

THE GRENELLE GUNPOWDER FACTORY EXPLOSION. ACCULTURATING TO INDUSTRIAL HAZARD IN FRANCE, 1790-1810

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In a recent article, Christopher Sellers and Joseph Melling introduced the notion of “industrial-hazard regimes” so as to put a phenomenon which is too often considered as timeless into historical perspective.¹ Indeed, since the 1980's, the notion of “risk society” has mostly been popularised by scientists, sociologists, geographers, or anthropologists, some of whom, like Ulrich Beck, becoming thus internationally known. Regarding historians, very few of them have analysed the emergence of industrial risk. But industrial (or artisanal, or mining) accidents, which have been spectacular for more than a century, existed throughout the anterior process of economic development in the Western world. They accompanied the birth of the urban and industrial civilisation they contributed to shape on a structural level. Yet, this “early” history is not very well known, which justifies the study of the emergence of risk during the first stages of industrialisation.² Accidents, because they give a concrete form to the danger, can be used to provide an approach to study this question. Whether they were

1. Joseph Melling, Christopher Sellers, “Towards a Transnational Industrial-hazard History: Charting the Circulation of Workplace Dangers, Debates and Expertise,” *British Journal of the History of Science*, vol. 45, n° 3, 2012, p. 401-424.

2. Thomas Le Roux, (dir.), *Risques industriels. Savoirs, régulations, politiques d'assistance, fin XVII^e-début XX^e siècle*, Rennes, Presses Universitaires de Rennes, 2016 ; Thomas Le Roux, « Editorial. L'émergence du risque industriel. France, Grande-Bretagne, XVIII^e-XIX^e siècles », *Le Mouvement Social*, 249, 4, 2014, p. 3-20.

major – like in great catastrophes – or quotidian – at the workplaces – accidents and their implications were a concern for society as a whole³. Risk management also played a part in the affirmation of constituted fields of knowledge and of spheres of expertise, and, when accidents happened, it highlighted the way public authorities tackled and solved the issue and how political economy was used so as to justify those decisions.

This article aims at interrogating the historical phenomenon of the emergence of industrial risk in France in the late eighteenth century and in the early nineteenth century, and at bringing to light the power legitimising discourses had in the gradual acceptance of those hazards. The historical sequence studied took place in the decade that started with the explosion of the gunpowder factory of Paris (Grenelle) in 1794 and ended with the 1810 decree on harmful factory enacted in France after severe concerns. In those twenty years, industrial risk became one of the characteristic features of urban life. That situation could not have happened without impassioned debates and consequential decisions.

The explosion of the gunpowder factory of Paris (Grenelle), 1794: the sudden emergence of industrial risk.

On 31 August 1794, the gunpowder factory of Grenelle, near the École Militaire and the Champ de Mars in Paris, exploded. The explosion killed about 600 people and injured more around 1000. How could such a major accident happen in the centre of Paris, at a time when the industrialisation process had just begun? It was perfectly known that gunpowder production was dangerous. Fires and explosions were frequent in such manufacturing. As a result, gunpowder production (a process in which charcoal, sulphur and saltpetre were mixed) was not tolerated in the immediate vicinity of cities. Under the monarchy, all the gunpowder factories were several kilometres away from domestic dwellings. Within the factories themselves, powder mills, which were always hydraulic, were clearly separated from other buildings as well⁴.

To begin with, the very existence of the Grenelle gunpowder factory resulted from exceptional arrangements with the building rules for similar industrial premises. That factory was one of the exceptional devices designed to implement the revolutionary militarisation of the Republican regime led by the Committee of Public Safety, the principal organ of the revolutionary government. In late 1793, it decided to concentrate the war production in Paris when the aristocratic foreign armies threatened to invade France. A “Manufacture de Paris”, consisting of numerous forges and weapons workshops and including a major saltpetre refinery and the Grenelle gunpowder factory as well, was quickly created. To ensure

3. Lars Bluma, Judith Rainhorn (dir.), special issue « History of the Workplace : Environment and Health at Stake » of *European Review of History*, vol. 20, n° 2, 2013 ; Christopher Sellers, Joseph Melling (ed.), *Dangerous Trade. Histories of Industrial Hazards Across a Globalized World*. Philadelphia, Temple University Press, 2012.

4. Brenda J. Buchanan (ed.), *Gunpowder, Explosives and the State. A Technological History*, Aldershot: Ashgate, 2006.



Explosion of the gunpowder factory of Paris (Grenelle), 1794. Nineteenth-century engraving.

the success of that grouping of production units, the Parisians were largely mobilised, particularly to collect saltpetre, the principal ingredient in gunpowder. Every attempt to resist that industrial concentration was thwarted. The *commodo et incommodo* enquiries, which till then, in the eighteenth century, were supposed to provide information about the appropriateness of building dangerous workshops or factories, were simply not made in that revolutionary context. The gunpowder factory was set up within the walls of Paris at one extremity of the Faubourg Saint-Germain, on the Grenelle site.⁵

Besides, to speed up the production of gunpowder, the manufacturing processes departed from the traditional techniques. The chemist Carny had invented a process that reduced the beating duration from twenty-one hours to four. One of his innovations was to blend the materials in barrels, thanks to cranks moved by the workers, instead of mixing them with a pestle, which was the traditional way. To understand that experimental choice, it should be kept in mind that some of the greatest scientists of the age were involved in the highest levels of the government or of the state administration. The chemists Fourcroy, Guyton de Morveau, Berthollet or Chaptal, who had followed the teachings of Lavoisier, took an active part in the republican mobilisation and were even sometimes members of

5. Thomas Le Roux, « Accidents industriels et régulation des risques : l'explosion de la poudrerie de Grenelle en 1794 », *Revue d'Histoire Moderne et Contemporaine*, vol. 58, n° 3, juillet-septembre 2011, p. 34-62. <<https://www.cairn.info/revue-d-histoire-moderne-et-contemporaine-2011-3-page-34.htm>>

the Committee of Public Safety.⁶ The new gunpowder was tested and authorised by Chaptal, Monge and Berthollet. By the way, the last one, with the help of Lavoisier, had tested the explosive potential of a new gunpowder, potassium chlorate, at the gunpowder factory of Essonnes (30km south of Paris) in October 1788. The resulting explosion had killed three workers and the two great chemists had had a narrow escape. The experimentation chosen for the Grenelle factory was therefore the product of a dynamic relationship between the new chemistry of Lavoisier and the industrial systems. The safety of the production processes was neither guaranteed by legal precedents about gunpowder factories nor by habit or experience.

Finally, the factory was built in great haste and elementary safety measures were ignored. In no more than two months, starting in April 1794, about fifteen workshops, in which hundreds of workers could work from dawn to dusk, were thus created. By the end of June 1794, there were more than 1500 workers in the factory, which had been designed by Chaptal and Carny so as to accommodate about 700 people. In the summer, the manufacture already produced more than 30% of French gunpowder. Everything had been set in place in order to speed up the building, to requisition the workforce, and to organize the expenses. In spite of the iron discipline maintained to protect the premises from sabotage, the injunction to always produce more by the Committee of Public Safety and the new concentration of workers contributed to a major increase of hazards⁷. On 14 July 1794, Barère, a member of the National Convention, marvelled at the establishment of that manufacture “to produce huge quantities of gunpowder, more gunpowder than any people in the universe has ever produced”.⁸ However, the authorities should have been aware of the explosion hazard as several accidents had already taken place. On the night of 20-21 August, the great saltpetre refinery, which had been established in the same hurry in the abbey of Saint-Germain-des-Prés, fell victim to flames. After that, several officials worried about safety failures in some revolutionary weapon workshops in Paris.

On 31 August, as no safety measure had been taken, the gunpowder factory exploded. All testimonies concurred in saying that there were a tremendous explosion, an enormous blast, very thick smoke and a deafening detonation that was even heard 25 kilometres away from the factory. The Committee of Public Safety, issuing ten decrees or so, commanded that the access to the premises should be made secure and organised the rescue operations. The injured were taken to the city hospices or to the Invalides. On the very site of the factory, nothing was left, it was a real *tabula rasa*. In the neighbourhood, the buildings were

6. Patrice Bret, *L'Etat, l'armée, la science. L'invention de la recherche publique en France, 1763-1830*, Rennes, Presses Universitaires de Rennes, 2002 ; Charles Coulston Gillispie, *Science and Polity in France. The revolutionary and Napoleonic years*, Princeton, Princeton University Press, 2004.

7. Camille Richard, *Le Comité de Salut Public et les fabrications de guerre sous la Terreur*, Poitiers: Rieder, 1921

8. *Archives parlementaires*, t. 93, p. 147-153.

badly damaged. There were also hundreds of casualties. The compensation lists reported that 536 people had been killed and 827 injured. It should also be taken into account that there were, without any doubt, at least ten unidentified corpses or so, and that a between one and two hundred victims did not receive any compensation for multiple reasons. The aid to victims revealed the State's role as a precursor, promoting the right to compensation. After quickly and generously distributing emergency aid, Revolutionary administrations took the time to build files for lifetime annuities, even if this meant being strict in awarding settlements and having to face many appeals notably due to the lengthy process. By asserting a legal framework, the handling of the consequences of the explosion was a landmark for aid and compensation policies for injured workers and widows, and this experience foreshadowed the protective State. A localised one-off event at the dawn of industrialisation, the gunpowder plant explosion nevertheless suggested the tensions surrounding the compromises of the industrial society in the nineteenth century.⁹

Ignoring the accident in risk legislation: the birth of the 1810 decree

Although the French State reacted to compensate injured people and widows, the influence of such an exceptional catastrophe on risk legislation was insignificant. In the immediate aftermath of the conflagration, a renewed interest in prevention and safety rules could be noted: the National Convention decided to divide the gunpowder production between several factories that lay in isolated sites several kilometres around Paris.¹⁰ However, it was mostly because war production gradually disappeared during the Thermidorian Reaction that industrial accidents ceased to happen in Paris.

On a more fundamental level, the question of responsibility was not really tackled, even if it would have been a necessary first step in order to remake risk legislation. There was no official investigation aiming at establishing responsibilities and Chaptal was left in peace. It was only three years later that the Académie des Sciences discussed the causes of the accident following a report by Cadet de Vaux. Under the Ancien Régime, he had been the health inspector for Paris, one of the official pharmacists of the Parisian administration from the 1770's to the 1790's. He was close to all the great scientists that had played a part in the war mobilisation under the Convention and in the industrialisation of Paris. He therefore said that the accident had been caused by the concentration of workers, who were potentially ignorant of the dangers. His conclusions were taken up by the Académie.¹¹

The people who were responsible for that exceptional production were exempted quite speedily and with much flimsiness by the scientists who transferred causality to fate and to

9. Claire Barillé, Thomas Le Roux, Marie Thébaud-Sorger, « Grenelle, 1794. Secourir, indemniser et soigner les victimes d'une catastrophe industrielle à l'heure révolutionnaire », *Le Mouvement Social*, vol. 249, n° 4, 2014, p. 41-71.

10. Camille Richard, *Le Comité de Salut Public*, *op. cit.*, p. 560-574.

11. Thomas Le Roux, « Accidents industriels... », *op. cit.*



Jean-Antoine Chaptal (1756-1832). Painting by Gabriel Lemonnier, early nineteenth century.

the workers' carelessness. According to Chaptal, who had advocated the adoption of the new production processes, all precautions had been taken. In his memoirs, which were written much later, and in a passage which was mostly meant to exonerate himself from any responsibility, he accused the Committee of Public Safety of "thoughtlessness" as they had dangerously increased the rhythm of production.¹² Actually, there was a conjunction of circumstances that facilitated the accident: the concentration of dangerous materials on a

12. Antoine Chaptal, « La vie et l'œuvre de Chaptal. Mémoires personnels rédigés par lui-même de 1756 à 1804 », in *Mes souvenirs sur Napoléon*, Paris, Plon, 1893, p. 45-46 and 48.

singular site, the adoption of quick production processes, the absence of elementary safety measures, the hastiness with which the premises had been built, the intensification of the production, and we are not even mentioning what was at stake in the factory on the political and military level.

The explosion had no influence on the regulation about industrial hazards. The accident was completely ignored in the reflections concerning safety rules in gunpowder factories at the end of the eighteenth century and in the nineteenth century. Risk management on an *ad hoc* basis was the norm. After the revolutionary moment, the old gunpowder manufactures were not reorganised and kept on working as they had done under the Ancien Régime. Grenelle was considered as something exceptional that did not concern the other factories. For instance, the manufacture of Essonnes was regularly inspected between 1802 and 1810 and safety devices were recommended, but there was never any allusion to Grenelle. Explosions happened, just like under the Ancien Régime. It was the case in the Rouen gunpowder manufacture in 1803. On that occasion, the explosion of Grenelle was not even mentioned. It was not considered as a traumatic memory, nor as something that could serve to identify hazards, nor as a myth that could be mobilised to initiate reforms.

The elaboration of the rules on unhealthy and hazardous industrial premises was in fact completely detached from the powder mill explosions.¹³ It resulted from a medium-term process that was twofold: the disappearance of the rules organising the economy of the Ancien Régime during the revolutionary episode was linked to the new industrialisation of the capital, of Rouen and of Marseille, where major chemical factories were built under the Directory and the Consulate. In Paris, in the early nineteenth century, about ten nitric acid workshops were installed *intra muros*, whereas fifteen manufactures or so, producing chlorine, sulphuric acid, ammonium or soda, were established in the periphery of the city and polluted their neighbourhoods with their corrosive and odorous vapours.¹⁴

One particular factory can be studied, Chaptal's sulphuric acid factory, which was established at the place known as Les Ternes, just outside Paris, in 1798. Indeed, under the Consulate, the tensions about the law of nuisance revolved around that particular manufacture. Chaptal, who had been in charge of the Grenelle gunpowder factory, was above all the new minister of the Interior. In 1803, as he had been brought before justice of the peace for having deteriorated the vegetation in the neighbourhood of his factory, he used his minister authority to stop the trial. However, in that case as in similar trials for industrial pollution, the principle of free enterprise was sufficiently threatened – as the neighbours complained about nuisance – for the minister of the Interior who had just followed Chaptal to commission the Académie des Sciences to write a report “on the factories exhaling an

13. Thomas Le Roux, *Le laboratoire des pollutions industrielles, Paris, 1770-1830*, Paris, Albin Michel, 2011.

14. John Graham Smith, *The origins and early development of the heavy chemical industry in France*, Oxford, Clarendon Press, 1979.

unpleasant smell, and on the dangers they can present to public health” in November 1804. But the people commissioned were Guyton de Morveau and Chaptal himself. Their report unsurprisingly turned the argument back on the local authorities and blamed them for their arbitrariness and for being an inconvenience to the arts and crafts, notably to chemical industry. It attacked the daily routine of persecutions by the neighbours and asked the State for industrial protection. On a more specific level, there was no allusion to the Grenelle accident in the report and the gunpowder factories were almost not mentioned: the two academicians just considered that they belonged to the least polluting type of industries among those that should be monitored by the administration. The report, which was very favourably disposed towards industries, was not immediately followed by regulatory measures. Rather, those measures were being invented in the Police prefecture of Paris. The prefect created a Health Council in 1802, and, in 1806, he issued an edict forbidding the establishment of any dangerous or unhealthy industry or craftsman’s workshop without prior authorisation by the administration.

Industrial nuisance became a national issue in 1809-1810, when the artificial soda industry quickly developed. It was the most polluting industrial production that had been known till then. Indeed, one ton of hydrochloric acid was discharged in the atmosphere for every four tons of soda produced. Like in 1804, the minister of the Interior commissioned the Académie des Sciences to write a report, written once again by Chaptal and Guyton de Morveau, with the help of Deyeux, Fourcroy and Vauquelin, who were chemists and pharmacists. The new report recommended that the unhealthy or inconvenient workshops and factories should be classified into three groups according to their environmental nuisance potential. It also recommended that those establishments should get an administrative authorisation before starting working. A few months later, the State gave those principles a legal existence thanks to the imperial decree of 15 October 1810.

Conclusion

It is therefore wrong to consider the 1810 decree as an answer to the explosion of the Grenelle gunpowder factory. Too many people at the head of the State, among whom Chaptal, who originated the 1810 decree, could have been held responsible for that accident. As it was not in his interest to ask new questions about the causes of the accident, he was mostly preoccupied with the fate of the burgeoning chemical industry. It was under his ministry, and afterwards thanks to his influence and his scientist friends’ that the 1810 decree was written, mostly because the first massive industrial nuisances appeared.

That observation does not mean that the explosion of the Grenelle factory was insignificant. Today, it is still the deadliest industrial accident in France (if we except the explosion of the Courrières mine that killed 1099 people in 1906). Besides, it is a symbol of the birth of a regime of risk expertise in which scientists, and in particular the chemists who participated in the chemical revolution initiated by Lavoisier, ruled. They departed from risk ex-

expertise as understood by local authorities and the police, which had not changed much in centuries and which aimed above all at taking preventive action against all industrial or artisanal risks. Thanks to the 1810 decree, the majority of industrial hazards and pollutions were accepted. Indeed, the conditions it imposed on industries allowed them to determine their own schedules most of the time.

However, the debates about the coexistence of industries and domestic dwellings were rekindled and lasted for a long decade between 1815 and 1825. Industrialisation made the labouring cities more dangerous, which was officially acknowledged by the State since the term of “dangerous” industrial premises appeared for the first time in 1825 when the classification created by the 1810 decree was revised. The explosion of the gunpowder factory of Grenelle can be considered as the first symptom of the civilisation of technological hazards, but it was not until the Restoration that the arguments for a public debate about the existence of major industrial hazards in cities appeared. The principal dangers in Paris were the explosion hazards of gasworks, steam engines and of the workshops producing all types of gunpowder and munitions. The metamorphosis of industrial cities followed a pattern similar to that of a three-act play with tragic overtones: first the emergence, then the legitimisation, finally the acculturation. Between 1817 and 1822, explosions, accidents and fears concurred to question the validity of developing those new technologies within cities. Then, in a few years, with the help of hygienist arguments and discourses that were supported by science and political economy, the authorities legitimated the necessary presence of industries within cities. Finally, after 1825, city-dwellers had to learn to live with those risks, which were imperfectly controlled by preventive measures¹⁵. When those controversies finally ended, industrial hazards had really conquered their place in urban centres, and that could only be made possible by a political justification that used the arguments provided by political economy and scientific expertise.

15. Thomas Le Roux, *Le laboratoire des pollutions industrielles*, *op. cit.*, p. 423-438 ; Thomas Le Roux, « Governing the toxics and the pollutants. France, Great Britain, 1750-1850 », *Endeavour*, vol. 40, n° 2, 2016, p. 70-81 ; Thomas Le Roux, « Chemistry and Industrial and Environmental Governance in France, 1770-1830 », *History of Science*, vol. 54, n° 2, 2016, p. 195-222 ; Jean-Baptiste Fressoz, *L'apocalypse joyeuse. Une histoire du risque technologique*, Paris, Le Seuil, 2012.