its view the fact that very few companies had installed such devices demonstrated that the technology had not proven to be effective. In addition, attacks were personal: Paul Hollande along with MPs Deléglise and Borrel were branded as agitators. Hollande’s work was heavily criticised for his stake with farmer unions and for his views that hydrofluoric acid was emitted during the electro-chemical reaction.³³

Nonetheless, the opacity of the administrative process and the laissez-faire position of the administrative authorities gave the growing anti-pollution movement a considerable push in the years before the First World War. Hollande’s conferences culminated in a large demonstration in Aigueblanche on the 19th of April 1913. Around a thousand farmers were gathered when he announced the creation of a departmental federation against industrial pollution along with MPs Antoine Borrel, Antoine Deléglise as well as the president of the Saint-Jean-de-Maurienne farmer union Noé Picollet, and Aigueblanche’s Mayor Francisque Ancenay.

The federation proposed to coordinate translocal collective action within a larger network and strive for larger social changes in an era which was awash with various Reform movements (TOPALOV 1999). The goal was no longer restricted to local entanglements in complex judiciary procedures but to foster wider legislative changes in the framework regulating polluting industries. Indeed its short-term objectives was to expand on the national scene and pressure industrialists to install anti-pollution technology.³⁴

Paternalism, social amenities and local accommodation to industrial pollution

However, the timing of the federation with world events could not have been less auspicious. Its statutes were released only months before the call to arms of the First World War

33. AD Savoie, M915 - Rapport du Conseil consultatif des arts et manufactures : Enquête sur les dommages pouvant être causés à l’agriculture par les fumées des usines électro-chimiques et électro-métallurgiques dans le Département de la Savoie, séance du 6 décembre 1911.

34. AD Savoie, M 915 - Établissements dangereux, insalubres, incommodes. - Fumées industrielles, émanations fluoriques : plaintes, enquêtes.

nipped the movement in the bud.³⁵ The subsequent events hardly made the issue of industrial pollution relevant. While factories and local communities served the war effort, demands for compensations became peripheral. And later, whereas the topic had regularly appeared in local papers, political discussions and election campaigns, its absence from the limelight during the interwar years suggests that industrial pollution was no longer perceived as a contentious issue. Problematically for historians, the controversy which compelled stakeholders to voice their opinions faded out of newspapers, correspondence, administrative papers, and therefore out of primary sources.

The fact that the topic eluded public discussions can partly be explained by the period's less favourable economic context. Aluminium production increased substantially less in the interwar years than in the years before the Great War. While manufacturing reached a low point in 1920 with just a little over 4,000 tons produced, pollution impacts were less manifest. All through the interwar years, production levels increased only from 1926 to 1930 with a peak of 12,500 tons in 1929. Factories then emitted around 500 tons of hydrofluoric acid per year up until the economic ripples of the Great Depression were felt and production was scaled back to pre-war levels.

In the second half of the 1920's, rising pollution levels made impacts more visible. In 1926, residents of an Italian worker neighbourhood in Saint-Jean-de-Maurienne complained to the Préfecture that their plants had been burnt and a number of rabbits had been found dead in the area. In light of these incidents, residents feared for their health. In response to such an unusual threat, experts of the Hygiene Board were sent to the area to assess potential health risks. Its members quickly reported back that complaints were unsubstantiated and that symptoms lacked description. In addition they emphasised the fact that previous expertise had already established the innocuousness of air emissions in the region.³⁶

Meanwhile, the Conseil d'arrondissement – a locally-elected body – protested that the industry had abandoned experiments with anti-pollution systems and simply preferred to pay compensations. Between 1924 and 1930, its members repeatedly asked the Préfet that a formal notice be given to end air emissions in the valley.

Responding to mounting complaints about air pollution in the region, hygiene inspector Lucien Devaud repeatedly wrote back that the issue had been settled by previous expertise from both the CCAM and the Hygiene Board, whose findings had demonstrated that air emissions in the valley were innocuous. Devaud also expressed surprising confidence in the industrialists' goodwill. In his view, the absence of such technology inside factory premises was proof enough of the technical infeasibility of reducing air emissions. He also appeared reluctant to take issue with industrialists who, for the most part, preferred to pay

35. AD Savoie, 60 PER15 - *L'indicateur de la Maurienne*, 3rd Jan. 1914.

36. AD Savoie, 18MI4 - Registre des délibérations du Conseil d'hygiène départemental de la Savoie 1920-1929.

compensation rather than invest in far more expensive anti-pollution systems. Indeed his attitude compelled the Société des thermes de la Léchère in the Tarantaise Valley to complain in 1933 to the préfet that the hygiene inspector answered grievances against polluting industries by “overly protecting factories which, for eight years, have formally refused to execute decrees (...) and laws”.³⁷

But the idea that industrialists would spontaneously adopt anti-pollution technology in the foreseeable future prevailed among many of the experts. Collective visions of technological development as devoid of political influences and of historically-contingent social and economic contexts sustained a powerful apolitical consensus in favour of laissez-faire industrial development which pushed hygiene experts to block complaints and sanitary alerts from administrative intervention. On the other hand the absence of collective infrastructures and counter-expertise to publicise the issue in terms that largely appealed to wider audiences sharply declined after half of the founding members, including Paul Hollande, left the region during the war.

In the aftermath of the First World War, Antoine Borrel wrote an article in the Journal of Alpine Research to deplore the state of affairs in Savoy's mountain regions. Writing about the increasing rural exodus and the falling birth rates caused by a declining agricultural economy, Borrel called for the industrial exploitation of all potentially-available natural resources left in the region to attract extractive and processing industries. While Borrel had hitherto been extremely critical of the environmental impacts of industrial development, his newfound mission made him drop the issue of pollution entirely. But his change of subject was not without rationale: his views that industrial development provided farmers with an incentive to stay on their lands were indeed substantiated by an overall change in the industry's attitude towards local communities in the area. In his view, the electrochemical industry now offered a secure source of employment to curb rural exodus and sustain the social fabric of rural communities.

After the First World War, widespread economic difficulties in the agricultural sector increasingly pushed pauperised farmers to accept seasonal jobs in the industrial sectors. For many farmers, agriculture in the Maurienne Valley progressively evolved from a main activity to an external source of revenue alongside shifts or seasonal work periods in factories. Farmers tended to avoid over-reliance on revenues from the industry and thus kept away from the radical changes generated by the proletarian life (LORENZETTI, 2012).

In parallel, firms increasingly found themselves in the position of having to fill in the vacancy left open by the perennial lack of public investments in remote mountain regions (BOURGUINAT, 1993). In 1921, the SEMF and PCAC fused into a single company: Alais

37. AD Savoie, M915 - Établissements dangereux, insalubres, incommodes. - Fumées industrielles, émanations fluoriques : plaintes, enquêtes, 1905-1936.

Froges et Camargue (AFC). AFC operated the Auzat and L'Argentière aluminium factories in the south of France as well as a substantial number of chemical factories (Salindres, Saint-Auban, Chedde, Salin de Giraud, Gardanne) and fluorite and bauxite mines.

Now managing a giant industrial corporation with greater access to raw materials, the company invested substantially more than its predecessors in social amenities. In the inter-war years, spending on social works reached around 25% of the wage bill and included family allowances, retirement funds, mutual aids, cooperatives, health insurances and medico-social services as well as mutual benefit societies. AFC added clinics staffed by nurses and doctors in each factory to provide free health assistance to workers (VINDT, 2006).

AFC also provided numerous services for local communities. The company subsidised Saint-Jean-de-Maurienne's hospital, various sanatoriums for tuberculosis, and vaccination campaigns (VINDT, 2006), and invested substantially in housing infrastructures (FROUARD, 2003) (COMBAL, 2015), education, religious congregations, sports and cultural activities promoting these as morally-sane alternatives to the temptations and vices of industrial towns (VINDT, 2006).

Moreover, AFC extensively addressed the economic impacts of its air emissions on the agricultural economy. The company instigated yearly visits from experts to assess damages in the polluted area and paid generous compensation.³⁸ Cash-in-hand payments were handed out individually from the director's office in order to avoid the public visibility of collective negotiations.³⁹ In 1927, scientific evidence on the existence of fluorosis in cattle in the vicinity of factories helped to generate payments for the loss of cattle. In fact, despite the impacts of air emissions on plants and animals, AFC largely sustained the agricultural economy of the valley by offering generous compensation schemes and complementary salaries to an otherwise increasingly impecunious activity.

In a speech given in 1954 to the Sabaudian academy, François Guise chose to look back on his long career as Prémont's factory director by praising the valley's exceptional hydroelectric potential for having "transformed a previously poor and desolate region". In his long description of the industry's benefits in the area, Guise portrayed hydroelectricity and aluminium manufacturing as enterprises attuned to the seasonal work rhythms of local farming practices: runoffs in the spring and summer complemented the idleness of the growing season with extra work available in the factories. But more so, Guise presented agriculture and hydroelectricity as similarly embedded in the landscape and dependent on the crucial role that mountains and forest covers played in supplying runoffs for energy exploitation while creating the humid conditions for farming activities.

38. Archives IHA, 2004006, Registre du syndicat agricole des plans.

39. IHA, IHA 159.06, Anne Dalmasso. Entretien avec Yves Lallemand le 1er avril 2011.

In his view “nature had made itself readily available for its own exploitation by placing forests on top of mountains for the purpose of regulating water distribution”. In endowing nature with a providential role to serve mankind, Guise also justified the damming of rivers and torrents by depicting them as commonplace elements of the landscape. However, Guise recognised that such processes were fragile and easily affected by human activities. Based on the prevalent views of the times, he wrongly accused pastoral activities of causing widespread deforestation at higher altitudes. Consequently, he condemned the “recklessness” of Man and wood-fired industrial activities for depleting forest resources and warned of the consequences of such actions. Indeed, deforestation would reduce soil-water retention and therefore diminish the valley’s hydropower potential. It would also lead to dryer local climates for cultivation and increase natural risks by aggravating exposition to landslides and torrential activity. Guise therefore praised efforts by foresters to regrow forest covers, control erosion and curb torrential activity in the Maurienne Valley. He emphasised the fact that both industries therefore had a strong incentive to act as “benevolent stewards of the mountain” and preserve its forests.

Guise’s idealised view of a perfectly ordained society in which agriculture and industry harmoniously coexisted to the benefit of the valley’s ecological processes ostentatiously made no mention of any of his industry’s negative impacts. As Guise gave his speech and described his vision of an ideal company town, the writing on the wall was to be made visible by the widespread use of Söderberg production units inside factories which generated far greater environmental and health impacts. In the early 1950’s a growing number of sanitary alerts and the increasing attention of regional authorities towards the issue threatened to crack François Guise’s picture-perfect vision of a model company town.

Conclusion

In the 1970’s air emissions impacted about 11,000 hectares of trees, about twice the area of a city like Lyon.⁴⁰ The far-reaching consequences of industrial pollution on the ecology of the valley led foresters to speak of a possible breaking point in the ecosystem. Were it left unaddressed, deforestation would be a permanent feature in some areas of the valley, leading foresters to seriously contemplate a substantial increase of natural risks such as avalanches and torrential activity.⁴¹

Local Maurienne scholar and former Pechiney engineer Daniel Déquier opened his book on the history of the aluminium industry in the Maurienne Valley by stating that “the Maurienne without its factories would not be the Maurienne”.⁴² In the decades separating

40. GARREC, J.P.; PASSERA, N.; PISTO, J. (1977), “Étude et cartographie de la pollution fluorée dans les massifs forestiers de la vallée de l’Arc (Maurienne-Savoie)”, *Revue forestière française*, 31, 381-389.

41. AD Savoie, 1518W 9 - Études et rapports forestiers - expertises par commune.

42. DEQUIER, D. (1992), *Maurienne, la vallée de l’aluminium*, Montmélian, La Fontaine de Siloé.

these events and his book, the bond between the industry and the local populations came to represent a considerable aspect of the local identity. The tremor created by the felling of chimneys in later periods when the opening to global market economies led to the closure of many factories, attested to its strength. The withdrawal of Pechiney's social organisation left jeopardised communities facing social dislocation and the lingering question of recovery from a single-resource economy in a post-industrial world. But alongside public processes of local economic rehabilitation lie the open wounds of an ambiguous industrial landscape, and competing social and cultural visions of the industry's legacy and the ways to collectively deal with its loss (DALMASSO, 2012) (COMBAL, 2015).

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