Comparison of environmental performance of waste-to-energy (WTE) plants in France with Denmark and Germany

Yohann Benhamou

Advisor: Professor Nickolas J. Themelis

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EXECUTIVE SUMMARY

The MSW combusted in the operating 127 WTE plants of France amounts to 16.1 million tons. All of these plants meet the particulate matter, mercury,dioxins, and other emission standards of E.U. and France, with the exception of NOx where the average WTE emission in 2006 was about 25% higher than the E.U. standard of 200 mg NOx/Nm3 of stack gas.

Thei study concentrated on dioxin emissions that are the most difficultA plant-by-plant analysis of the 127 French WTE plants showed that in 2006 only six plants exceeded the E.U. standard for dioxin emissions from WTE (0.1 ng TEQ/Nm3). However, as of 2009, all operating WTE plants in France met this standard and the average of their dioxin emissions was less than 50% of the French standard, that is less than 0.05 ng TEQ/Nm3. For the 16 million tons of MSW combusted in France annually, the corresponding total amount of dioxins emitted by all French WTE plants in one year is calculated to be only 4 grams TEQ.

This study showed that there was very poor communication to the public and access to information with regard to WTE emissions, in France. This has led to an erroneous perception of "incineration" by the public and the French intelligentsia, as witnessed by the conclusions of the 2007 Grenelle de l'Environement that stated: *"The place of incineration in the politics of waste management in France has been a source of long debates but there are still widely divergent positions. A significant decrease in the quantities incinerated and stored is desired by some groups, this decrease should be reflected, for some in a halt in new incineration projects."* This is in contrast to the full acceptance of waste-to-energy in Denmark, Germany, the Netherlands, and other European nations.

As in other highly developed nations, in the last twenty years the French WTE facilities have adopted advanced air pollution cotrol systems and over one hundred incinerators that could not be retrofitted were closed. Prior to 1985, the health risks associated with dioxin emissions were not known and the dioxin emissions were a thousand times higher than at at the present time.

The author found that it is extremely difficult for citizens to get access to current information about emissions of WTE plants. This is is the main reason that incineration has still a bad reputation in France, even though this study demonstrated that the French WTEs meet the same standards as other European countries, such as Denmark and Germany.

November 24, 2010 Addendum to thesis by Prof. N.J. Themelis

The following Table is an updated edition of data presented in this thesis by J. Benamou, using the data provided in the "master" spreadsheet of the Ministry of Ecologie of France that lists over 60,000 industrial dioxin emissions between 2002 and 2008 (full reference is shown in Benhamou thesis. The summary of this Table shows that in 2008 the average dioxin emission of all WTE plants in France was 0.013 nanograms per cubic meter of stack gas, i.e. 13% of the French and E.U. allowable standard for dioxin emissions. The total WTE capacity (at an assumed 90% overall plant availability) was about 15.3 million tons. The actual tonnage processed in French WTE facilties in 2008 was about 12.5 million tons. At an assumed process gas generation of 5000 Nm3 per ton MSW, the total dioxin emission of the French WTE industry in 2008 amounted to 1 gram TEQ.

Addendum: List of French WTE plants, capacities, 2008 dioxin emissions (N.J. Themelis, November 24, 2010)

Plant NAME, location (start-up year of each unit)	Capacity tons/y	Dioxins, ng TEQ/Nm^3
ANGERS GEVAL, Sainte Gemmes s/Loire (1974, 1974, 1974)	118,000	0.005
ANGOULEME, Charentes, Angoulême (1986)	33,000	0.000
ANNECY, Chavanod (1986, 1994, 2001)	128,000	0.004
ANTIBES, Antibes, Alpes Maritimes (1970, 1970)	150,000	0.027
ARCANTE, Blois (2000, 2000)	87,000	0.010
ARGENTEUIL, Argenteuil, IdF (1975, 1975, 1998, 2006)	307,000	0.014
AUREADE, Chalons sur Marne (2006)	99,000	0.004
AVIGNON, Avignon, Vedène (1995, 1995, 1996)	142,000	0.032
BAYET RONAVAL, Bayet (1982, 1988)	71,000	0.007
BELFORT BOUROGNE, Belfort (2002, 2002)	98,000	0.009
BELLEGARDE, Bellegarde s/Valserine (1998, 1998)	126,000	0.140
BENESSE-MAREMNE, Benesse-M., Landes (1972, 1985)	59,000	0.006
BESANCON SNC BIVAL, Besançon (1976, 2002)	55,000	0.002
BESSIERES, Bessières (2000, 2000)	180,000	0.016
BORDEAUX, Bègles (1998, 1998, 1998)	260,000	0.008
BORN, Pontenx-les-Forges (1997)	42,000	0.001
BOURG D'OISANS RONAVAL, Bourg d'oisans, Livet (1998)	20,000	0.002
BOURG SAINT MAURICE CORREZE, Bellentre (1991)	26,000	0.002
BOURGOIN JALLIEU RONAVAL, Bourgoin J. (1986,1995)	87,000	0.014
BREST GEVAL, Brest (1988, 1988)	142,000	0.001
BRIEC, Briec de l'Odet (1996, 1996)	32,000	0.008
BRIVE, Saint-Pantaléon-de-Larche (1973, 1973, 1973)	83,000	0.007
CAEN, Colombelles (1971, 1972)	126,000	0.006
CALCE, Usine de Perpignan, Calce (2003, 2003)	171,000	0.006
CARHAIX, Carhaix (1994)	32,000	0.000
CARRIERES s/POISSY, Carrieres sous-Poissy (1998, 1998)	118,000	0.006
CARRIERES s/SEINE, Carrières s/Seine, IdF (1977, 1988)	158,000	0.008
CENON, Cenon, Gironde (1984, 1984)	126,000	0.002
CERGY CGECP, Cergy Pontoise (1995, 1995)	166,000	0.008
CHAMBÉRY, Chambéry (1977, 1977, 1996)	114,000	0.002
CHARTRES, Mainvilliers (1999, 1999)	118,000	0.014
CHATEAUDUN, Chaumont (1976)	27,000	0.006
CHAUMONT SHMVD, Chaumont (1998, 1998)	79,000	0.002
CHEDDE-PASSY, Passy (1995)	59,130	0.001
CHINON, INOVA, Saint-Benoît-La-Forêt (1983)	22,000	0.001
CLUSES, Cluses Marignier (1991)	39,000	0.000
COLMAR, Colmar (1988, 1988)	95,000	0.010
CONCARNEAU GEVAL, Concarneau (1989, 1989)	61,495	0.005
DIEPPE, Rouxmesnil-Bouteilles (1971, 1971)	29,000	0.008
DIJON UICA, Dijon (1974, 1974)	181,000	0.002
DOUCHY, Douchy les Mines, Nord (1977, 1977)	88,000	0.002
ESIANE, Villers-Saint-Paul, Ile de France (2004, 2004)	173,448	0.003
EVREUX, sud de l'Eure, Guichainville (2003, 2003)	88,000	0.004
GIEN, Gien, Loiret (1999, 1999)	79,000	0.006
GRENOBLE, Grenoble, Tronche (1974, 1974, 1996)	195,000	0.025

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HAGUENAU, Schweighouse s/Moder (1990, 1990)	79,000	0.005
HALLUIN, Halluin (2000, 2000, 2000)	343,000	0.031
HENIN-BEAUMONT, Henin-Beaumont (1972, 1974)	95,000	0.007
ISSEANE, Issy-les-Moulineaux, Paris (2008, 2008)	481,000	0.062
IVRY, Ivry sur Seine, Val de Marne, IdF (1969, 1969)	788,000	0.063
LA ROCHELLE SETRAD, Rochelle (1988, 1988)	63,000	0.002
LABEUVRIÈRE, Labeuvrière, Pas de Calais (1979, 1979, 1979)	158,000	0.002
LAGNY, St Thibault des Vignes (1985, 1995)	158,000	0.010
LAMBALLE, Planguenoual (1993)	47,000	0.005
LASSE, Lasse. Salamandre (2004)	99,000	0.001
LE MANS SEC, Le Mans (1973, 1991, 2003)	229,000	0.005
LIMOGES, Limoges (1989, 1989, 1992)	118,000	0.020
LONS-LE-SAUNIER, Lons-le-Saunier (1994)	39,000	0.011
LUNEL, Lunel-Viel (1999, 1999)	126,000	0.003
LYON NORD, Rillieux (1989, 1989)	189,000	0.010
LYON SUD, Lyon (1989, 1989, 1989)	284,000	0.005
MANTES, Guerville (1997, 1997, 1997)	95,000	0.004
MARTINIQUAISE, Fort de France (2002)	110,000	0.009
MASSY, Massy (1985, 1986)	87,000	0.011
MAUBEUGE, Maubeuge (2001, 2001)	87,000	0.001
MELUN, Vaux-le-Penil (2003, 2003)	126,000	0.010
MESSANGES, Messanges (1976)	24,000	0.001
METZ, Metz (2001, 2001)	126,000	0.004
MONTARGIS, Amilly (1969)	22,000	0.003
MONTAUBAN, Montauban (1986)	39,000	0.002
MONTERAU, Monterau Fault Yonne (1973)	25,000	0.004
Monthyon, Monthyon (1998, 1998, 1998)	142,000	0.106
MONTVALOR, Montbéliard (1988, 1988)	63,000	0.005
Mourenx, Mourenx (1990)	16,000	0.006
MULHOUSE, Sausheim, Nord-es, Haut Rin (1999, 1999)	166,000	0.099
NANCY ENERGIE, Ludres (1995, 1995)	126,000	0.012
NANTES ARC EN CIEL, Nantes (1987, 1987)	130,000	0.007
NANTES, Couëron (1994, 1994)	89,000	0.019
NEVERS SONIRVAL, Nevers, Fourchambault (2002)	47,000	0.005
NICE SONITHERM, Nice (1977, 1977, 1982, 1998)	426,000	0.014
NIMES EVOLIA, Nîmes (2004)	110,000	0.004
NOYELLES SOUS LENS, Noyelles s. L., Pas de Calais (1973)	106,000	0.030
PAILLE, Surgères (1981)	28,000	0.004
PAU, Sud-Ouest, Lescar, Pyrenees Atlantique (1987, 1990)	87,000	0.008
PITHIVIERS, Pithiviers (1985)	26,000	0.008
PLOUHARNEL, Plouharnel (1971)	33,000	0.004
PLUZUNET VEOLIA, Pluzunet (1997)	55,000	0.002
POITIERS SETRAD, Poitiers (1984, 1984)	63,000	0.006
PONTARLIER, Pontarlier (1989)	39,000	0.001
PONTCHARRA RONAVAL, Pontcharra (1977)	22,000	0.002
PONTIVY, Pontivy (1990)	32,000	0.000

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PONTMAIN, Pontmain (1983, 2003)	55,000	0.001
RAMBERVILLIERS SOVVAD, Rambervillers (1983, 1983, 2002)	102,000	0.099
RAMBOUILLET, Ouarville (2000, 2000)	126,000	0.004
REIMS REMIVAL, Reims (1989, 1989)	102,000	0.015
RENNES SOBREC, Rennes (1968, 1968, 1996)	142,000	0.006
ROCHEFORT SETRAD, Echillais (1990)	39,000	0.001
ROSIER D'EGLETONS, Rosier d'Egletons (1997)	42,000	0.002
ROUEN SNV VESTA, Grand Quevilly (2000, 2000, 2000)	343,000	0.072
RUNGIS SOTRIS, Rungis (1985, 1985)	134,028	0.012
SAINT OUEN, Saint Ouen (1990, 1990, 1990)	662,000	0.095
SAINT-JEAN-D. F., Saint-Jean-d. F. (1970, 1975)	126,000	0.004
SARAN, Saran (1995, 1995)	110,000	0.005
SARCELLES, Sarcelles (1978, 1978)	158,000	0.010
SENS, Sens (1988)	24,000	0.006
SETE SETOM, Sète (1992)	44,000	0.005
ST PIERRE D'OLÉRON, St Pierre d'oléron (1974, 1974)	79,000	0.009
STRASBOURG, Strasbourg (1975, 1975, 1975, 1975)	356,000	0.018
SYTEVOM, Noidans-le-Ferroux (2007)	79,000	0.001
TADEN, Dinan (1998, 1998)	126,000	0.012
THIVERVAL GRIGON, Thiverval-Grignon (1974, 1974, 1993)	275,000	0.050
THONON LES BAINS, Thonon les Bains (1988)	39,000	0.000
TIGNES RONAVAL, Tignes (1985)	11,826	0.001
TOULON, Toulon (1983, 1984, 1984)	300,000	0.010
TOULOUSE SETMI, Toulouse Mirail (1969, 1969, 1975, 1997)	315,000	0.002
TRONVILLE EN BARROIS, Tronville en Barrois (1983)	32,000	0.004
VALENCIENNES, Saint Saulve (1977, 1977, 1977)	130,000	0.003
VAULX, Vaux-le-Penil (2003, 2003)	126,000	0.007
VERNOU-EN-SOLOGNE, Vernou-en-Sologne (1986)	18,000	0.001
VERT LE GRAND, Vert le Grand (1999, 1999)	221,000	0.016
VILLEFRANCE, Villefranche sur Saône (1984, 2002)	87,000	0.013
VILLEJUST, Villejust. Ile de France (1972, 1984)	110,000	0.004
VITRÉ, Vitré (1988)	32,000	0.002
Total WTE capacity (at 90% plant availabilility):	**15,267,927**	**0.013**
Number of plants listed: 128		
E.U. and French standard as of 2002: 0.1 ng TEQ/ Nm3		
Average dioxin emission of all WTE: 0.013 ng TEQ/Nm3		
2008 Dioxin emissions of all French WTE plants, grams TEQ: 1.01 gram TEQ		

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I. Introduction

Fifty million tons of municipal solid waste (MSW) were generated in 2006 in France according to the **ADEME**, the French Environmental and Energy Agency. The annual production of MSW has been stabilized in the past five years. However, a the population of France continues to grow, there will be more and more waste produced. According to Eurostat statistics, 18% of the French MDSW is recycled, 15% is composted, 32% is incinerated and 36% is landfilled. In 1993, there were about 300 incinerators *(WTE plant)* in France, some of which had a very small capacity. Today, there are 128 incinerators operating. This includes 110 plants with energy production and 18 without energy production.

Incinerators, called Waste-to-Energy (WTE) in the U.S. and E.U. reduce the volume of municipal solid waste by about 90%, by burning it. Also, electrical energy is generated by the combustion of this waste and, in addition, thermal energy can be recovered and used for district heating. Incinerators can also burn dangerous waste, such as chemical products, that otherwise may pollute the soil in which they are landfilled.

Despite the fact that one thrid of the French MSW is processed in incinerators,t there is a fear about WTE technology in France. This is expressed clearly in the *Grenelle Environnement*, the French political guideline for environmental and energy policy that was written in 2007 (*Grenelle Environnement's website*):

"The place of incineration in the politics of waste management in France has been a source of long debates but there are still widely divergent positions. A significant decrease in the quantities incinerated and stored is desired by some groups, this decrease should be reflected, for some in a halt in new incineration projects."

The above excerpt clearly shows that the French opinion about incinerators is largely divergent and that some people are strictly opposed to the construction of new incinerators. There is no precise measure that deals with further development of waste to energy plants because the community is afraid of them.(as if they were scaring the French community). . There are several possible reasons for the poor opinion of WTE in France. First, there is a lack of adequate communication from either the WTE industry or government agencies regarding WTE technology and practices to the French population. Therefore, incineration appears as something hazardous, scary and unnecessary. Second, there may be some WTE plants that do not comply with the EU emission standards, especially in the case of small plants that would require a relatively large amount of money for their Air Pollution Control (APC) systems to be retrofitted to comply with European and also French regulations. In the past, there was a major concern about health effects of WTE, due to to a high incidence of cancers next to some incinerators that were emitting high concentrations of pollutants. An article published by ADEME in 2000 (*http://www.ademe.fr/htdocs/publications/lettre/63/63technique.htm*) reported that it would cost 700 million Francs (120 million euros approximately) to modernize the Air Pollution Control (APC) system of MSW incinerators of a capacity of more than 150 tons per day. Therefore, it is possible that many incinerators have not been upgraded to modern emission control standards.

The main objective of this study is to collect precise and up-to-date data about all the operating WTE plants in France and to determine whether some of them are still not complying with the European standards in terms of emissions. It is possible that the French WTE industry may still include some small plants that have not retrofitted their

control systems to E.U standards and therefore have relatively high emissions. This may be a reason why the French have such a bad impression of WTE plants.

In view of the positive attitude of the Danish and German public towards WTE, this thesis also compares French environmental monitoring and reporting WTE emissions with the corresponding practice in Denmark and Germany.

II. The situation of Waste management in France in 2010

This section, describes how the Waste to Energy plants are organized in France. It discusses, the governmental entities that h are monitoring WTE emisions, the French regulations regarding allowable emission concentrations of various contaminants in the WTE stack gas, and other information about this sector.

II. 1. Figures about MSW generation and disposition in France

According to the Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME), the French Environmental and Energy Agency, *868 millions* tons of all kinds of wastes (industrial, agricultural, etc.) were generated during the year 2006 (*Les Déchets en chiffre, ADEME Edition 2009*). This amount included *50 million* tons of municipal solid waste. The amount of MSW produced solely by households was estimated to 20 million tons (about 354 kg per capita in 2008 *Source :* *http://europa.eu/rapid/pressReleasesAction.do?reference=STAT/10/43&format=HTML&aged=0&language=EN&guiLanguage=en*). The rest accounted for waste from local communities, bulky waste, and the waste gathered with MSW. Figure 1 shows a stabilization in the annual generation of household waste per inhabitant around the years 2000. In 2008, the amount of MSW generated in Frnace was equal to 543 kg per capita.

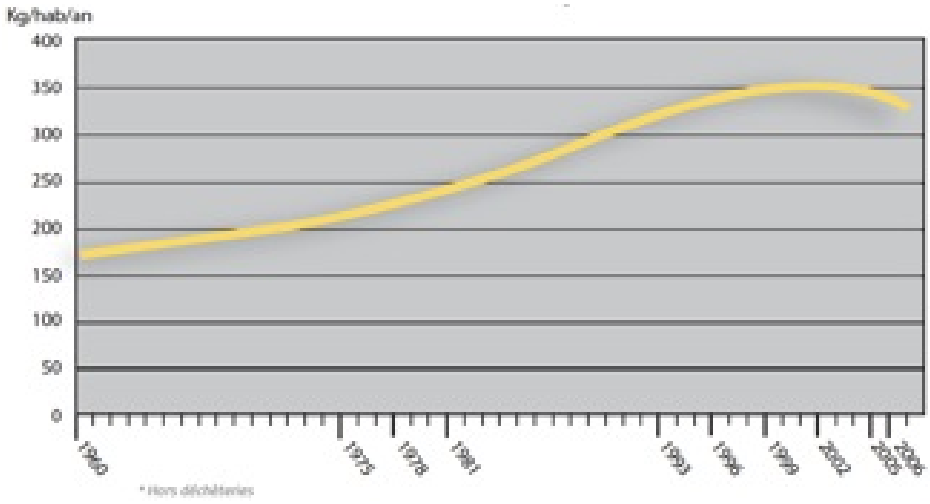


Figure 1. Trend in generation of household waste in France
Source: Ademe (Les Déchets en chiffre, ADEME Edition 2009)

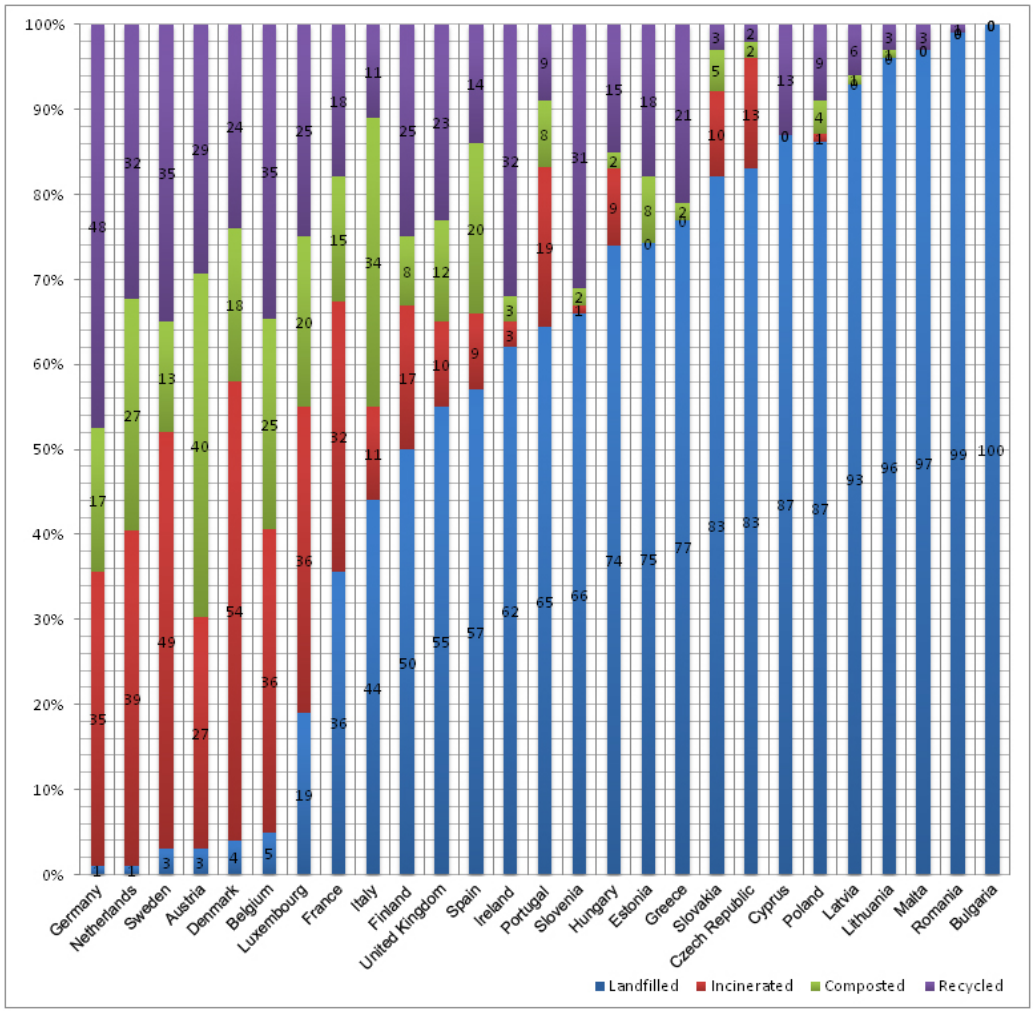


Figure 2. Disposition of MSW in the 27 nations of E.U. in 2007
Source : EUROSTAT)

Figure 2 shows the four principal methods used for disposing of municipal solid waste among the 27 European states in 2008. The blue color represents the percentage that is *landfilled*. The green represents the amount that is composted, the red represents the amount incinerated and the purple the amount recycled.

This graph shows that northern countries, such as Denmark, Sweden, the Netherlands, and Germany, are the most advanced in terms of environmental management of municipal solid waste; they landfill less than 5% of the total MSW generated. Germany is the best in terms of recycling policy with a recycling percentage over 40%.

France is doing better than many other E.U. nations but, in 2008, it still landfilled 36% of its MSW, incinerated 32%, composted 15% and recycled 18%.

Table 1 shows the data used in Figure 2. It has ranked the different countries from the most «environmentally friendly», in terms of waste management practice, to the least.

Table 1. Disposition of MSW in the 27 nations of E.U. in 2007 (S*ource : EUROSTAT)*

	Landfilled	Incinerated	Composted	Recycled	Municipal waste generated, kg per person
EU27	**40**	**20**	**17**	**23**	**524**
Germany	1	35	17	48	581
Netherlands	1	39	27	32	622
Sweden	3	49	13	35	515
Austria	3	27	40	29	601
Denmark	4	54	18	24	802
Belgium	5	36	25	35	493
Luxembourg	19	36	20	25	701
France	36	32	15	18	543
Italy	44	11	34	11	561
Finland	50	17	8	25	522
United Kingdom	55	10	12	23	565
Spain	57	9	20	14	575
Ireland	62	3	3	32	733
Portugal	65	19	8	9	477
Slovenia	66	1	2	31	459
Hungary	74	9	2	15	453
Estonia	75	0	8	18	515
Greece	77	0	2	21	453
Slovakia	83	10	5	3	328
Czech Republic	83	13	2	2	306
Cyprus	87	0	0	13	770
Poland	87	1	4	9	320
Latvia	93	0	1	6	331
Lithuania	96	0	1	3	407
Malta	97	0	0	3	696
Romania	99	0	0	1	382
Bulgaria	100	0	0	0	467

II. 2. Policy and Legislation about waste management in France

II.2.1 « Le Grenelle Environnement »

« Le Grenelle Environnement » consists of series of political meetings that were organized in France in October 2007 where influential people met to to disucss and decidem onn French long-term policies regarding environmental issues and sustainable development. The « Grenelle » was announced on May 18th 2007 by Alain Juppé, the French minister of Ecology at that time. This particular « Grenelle » brought togetherd politicians, professional organizations, and NGOs to consider how to deal with present and future challenges in terms of environmental issues.

With regard to the subject of this thesis, it is interesting to review the concrete measures taken with regard to solid waste management in France, as stated explicitly in the published results of the« Grenelle ». (Grenelle Environnement's website) There was a report describing conclusions reached as to what kind of measures were proposed in terms of waste management. The first main goal discussed was the prevention of waste: «*Reducing the waste produced and developing recycling* **».** The second goal was to ensure a *« Clear reduction in the health and environmental impacts of waste management*

policies ». This was to be achieved by prioritizing the evaluation of the environmental and health impacts of waste management policies (i.e. the waste management hierarchy). The third goal was to *«raise awareness and (provide) information to the French citizens »*. The author will return later to this third point as it is a major reason why incineration has had such a bad reputation in France over the past years.

The fourth and final goal dealt with the position of incineration. What emrged from the « Grenelle » was the highly ambiguous statement that *«there are divergent opinions on that matter and no concrete objective has been fixed by the Grenelle »*. The Grenelle noted that the *"place of incineration in the politics of waste management in France has been a source of long debates but there are still widely divergent positions. A significant decrease in the quantities incinerated and stored is desired by some groups, this decrease would be reflected for some in a halt in new incineration projects."*

It can be seen that the "Grenelle Environnement" focused on prevention and recycling and did nolt take any clear position on incineration/WTE, despite the fact that 34% of the French MSW is combusted in 110 WTE and 18 incinerator plants.

Furthermore, , the "Grenelle" provided numerical targets for increasing recycling and decreasing incineration.

- Reducing the amount of household waste produced by 7% during the next 5 years.
- Increasing recycling to a rate of 35% in 2012 and 45% in 2015 for household garbage, as compared with 24% in 2004.
- Reducing the amount of waste going to incineration or landfilling by an average of about 15% before 2012. This measure gives time to the concerned actors to deal with their waste management policies.

In summary, the Grenelle, contrary to what is happening in the most advanced EU nations (Table 1), did not indicate that WTE is an environmentallypreferable technology to landfilling. In fact, it treated both WTE and landfilling as undesirable technologies. This left a vacuum in attaining sustainable waste management in France, since international experience has shown that it is impossible to reduce landfilling appreciably, in the absence of WTE (Table 1, Figure 2).

It is interesting to note that despite the negative image imparted by « Grenelle » on WTE, one of the largest and most important WTEs in the world, the Isseane plant in Paris, started operations in 2008 in the heart of the most visited city and five kilometers from the Eiffel Tower.

II.2.2 The official French reglementation regulating WTE emissions

The official text regulating the WTE plants' emissions was issued bythe French Ministry of Ecology on March 17, 2005 (Ineris website). It defines the requirements and emission standards that must be met by WTE plants. These standards are presented in another section of trhis report.

II.3 Identification of governmental, non-governmental and academic organizations concerned with waste management

In this section, we will describe government agencies concerned with waste management in France.

Figure 3 on the next page explains schematically how are the emissions monitored :

France is divided into 22 Regions. Each WTE plant reports annually its emissions to a DREAL (Direction Régionale de l'Environnement, de l'Aménagement et du logement) which represents the French Ministry of Ecology at at the regional level.

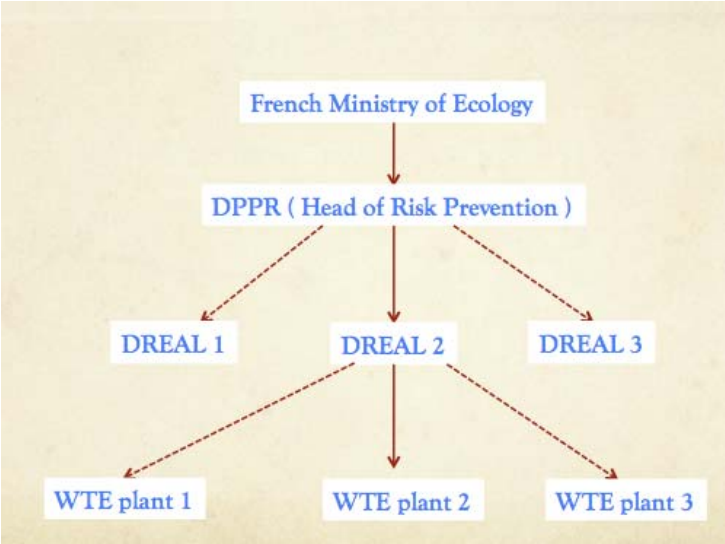


Figure 3, French WTE's management organizational figure
Source :French Ministry of Ecology)

Each DREAL then reports the emissions of all the WTE plants in its region to the **DPPR** (Direction de la Prévention des Pollutions et des Risques), an agency that monitors and prevents every pollution risk associated to a given activity through the authority of the Ministry of Ecology.

The **IREP (**Registre Français des émissions polluantes) is supposed to publish all the declarations of emissions sent to the DREALs at a unique website. The E-PRTR (European Pollutant Release and Transfer Register) gathers the same kind of data on a European scale.

The **ADEME** (Agence de l'Environnement et de la Maîtrise de l'Energie) is a public institution placed under the authority of both the Ministry of Ecology and the Ministry of Education and Research. It is supposed to implement the public policies in the field of Environment, Energy, and Sustainable Development. This agency advises and provides its expertise to companies, citizens, cities or any other entites that need to improve their environmental performance. The ADEME also helps in financing various projects in the fields of waste management, soil preservation, energy efficiency, sustainable energies, air quality, and noise prévention. This agency had 930 employees in 2009 and its overall budget is 832 million euros.

The **INERIS** (Institut National de l'Environnement industriel et des Risques) is a public institution placed under the authority of the Ministry of Ecology. Its mission is to conduct

research and studies aiming to help preventing any risk that economic activities might induce. The organization had over 580 employees in 2009, including 336 engineers, researchers, and executives and its overall budget is 60 million euros.

The **SVDU** (Syndicat national du traitement et de la Valorisation des Déchets urbains et assimilés) rallies all the different players in the field of waste management in France. Its website gives information about the different WTE plants and about the technology in general.

II.4 Detailed description of the WTE plants in France

This section the operating WTE facilities in France and also what they currently achieve with regard to the principal emissions: Particulate Matter, SO_2, NO_x, Total Organic Compounds (TOC), CO, Mercury, and dioxins. In a later section, these results are compared with E.U. and French regulations, as well with the levels of emissions obtained by the WTE industries in Denmark and Germany.

II.4.1 French and EU directives in terms of emission standards

The French regulation for WTE emissions is is the official ordinance of the French Ministry of Ecology, issued on March 17th 2005 (Ineris Website). The European Directive on WTE emissions is the official document published by the European Parliament on December 28th 2000. The French and European Regulations have been fully harmonized over the past years.

II.4.2 WTE plants nominated for WTERT 2006 Award

Table 3 compares the emissions of ten WTE plants that were nominated for the WTERT 2006 Award for "one of the best WTEs in the world" to the E.U. standards: ASM in Brescia, SYSAV in Malmo, AEB in Amsterdam, Veolia SELCHP in London, Montenay in Montgomery, Covanta in Montgomery, Montenay in York, Spittelau in Vienna, and Umea in Sweden.

Table 2. Average emissions of the WTE plants that were nominated to the WTERT 2006 Award *Source : www.wtert.org)*

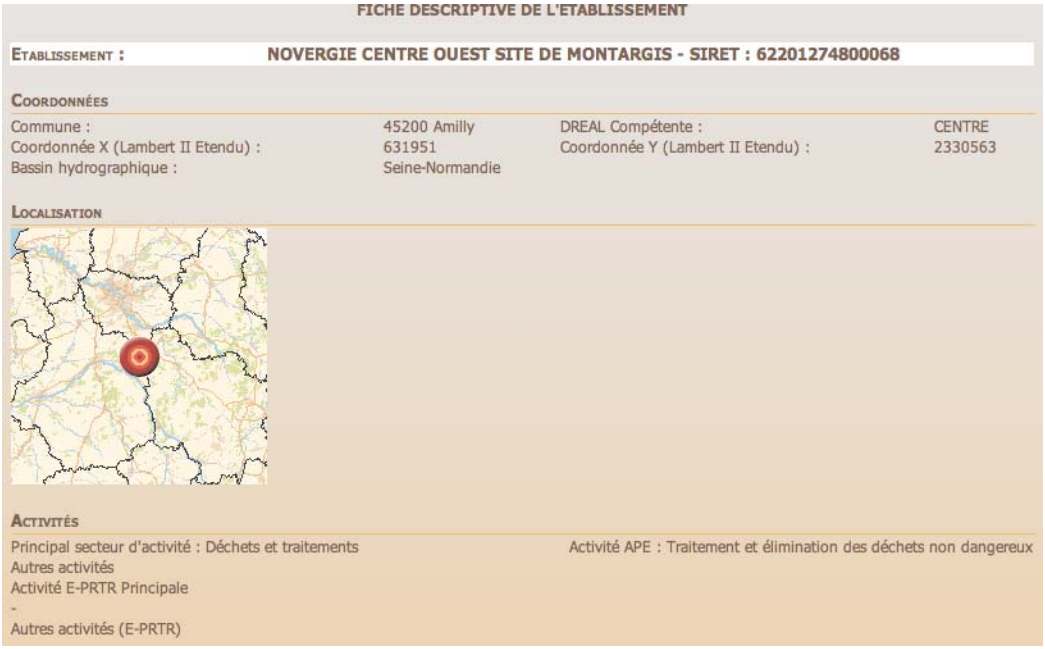
	Average of all ten WTEs	**EU Standard**	**Average as % of EU standard**
Emissions in mg/Nm^3			
Particulate matter	3.09	10	31%
SO_2	6.8	50	14%
NO_x	129	200	65%
TOC	1.02	10	10%
CO	21.9	50	44%
Mercury	0.01	0.05	15%
Dioxins (ng	0.02	0.1	24%

TEQ/Nm^3)			

II.4.3 Lack of trasparency of WTE emission data reported by government agencies

Before presenting and analysing the results obtained from the different WTE plants in France, it should be stressed that it was very difficult to obtain these numbers. Indeed, there is not a single website where the emissions can be easily found for every year and every operating WTE.

The French official website of the *IREP*, or *Registre français des émissions polluantes sur Internet*, which is expected to reference those emissions is not at all up to date. For example, if one seeks information on the emissions of the Novergie WTE plant located in Amilly, here is what is provided on the IREP website:



FICHE DESCRIPTIVE DE L'ETABLISSEMENT

ETABLISSEMENT : NOVERGIE CENTRE OUEST SITE DE MONTARGIS - SIRET : 62201274800068

COORDONNÉES

Commune :	45200 Amilly	DREAL Compétente :	CENTRE
Coordonnée X (Lambert II Etendu) :	631951	Coordonnée Y (Lambert II Etendu) :	2330563
Bassin hydrographique :	Seine-Normandie		

LOCALISATION

ACTIVITÉS

Principal secteur d'activité : Déchets et traitements
Activité APE : Traitement et élimination des déchets non dangereux
Autres activités
Activité E-PRTR Principale
-
Autres activités (E-PRTR)

Figure 3. Description of the Novergie WTE plant located in Amilly *Source : IREP*

EMISSIONS ET POLLUANTS - Afficher les 5 dernières années

Emissions dans l'Air

Polluant	Unité	2003	2004	2005	2006	2007	2008
Chlore	kg/an	303	n.d.	n.d.	n.d.	n.d.	n.d.
CO2 Total	t/an	n.d.	19 500	22 400	20 200	20 900	20 900
Dioxyde de carbone (CO2) d'origine biomasse	kg/an	n.d.	n.d.	n.d.	n.d.	11 900 000	n.d.
Fluor et ses composés (F)	kg/an	37	n.d.	n.d.	n.d.	n.d.	n.d.
Hexachlorocyclohexane (HCH)	kg/an	31 300	n.d.	n.d.	n.d.	n.d.	n.d.
Hydrochlorofluorocarbures (HCFC)	kg/an	n.d.	n.d.	n.d.	n.d.	27	22

Afficher les 5 dernières années

Quantité de déchets produits ou traités

Déchet (T/an)	2003	2004	2005	2006	2007	2008
Production de déchets dangereux	n.d.	n.d.	700	786	939	963
Production de déchets non dangereux	n.d.	n.d.	n.d.	n.d.	n.d.	4 100
Traitement de déchets non dangereux	n.d.	n.d.	20 500	28 400	28 883	28 090

Prélèvement en eau en m3/an

Milieu prélevé	2003	2007	2008
Eau de surface	0	0	0
Eau souterraine	0	0	0
Réseau	20 200	47 100	52 800

Figure 4. Emissions of the Novergie WTE plant located in Amilly *Source : IREP*

It can be seen that the only emissions reported are carbon dioxide and HCFC. Even those data are presented in terms of kilograms per year which makes it difficult to compater with the emission standards that are expressed as emission concentrations. This site is clearly inadequate to show whether the plant is complying with the French emission standards. The major polluttants such as particulate matter, SO_2, NO_x, total organic compounds, carbon monoxide, heavy metals, and dioxins are not even mentioned.

As norted earlier, each DREAL is supposed to collect and report the emissions from all the incinerators in its Region. However, no such information is provided in their web pages. A request for such information was sent to some DREAL but they replied that this information is available on the *IREP website*, which clearly is not the case. Some DREALs also proposed that we contact directly the plant in question to get their emission data which is is quite disturbing, since the DREAL is the governmental entity responsible for collecting and reporting the emissions from all the WTE plants in its region.

Therefore, there is clearly a lack of transparency in the governmental reporting of WTE emission data to the public. Further analysis of the emissions of various WTE plants, obtained during this study will provide a a precise insight of the WTE industry in France and will show that there is no reason for not publicizing fully the emissions of WTE facilities in France.

II.4.4 Results obtained from various WTE plants in France

The national waste processing capacity is about 16 million tons of MSWper year. A quick calculation shows that this figure is higher than Eurostat data since there are 63 million people living on French soil and produce 543 kg of MSW per capita. Assuming the Eurostat incineration rate in France of 32%, yields :

63,000,000*543*0.32*(1/1,000,000,000)=11 million tons

On the basis of a master file of 60,000 industrial emissions obtained from the Ministry of the Ecology, the author constructed the spreadsheet shown in Appendix 2 this Report. However, the emissions reported by the Ministry of Ecology, and also in the spreadsheet of Appendix 2, are expressed in kg/year. In order to be able to compare these values to the environmental standards that are expressed as concentrations, the author converted these units to ng/Nm^3 for dioxins, using the following conversion equation. Here is the detailed calculation :

It is assumed that each WTE in France emits 5000 Nm^3 per ton of MSW combusted. Therefore, the concentration of dioxins in the stack gas is :

$$\frac{\left(a \times 1{,}000 \frac{g}{kg} \times 10^9 \frac{ng}{g}\right)}{b \times 5{,}000 \frac{Nm^3}{ton}}$$

where a is the amount of dioxins emitted in kg/year and b is the annual plant's capacity in tons.

Table 3 shows an up-to-date list of all the units of all operating WTE plants in France as of April 2010.

Table 3. Location, year of construction, and capacity of all operating WTE units in France

Plant Name	Plant Location	Year of Construction	Plant Capacity (tons/hour)	Plant Capacity (tons/year)
Vernou-en-Sologne	Mère	1986	2.3	18216
Messanges	Messanges	1976	3	23760
Mourenx	Mourenx	1990	2	15840
Ivry 1st plant	Paris	1969	50	396000
Ivry 2nd plant	Paris	1969	50	396000
Saint Ouen	Saint Ouen	1990	28	221760
Saint Ouen	Saint Ouen	1990	28	221760
Saint Ouen	Saint Ouen	1990	28	221760
Antibes 1st plant	Antibes	1970	9.5	75240
Antibes 2nd plant	Antibes	1970	9.5	75240
Rouen 2 plant 1	Grand Quevilly	2000	14.5	114840
Rouen 2 plant 2	Grand Quevilly	2000	14.5	114840
Rouen 2 plant 3	Grand Quevilly	2000	14.5	114840
Halluin 1st plant	Halluin	2000	14.5	114840
Halluin 2nd plant	Halluin	2000	14.5	114840
Halluin 3rd plant	Halluin	2000	14.5	114840
Nîmes	Nîmes	2004	14	110880
Vert le Grand 1st plant	Vert le Grand	1999	14	110880
Vert le Grand 2nd plant	Vert le Grand	1999	14	110880
Aureade	La Veuve	2006	12.5	99000
Lasse Sivert	Lasse	2004	12.5	99000
Lyon Sud 1st plant	Lyon 7ème	1989	12	95040
Lyon Sud 2nd plant	Lyon 7ème	1989	12	95040

Lyon Sud 3rd plant	Lyon 7ème	1989	12	95040
Nice 1st plant	Nice	1977	12	95040
Nice 2nd plant	Nice	1977	12	95040
Nice 3rd plant	Nice	1982	12	95040
Nice 4th plant	Nice	1998	18	142560
Lyon Nord	Rilleux	1989	12	95040
Lyon Nord	Rilleux	1989	12	95040
Toulon 1st plant	Toulon	1984	12	95040
Toulon 2nd plant	Toulon	1984	12	95040
Toulon 3rd plant	Toulon	1983	14	110880
Mulhouse 1st plant	Sausheim	1999	10.5	83160
Mulhouse 2nd plant	Sausheim	1999	10.5	83160
Bessières	Bessières	2000	11.4	90288
Bessières	Bessières	2000	11.4	90288
Strasbourg Plant 1	Strasbourg	1975	11.3	89496
Strasbourg Plant 2	Strasbourg	1975	11.3	89496
Strasbourg Plant 3	Strasbourg	1975	11.3	89496
Strasbourg Plant 4	Strasbourg	1975	11.3	89496
Bordeaux 1st planst	Bègles	1998	11	87120
Bordeaux 2nd plant	Bègles	1998	11	87120
Bordeaux 3rd plant	Bègles	1998	11	87120
Esiane	Villers-Saint-Paul	2004	11	87120
Esiane	Villers-Saint-Paul	2004	11	87120
Cergy 1st plant	Cergy Pontoise	1995	10.5	83160
Cergy 2nd lpant	Cergy Pontoise	1995	10.5	83160
Carrières sur Seine 1st plant	Carrières sur Seine	1977	10	79200
Carrières sur Seine 2nd plant	Carrières sur Seine	1988	10	79200
Sarcelles 1st plant	Sarcelles	1978	10	79200
Sarcelles 2nd plant	Sarcelles	1978	10	79200
Arras	Arras	2004	3.3	26136
Thivernal-Grignon 1st plant	Thivernal-Grignon	1974	10.1	79992
Thivernal-Grignon 2nd plant	Thivernal-Grignon	1974	10.1	79992
Thivernal Grigon 3rd plant	Thivernal-Grignon	1993	14.7	116424
Toulouse 1st plant	Toulouse Mirail	1969	10	79200
Toulouse 2d plant	Toulouse Mirail	1969	8	63360
Toulouse 3rd plant	Toulouse Mirail	1975	8	63360
Toulouse 4th plant	Toulouse Mirail	1997	14	110880
Nantes (1st plant)	Nantes	1987	9.5	75240
Nantes (2nd plant)	Nantes	1987	9.5	75240
Dijon 1st plant	Dijon	1974	11.5	91080
Dijon 2nd plant	Dijon	1974	11.5	91080
Brest 1st plant	Brest	1988	9	71280
Brest 2nd plant	Brest	1988	9	71280
Rungis 1st plant	Rungis	1985	8.5	67320
Rungis 2nd plant	Rungis	1985	8.5	67320
Bellegarde sur Valserine 1s t plant		1998	8	63360
Bellegarde sur valserine 2nd plant	Bellegarde sur valserine	1998	8	63360
UIOM de Cenon 1st plant	Cenon	1984	8	63360
UIOM de Cenon 2nd	Cenon	1984	8	63360

plant				
Grenoble 1st plant	Grenoble	1974	8.25	65340
Grenoble 2nd plant	Grenoble	1974	8.25	65340
Grenoble 3rd plant	Grenoble	1996	8.25	65340
Nancy energie 1st plant	Ludres	1995	8	63360
Nancy energie 2nd plant	Ludres	1995	8	63360
Lunel 1st plant	Lunel-Viel	1999	8	63360
Lunel 2nd plant	Lunel-Viel	1999	8	63360
Rambouillet 1st plant	Ouarville	2000	8	63360
Rambouillet 2nd lpant	Ouarville	2000	8	63360
Saint-Jean-De-Folleville 1st plant	Saint-Jean-De-Folleville	1970	8	63360
Saint-Jean-De-Folleville 2nd plant	Saint-Jean-De-Folleville	1975	8	63360
Lagny 1st plant	St Thibault des Vignes	1985	8	63360
Lagny 2nd plant	St Thibault des Vignes	1995	12	95040
Melun 1st plant	Vaulx-le-Penil	2003	8	63360
Melun 2nd plant	Vaux-le-Penil	2003	8	63360
Caen 1st plant	Colombelles	1971	8	63360
Caen 2nd plant	Colombelles	1972	8	63360
Argenteuil (1st plant)	Argenteuil	1975	7.5	59400
Argenteuil (2nd plant)	Argenteuil	1975	7.5	59400
Argenteuil (3rd plant)	Argenteuil	1998	9	71280
Argenteuil (4th plant)	Argenteuil	2006	15	118800
Carrières-sous-Poissy 1st lant	Carrières sous Poissy	1998	7.5	59400
Carrières-sous-Poissy 2n plant	Carrières sous Poissy	1998	7.5	59400
Chedde-Passy	Le Fayet	1995	7.5	59400
Chartres 2 1st plant	Mainvilliers	1999	7.5	59400
Chartres 2 2nd plant	Mainvilliers	1999	7.5	59400
Nantes 1st plant	Coeuron	1994	7	55440
Nantes 2nd plant	Coueron	1994	7	55440
Martiniquaise de valorisation 1st plant		2002	7	55440
Martiniquaise de valorisation 2nd plant	Fort de France	2002	7	55440
Monthyon 1st plant	Monthyon	1998	7	55440
Monthyon 2nd plant	Monthyon	1998	7	55440
Monthyon 3rd plant	Monthyon	1998	4	31680
Pluzunet	Pluzunet	1997	7	55440
Saran 1st plant	Saran	1995	7	55440
Saran 2nd plant	Saran	1995	7	55440
Dinan 2 1st plant	Taden	1998	8	63360
Dinan 2 2nd Plant	Taden	1998	8	63360
Noyelles sous lens 1st plant	Lens	1973	6.7	53064
Noyelles sous Lens 2nd plant	Lens	1973	6.7	53064

Nevers	Fourchambault	2002	6	47520
Reims 1st plant	Reims	1989	6.5	51480
Reims 2nd plant	Reims	1989	6.5	51480
Villefranche 1st plant	Villefranche sur Saône	1984	4.5	35640
Villefranche 2nd plant	Villefranche sur Saône	2002	6.5	51480
Colmar 1st plant	Colmar	1988	6	47520
Colmar 2nd plant	Colmar	1988	6	47520
Metz 1st plant	Metz	2001	8	63360
Metz 2nd plant	Metz	2001	8	63360
Avignon 1st plan	Vedène	1995	6	47520
Avignon 2nd plnat	Vedène	1995	6	47520
Avignon 3rd plant	Vedène	1996	6	47520
Evreux Sud 1st plant	Guichainville	2003	5.6	44352
Evreux Sud 2nd plant	Guichainville	2003	5.6	44352
Lamballe	Planguenoual	1993	5.9	46728
Sète	Sète	1992	5.6	44352
Blois (1st plant)	Blois	2000	5.5	43560
Blois (2nd plant)	Blois	2000	5.5	43560
Douchy 1st plant	Douchy les Mines	1977	5.5	43560
Douchy 2nd plant	Douchy les Mines	1977	5.5	43560
Massy 1st plant	Massy	1985	5.5	43560
Massy 2nd plant	Massy	1986	5.5	43560
Maubeuge 1st plant	Maubeuge	1980 closed in 2002		
Maubeuge 2nd plant	Maubeuge	1980 closed in 2002		
Maubeuge 3rd plant	Maubeuge	2001	5.5	
Maubeuge 4th plant	Maubeuge	2001	5.5	43560
Valenciennes 1st plant	Saint Saulve	1977	5.5	
Valenciennes 2nd plant	Saint Saulve	1977	5.5	
Valenciennes 3rd plant	Saint Saulve	1977	5.5	43560
Born 2	Pontx-les-Forges	1997	5.3	41976
Rosier d'Egletons	Rosier d'Egletons	1997	5.3	41976
Gien 1st plant	Arrabloy	1999	5	39600
Gien 2nd plant	Arrabloy	1999	5	39600
Labeuvrière 1st plant	Béthune	1979	5	39600
Labeuvrière 2nd plant	Béthune	1979	5	39600
Labeuvrière 3rd plant	Béthune	1979	10	79200
Bourgoin Jallieu 1st plant	Bourgoin Jallieu	1986	5	39600
Bourgoin Jallieu 2nd plant	Bourgoin Jallieu	1995	6	47520
Chaumont 1st plant	Chaumont	1998	5	39600
Chaumont 2nd plant	Chaumont	1998	5	39600
Pau 1st plant	Lescar	1987	5	39600
Pau 2nd lpant	Lescar	1990	6	47520
Limoges 1st plant	Limoges	1989	5	39600
Limoges 2nd plant	Limoges	1989	5	39600
Limoges 3rd plant	Limoges	1992	5	39600
Lons-le-Saunier	Lons-le-Saunier	1994	5	39600
Cluses/Marignier	Marignier	1991	5	39600
Montauban	Montauban	1986	5	39600

Agen	Pessac	1991	5	39600
Pontarlier	Pontarlier	1989	5	39600
Rennes 1st plant	Rennes	1968	5	39600
Rennes 2nd plant	Rennes	1968	5	39600
Rennes 3rd plant	Rennes	1996	8	63360
Angers 1st plant	Sainte Gemmes sur Loire-Angers	1974	5	39600
Angers 2nd plant	Sainte Gemmes sur Loire-Angers	1974	5	39600
Angers 3rd plant	Sainte Gemmes sur Loire-Angers	1974	5	39600
Haguenau 1st line	Schweighouse sur Moder	1990	5	39600
Haguenau 2nd line	Schweighouse sur Moder	1990	5	39600
Thonon les Bains	Thonon les Bains	1988	5	39600
Villejust 1st plant	Villefranche sur Saône	1972	6	47520
Villejust 2nd plant	Villejust	1984	8	63360
Henin-Beaumont 1st plant	Henin-Beaumont	1972	6	47520
Henin-Beaumont 2nd plant	Henin-Beaumont	1974	6	47520
Chambéry 1st plnat	Chambéry	1977	4.2	33264
Chambéry 2nd plant	Chambéry	1977	4.2	33264
Chambéry 3rd plant	Chambéry	1996	6	47520
Annecy 1st plant	Cran Gevrier	1986	4.2	33264
Annecy 2nd plant	Cran Gevrier	1994	6	47520
Annecy 3rd plant	Cran Gevrier	2001	6	47520
Angoulême	La Couronne	1986	4.2	33264
Plouharnel	Plouharnel	1971	4.2	33264
Belfort 1s tplant	Bourogne	2002	6.2	49104
Belfort 2nd plant	Bourogne	2002	6.2	49104
Briec 1st plant	Briec de l'Odet	1996	2	15840
Briec 2nd plant	Briec de l'Odet	1996	2	15840
Carhaix	Carhaix	1994	4	31680
La Rochelle 1st plant	La Rochelle	1988	4	31680
La Rochelle 2nd plant	La Rochelle	1988	4	31680
Montbéliard 1st plant	Montbéliard	1988	4	31680
Montbéliard 2nd plant	Montbéliard	1988	4	31680
Pontivy	Pontivy	1990	4	31680
Bayet 1st plant	Saint Pourcain sur Sioule	1982	4	31680
Bayet 2n plant	Saint Pourcain sur Sioule	1988	5	39600
tronville en Barrois	tronville en Barrois	1983	4	31680
Vitré	Vitré	1988	4	31680
concarneau 1st plant	Concarneau	1989	3.9	30888
Concarneau 2nd plant	Concarneau	1989	3.9	30888
Brive 1st plant	Brive la Gaillarde	1973	3.5	27720
Brive 2ndplant	Brive la Gaillarde	1973	3.5	27720
Brive 3rd plant	Brive la Gaillarde	1973	3.5	27720
Paille	Surgères	1981	3.5	27720
Chateaudun	Chateaudun	1976	3.4	26928

Bourg Saint Maurice	Bellentre	1991	3.3	26136
Mantes 1st plant	Guerville	1997	4	31680
Mantes 2nd plant	Guerville	1997	4	31680
Mantes 3rd plant	Guerville	1997	4	31680
Poitiers 1st plant	Poitiers	1984	4	31680
Poitiers 2ns plant	Poitiers	1984	4	31680
Pithiviers	Pithiviers	1985	3.25	25740
Monterau Fault Yonne	Monterau Fault Yonne	1973	3.2	25344
Pontmain 1st plant	Pontmain	1983	3	23760
Pontmain 2nd plant	Pontmain	2003	4	31680
Benesse Maremne 1st plant	Benesse-Maremne	1972	3	23760
Benesse Maremne 2nd plant	Benesse-Maremne	1985	4.5	35640
Besançon 1st plant	Besançon	1976	3	23760
Besançon 2nd plant	Besançon	2002	4	31680
Dieppe 1st plant	Dieppe	1971	2.5	19800
Dieppe 2nd plant	Dieppe	1971	2.5	19800
Epinal 1st plant	Rambervillers	1983	3.5	27720
Epinal 2nd plant	Rambervillers	1983	3.5	27720
Epinal 3rd plant	Rambervillers	2002	6	47520
Sens	Sens	1988	3	23760
Montargis	Amilly	1969	2.8	22176
Pontcharra	Pontcharra	1977	2.7	21384
Créteil 1st lpant	Créteil	2000	15	118800
Créteil 2nd plant	Créteil	2000	15	118800
Créteil 3r plant	Créteil	1994	2	15840
Rochefort 1st plant	Echillais	1990	2.5	19800
Rochefort 2nd plant	Echillais	1990	2.5	19800
Bourg d'oisans	Livet	1998	2.5	19800
St Pierre d'oléron 1st plant	St Pierre d'oléron	1974	5	39600
St Pierre d'oléron 2nd plant	St Pierre d'oléron	1974	5	39600
Tignes	Tignes	1985	1.5	11880
Aurillac	Aurillac	1988	1	7920
SYTEVOM	Noidans-le-Ferroux	2007	10	79200
SYCTOM Isséane	Issy-les-Moulineaux	2010	30.5	241560
SYCTOM Isséane	Issy-les-Moulineaux	2010	30.5	241560
UIOM de Brive	Saint-Pantaléon-de-Larche	1973	3.5	27720
UIOM de Brive	Saint-Pantaléon-de-Larche	1973	3.5	27720
UIOM de Brive	Saint-Pantaléon-de-Larche	1973	3.5	27720
UIOM de Calce Plant 1	Calce	2003	11	87120
UIOM de Calce Plant 2	Calce	2003	11	87120
Le mans 1st plant	Le Mans	1973	8	63360
Le Mans 2nd plant	Le Mans	1991	9	71280
Le Mans 3rd plant	Le Mans	2003	12	95040
UIOM Inova	Saint-Benoît-La-	1983	2.8	22176

	Forêt			
Vaulx 1st plant	Vaux-le-Penil	2003	8	63360
Vaulx 2nd plant	Vaux-le-Penil	2003	8	63360

Let us now examine some results about the different pollutants' emissions collected for the different plants.

The official French and European standards have established an upper limit for mercury and heavy metal emssions at, respectively, 0.05 and 0.5 mg/m^3. The average mercury and heavy metal emissions in 2006 (see the Excel Spreadsheet in Appendix 2) were 0.014 mg/Nm^3 and 0.13 mg/Nm^3, both of which are less than one third of the regulatory requirement.

Table 4 shows the emissions of two Novergie WTE facilities :Arcante and Valorena. The Arcante plant is located in Blois and has capacity of 86,500 tons per year whereas the Valoréna WTE has capacityof 140,000 tons per year.

Table 4. Emissions of two Novergie WTE plants *Source : Novergie website*

	Arcante 1st Plant	**Arcante 2nd Plant**	**Valorena 1st Plant**	**Valorena 2nd Plant**	**E.U Standard**
EMISSIONS in mg/Nm3					
Particulate Matter	0.3	0.29	0.28	0.2	10
SO2	18.8	29.3	0.4	2.9	50
NOx	317.1	287.4	58.5	48.2	200
TOC	0.8				10
CO	8.4	9	4	3.4	50
Mercury	0.00095	0.00083			0.05
Dioxin 1st measurement (ng/Nm3)	0.038	0.038			0.1
Dioxin 2nd measurement (ng/Nm3)	0.018	0.018			0.1

Table 4 shows that with the exception of the NOx standard that was exceeded by Arcante, all other emissions were well below the standards.

On the list below are referenced all the currently operating WTE plants in France. As noted earlier, collecting emission data of French WTEs has been a really difficult job since there are no regional or national websites exclusively dedicated to WTE plants and that provide a list of operating WTE and their emissions in a form that can be easily compared with the national standards. Fortunately there are two national sources that include data on WTE plants and were brought to the attention of the author by Prof. A. Vardelle of the University of Limoges:

http://installationsclassees.ecologie.gouv.fr/

www.pollutionsindustrielles.ecologie.gouv.fr/.

The first one references emissions of all industrial plants in France, without a separate section on WTEs. The WTE data need to be sorted out from a spreadsheet that includes nearly 60,000 rows of emission data. The second provides some plants' emissions but it is not at all up-to-date. As noted above, a common problem with the reporting of emission

data in these sites is that they are in the form of kilograms per year which makes comparison with emission standards, that are reported in mg per cubic meter of stack gas, very difficult. In this study, the kilograms of dioxins reported by the ministry of ecologie were converted to individual emissions for each plant by assuming that the volume of gas generated per ton of MSW combusted at each plant was 5000 standrad cubic meters per ton.

II.5 Main French companies focused on waste management

In this section we will list all the major French companies dealing with waste management in France and abroad.

II.5.1 Veolia Propreté

The first and largest company in France is **Veolia Propreté**, which is one of the four business lines of Veolia Environnement, the only group worldwide that unites under a single brand all environmental services sectors of water, waste management, energy services and transportation. Veolia Propreté plays a major role in waste management, in the public as well as in the private sector.

http://www.veolia.com/fr/groupe/activites/

Veolia Propreté has realised sales of 10.1 billion euros in 2008, is present in more than 33 countries and has 97,406 employees.

It provides different kinds of services such as :

- Services to local communities : The company's employees collect the waste produced and transport it to the appropriate structure where it is being processed. The company also has in charge the local communities' cleanliness and has to maintain this cleanliness as much as possible.

- Services to companies : Veolia Propreté proposes to companies, whatever their size may be, solutions in terms of waste valorization and a set of industrial services associated.

- **Treatment and valorization :** Veolia Propreté processes and valorizes waste in order to take advantage of it. For example, it can burn waste to produce heating or electricity for surrounding habitants.

- Management of special and hazardous waste : Veolia has an expertise in terms of special and hazardous waste and has a well-known knowledge in terms of this kind of waste management.

Veolia Propreté has 852 plants which include 100 WTE plants. It has collected in 2008 more than 45.9 million tons of waste, has processed 66.6 million tons, recycled 12.3 million tons and has sold 5.2 million MWh of electric energy which corresponds to the electric needs of more than 900,000 europeans.

In France in 2008, Veolia Propreté has .. plants It has collected 15,529 ktons, has processed 17,823 ktons and valorized 5072 ktons of waste to produce 1788 GWh of thermal energy and 950 GWh of electric energy.

http://www.veolia-proprete.com/veolia/ressources/files/1/349,chiffres-cles-france-08.pdf

http://www.veolia-proprete.com/apropos/chiffres-cles/

II.5.2 Novergie

Novergie, which is a subsidiary of Suez Environnement (GDF Suez Group) is the second major group in terms of waste management in France. Novergie builds, realises and exploits around 40 WTE plants in France.

Novergie has realised sales of 377 million euros in 2007 and has 1341 employees.

Novergie has been working with local communities on their waste management policy since 1962. It designs, builds and exploits about 40 WTE plants and 6 waste sorting centers.

Novergie focuses on 4 main kind of activities :

- Waste to Energy plants operation : This activity is Novergie's main one with **39 WTE plants in operation**.
- Waste valorization : Novergie operates 6 plants which have a global capacity of 131,500 tons per year. These plants enable to valorize waste. For example, in 2006, 84% of the entering waste has been valorized including 68% of paper, 18% cardboard and 9% plastics. The waste that cannot be valorized are sent to WTE plants to be valorized energetically either to produce heat or electricity.
- Multitype treatment : Novergie provides an «tailor-made » solution given the type of waste it has to valorize and its potential. For example, for a specific waste, it might be more appropriate to incinerate it than to try recycling it and Novergie has the skills to determine the best solution.

- Research and Development : The R&D programs at Novergie are established in close cooperation with the French Ministry of Ecology and are based over several years. Many programs engaged are looking at a way to diminish some pollutant's emission concentrations in order to fit the French and European standards.

Novergie has processed more than 3.9 million tons of waste and sold 701,000 MWh of electric energy in 2006.

Table 5 shows the Novergie WTE plants currently in operation :

Table 5. 2010 list of the operating Novergie plants with their capacity, heat and electricity generated *Source : Novergie website*

Name of WTE	**Location**	**Capacity (tons/year)**	**Heat generated (MWh/year)**	**Electricity generated (MWh/year)**
Argenteuil	Argenteuil	173,000	63,600	100,000
Azalys	Carrières-sous-Poissy	115,000	N/A	44,400
Carrières sur Seine	Carrières sur Seine	123,000	38,000	10,100
CIE	Créteil	225,000	N/A	128,100
Eslane	Villiers-St-Paul	157,500	N/A	63,700
Name	**Location**	**Capacity (tons/year)**	**Heat generated (MWh/year)**	**Electricity generated (MWh/year)**
Meuse Energie	Tronville-en-Barrois	30,000	14,200	N/A
Saint Thibault-des-vignes	St-Thibault-des-vignes	140,000	N/A	70,000
Sausheim	Sausheim	165,000	N/A	64,700
Schweighouse	Schweighouse	70,000	44,500	9,100
Sovvad	Rambervilliers	95,000	1700	38,600
Valoryele	Ouarville	120,000	N/A	60,000
Arcante	Blois	86,500	1400	45,500
Carhaix	Carhaix	30,000	N/A	9,500
Evreux	Evreux	90,000	N/A	47,100
Lamballe	Planguenoual	42,000	N/A	12,300

Montargis	Amilly	29,500	0	0
Oréade	Saint Jean de Folleville	192,000	N/A	84,400
Orisane	Mainvilliers	110,000	N/A	65,500
Sirac (Caen)	Colombelles	114,000	89,400	N/A
Smeco	Pontmain	54,000	77,000	N/A
Valoréna	Nantes	140,000	137,000	N/A
Vitré	Vitré	28,000	21,000	1,500
Name	**Location**	**Capacity (tons/year)**	**Heat generated (MWh/year)**	**Electricity generated (MWh/year)**
Amétyst	Montpellier	203,000	0	30,000
CCUAT	Toulon	285,000	14,200	96,900
Juratrom	Lons-le-Saunier	37,000	22,000	5,000
Ocréal	Lunel-Viel	120,000	N/A	62,600
Pontarlier	Pontarlier	37,500	34,000	N/A
SET Faucigny	Bellegarde	120,000	N/A	54,800
SET Mont-blanc (Passy)	La Fayet	60,000	N/A	21,300
Valezan	Valezan	24,000	0	0
Valorly (Lyon)	Rillieux le Pape	180,000	94,000	30,600
Vedène	Vedène	205,000	N/A	105,000
Angoulême	La Couronne	32,000	0	0
Astria	Bègles	273,000	N/A	122,000
Corrèze incinération	Rosier d’Egletons	40,000	N/A	13,400
Econotre	Bessières	170,000	N/A	93,000
Montauban	Montauban	37,500	18,500	N/A
Pau	Lescar	82,000	N/A	20,700
Sogad (Agen)	Le Passage	32,000	23,500	N/A

Source :www.novergie.fr/page/groupe/groupe-chiffres.php

II.5.3 Groupe Tiru

Groupe Tiru is the third largest waste management group in France. It is co-owned by the EDF group (51%), the GDF Suez group (25%) and Veolia (24%). The Groupe Tiru is specialized in municipal solid waste valorization and produces district heating and electricity. Groupe Tiru has 30 plants worldwide that include 21 WTE plants.

Groupe Tiru focuses on three main kind of activities :

- Thermal valorization by incineration, which produces electricity and heat.
- Biological valorization with the production of biogas and compost.
- Technical engineering amont the division *Tiru Ingenierie* which provides technical assistance, project management of complete units, and technological eve.

Each year, more than 4.2 million tons of waste are processed. Groupe Tiru has also managed to sell more than 3,660,000 MWh of electricity and heat which corresponds to providing heating to 447,000 habitants. Groupe Tiru has valorized more than 60,000 tons of scrap metal, 620,000 tons of clinker, and has sorted more than 170,000 tons of waste.

The following is a listing of the Groupe Tiru WTE plants in France.

Table 6. 2010 list of the operating Groupe Tiru plants (*Source : Groupe Tiru website)*

Calais	Hénin-Beaumont	Pontenx-les-forges	Saint-Saulve
Calce (Perpignan)	Issy-les-moulineaux (Isseane)	Pontivy	Strasbourg (Protires)
Créteil	Ivry-Paris XIII	Rosiers d'egletons	Villefranche-sur-saône
Douchy-les- Mines	Mont-de-marsan	Saint Barthélémy	Villers-saint-paul
Gien	Paillé	Saint-Ouen	

II.6 Uses of energy generated at WTE plants

The two main applications of the energy produced by WTE plants are the production of heat for district heating and the production of electricity. In 2009, 3763 GWh of electricity have been produced by energy valorization. WTE production amounts for 3206 GWh, which represented 85% of the total electricity prodution. (*Les Déchets en chiffre, ADEME Edition 2009)*

The national electricity production in 2009 was 520 TWh, therefore WTE energy valorization amounteed to about 0.7% of the total.

There have been 7348 GWh of thermal energy produced in 2009, and WTE's production amounts for 6700 GWh, which represents 91%.

The Isséane WTE, for example, is located on the bank of Seine River at Issy-les-Moulineaux of Paris and treats more than 460,000 tons of waste per year and provides district heating.

III. Comparison of Waste management in France with Denmark and Germany

In this final part, we are going to take a look at two foreign examples and models in terms of Waste management in Europe : Denmark and Germany.

We will take a look at the Danish and German laws in terms of Waste management, take a look at a couple of « good » Danish and German plants, and then compare a couple of the data collected with the French data on WTE plants.

III.1 Denmark

In this section, we will present the Danish situation in terms of waste management and the evolution of some major emissions between the year 2003 and 2008.

Danish municipal solid waste represents around 3 million tons per year which is much smaller than the 11 million tons we have in France. Denmark has around 30 plants with an average capacity of 17 tons/hour. (ISWA). Table 7 provides an overview of the Danish WTE plants configuration on a national scale. This table includes 25 WTE plants, exclusively electricity generating ones. It classifies the number of plants with regard to their air pollution control system.

Table 7. Overview of the main characteristics of WTE plants in Denmark
Source : Document from Teknik & Miljø: Affald-Reform, Politik og inspiration

Type of air pollution control system	Number of plants	Dioxin removal system	SNCR system for Nox	Capacity tons/year	% of capacity
Dry Scrubber and Bagfilter	2	3	2	216,040	7
Semi-Dry Scrubber and Bagfilter	6	6	4	648,406	21
Bagfilter and Water Scrubber	3	3	2	728,144	24
Electrofilter and Water Scrubber	7	7	5	538,641	18
Electrofilter and Bagfilter	7	6	4	893,479	30
Total:	25	25	17	3,022,710	100

The following figures give the evolution in terms of emissions for a series of pollutants between 2003 and 2008, according to their air pollution control system. *ESP+WET+FB* stands for Electrofilters, water scrubbers and bagfilters, *SD+FB* stands for Semi-Dry scrubber and bagfilter and *ESP+WET* stands for Electrofilters and bagfilter.

The emission standards are those of the European Union, as presented on page 14.

We can see that a huge effort has been made in pollution prevention between those two years as the concentration of pollutant emitted has decreased noticeably.

The most important decrease is for the plants equipped with *ESP+WET* technologies which represent, according to Table 7, 18% of the overall capacity.

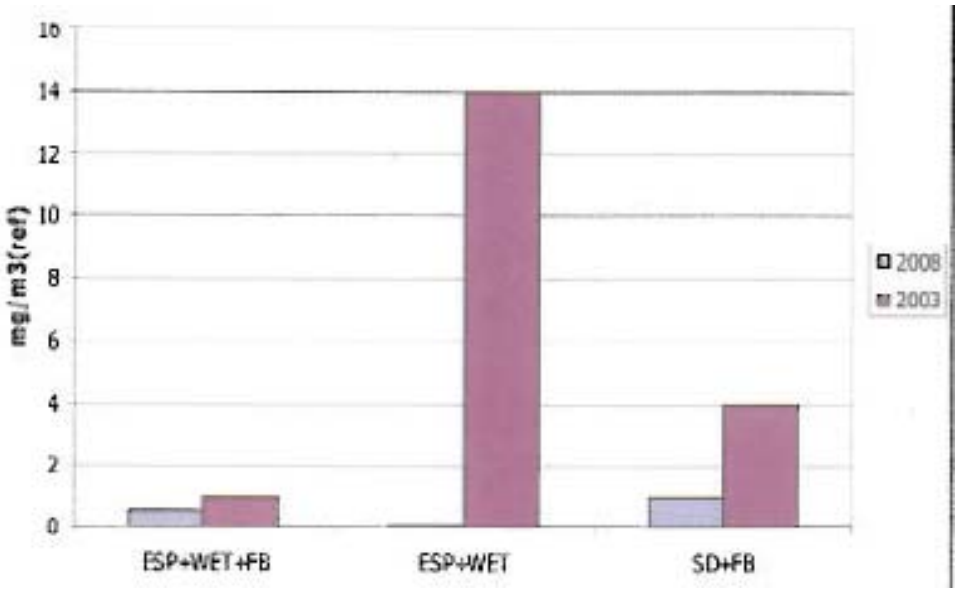


Figure 4 : Particulate matter emissions in Denmark in 2003 and 2008 *Source : Teknik & Miljø*

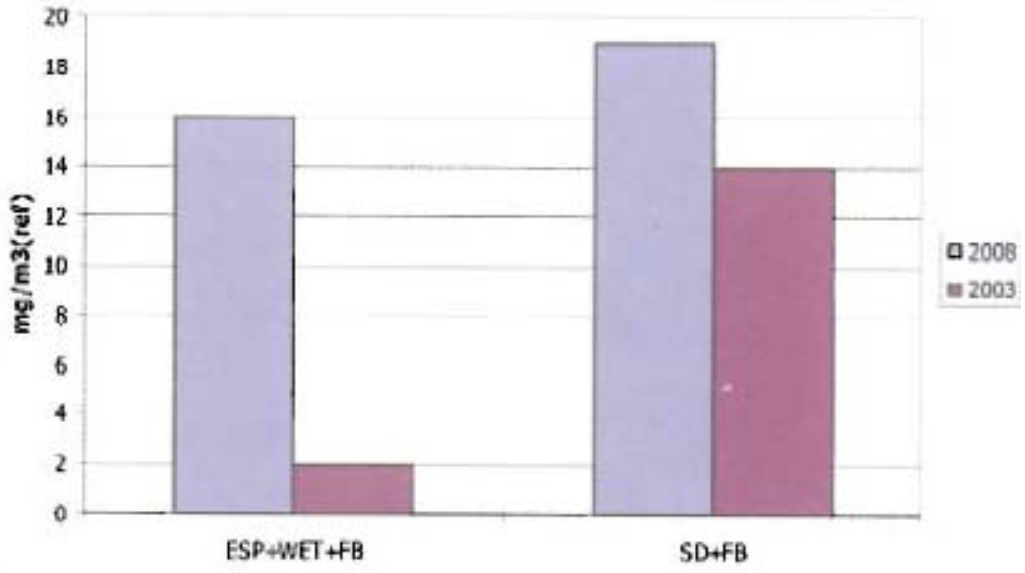


Figure 5 : SO_2 emissions in Denmark in 2003 and 2008, *Source : Teknik & Miljø*

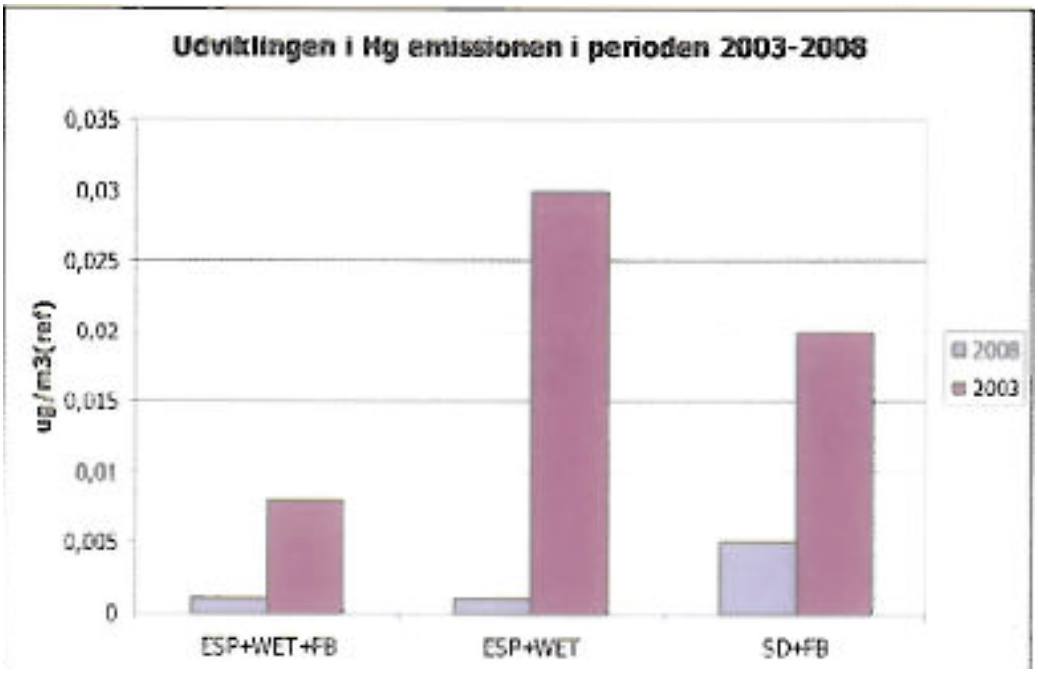


Figure 6 : Hg emissions in Denmark in 2003 and 2008, *Source : Teknik & Miljø*

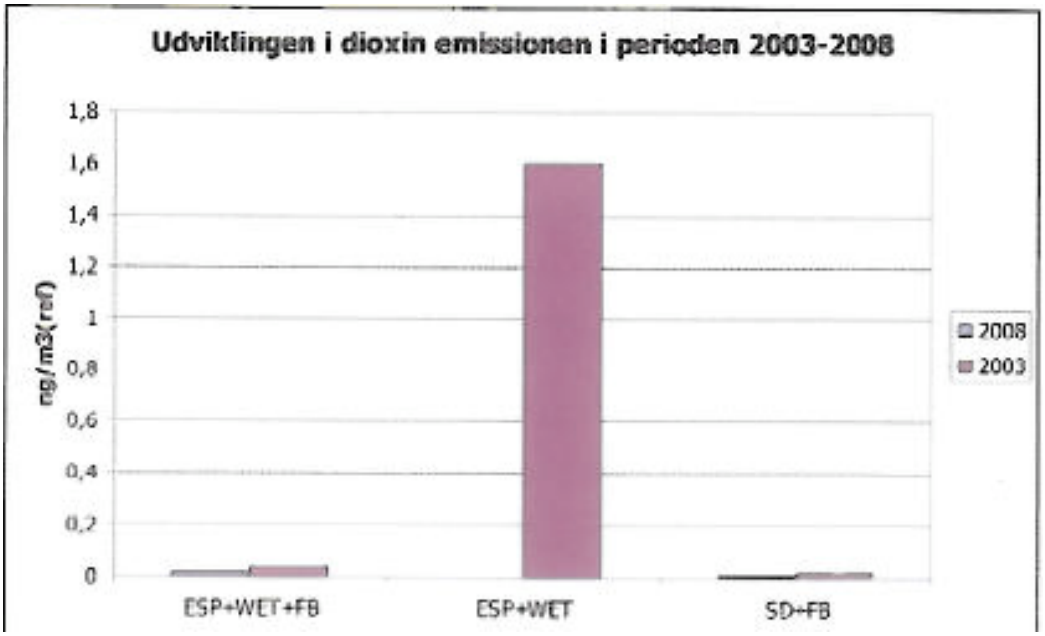


Figure 7 : Dioxins emissions in Denmark in 2003 and 2008, *Source : Teknik & Miljø*

III.2 Germany

In this section, we will present the German WTE emissions.. Germany has about 70 WTE plants on its soil with an average capacity of 36 tons/hour. (ISWA). The amount of German municipal solid waste incinerated was about15 million tons per year in 2004

The ITAD website gathers information about WTE management in Germany and was very helpful in building the following tables and charts.

Table 8 gives an insight about the German regulations in terms of WTE plants emissions, and the average values of emissions reported for all the WTE plants in Germany. It can be seen that all values are substantially lower than the national standards. This confirms Germany's leading position in terms of environmental control of WTE emissions..

Table 8. WTE German standards and 2007 lowest emissions reported in Germany (*Source: ITAD)*

Daily Values (mg/m3)	**German standards**	**Lowest values reported**
Particulate matter	10	0.3
SO2	50	1.35
Nox	200	28.8
TOC	10	0.2
CO	50	6.05
Mercury	0.03	0.001
Heavy metals	0.51	0.0162
Dioxins (ng/Nm^3)	0.11	0.00058

Figure 8 shows a graphical representation of the average emissions of all German WTE, expressed as percent of the German standards..

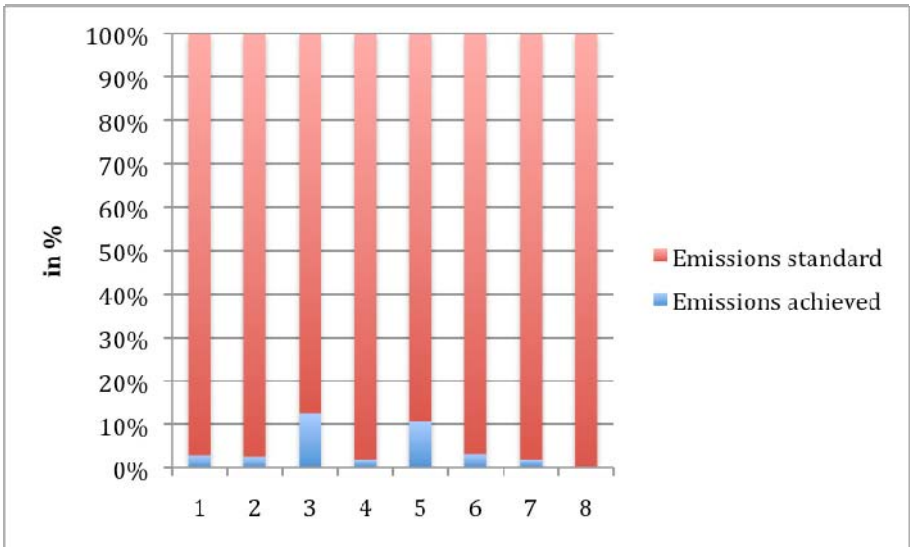


Figure 8. WTE emissions achieved by German WTE plants, presented as percent of the 100% emissions standard. *Source : ITAD (1 :PM ; 2 :SO2 ; 3 :NOx ; 4 :TOC ; 5 : CO; 6: Hg; 7 heavy metals; 8: dioxins)*

The following graph (Figure 9) shows the particulate emissions of individual German plants, vs the E.U. and German standard of 10 mg/Nm^3 of dry stack gas. It can be seen that the highest reported emission was only 20% of the standard value of 10 mg/Nm^3.

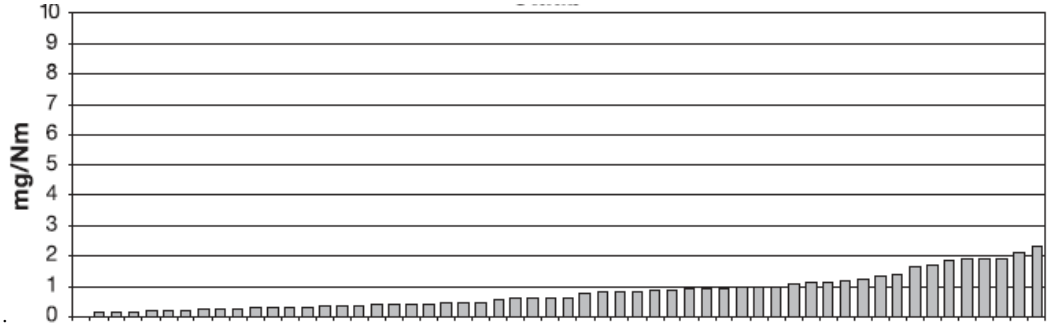


Figure 9. Particulate matter emissions reported for German WTE plants vs the German emission standard (*Source : ITAD)*

Figure 10 shows that all German WTE plants were below the German standard of 200 mg/Nm^3. Figures 11 and 12 show that the sulfur dioxide and mercury emissions of all WTEs were substantially lower than the corresponding standards.

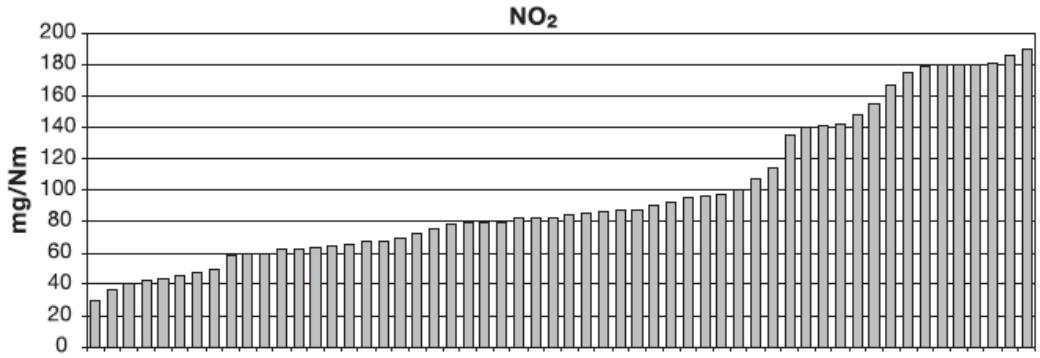


Figure 10. NO_2 emissions reported for German WTE plants vs the German emission standard (*Source : ITAD)*

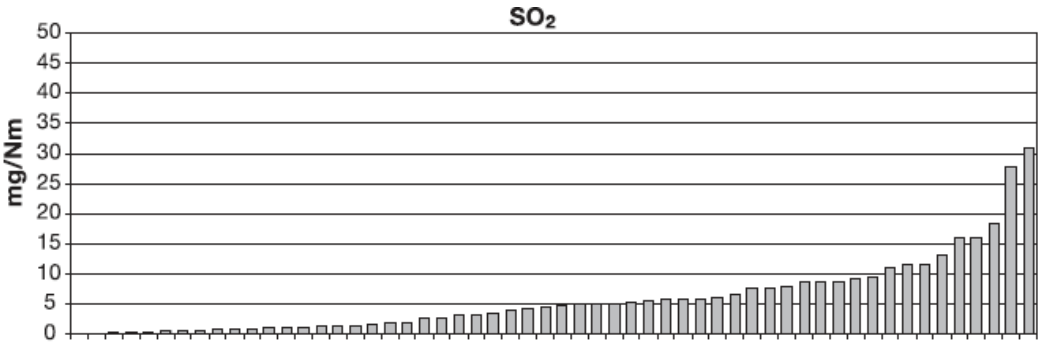


Figure 11. SO_2 emissions reported for German WTE plants vs the German emission standard (*Source : ITAD)*

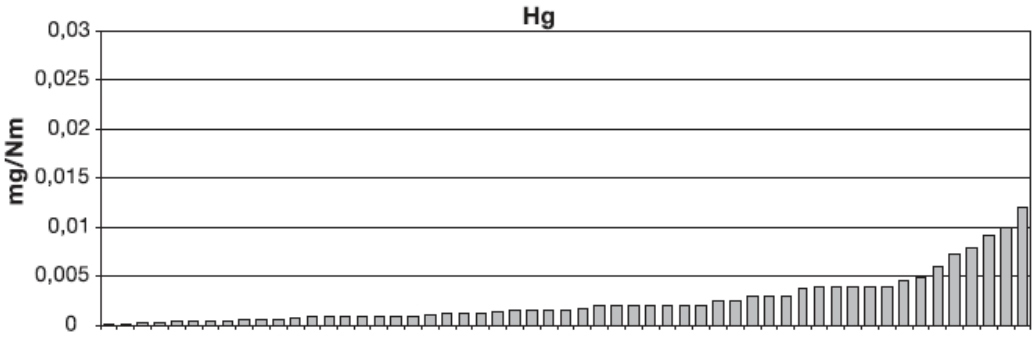


Figure 12. Mercury emissions reported for German WTE plants vs the German emission standard (*Source : ITAD)*

III.3 Comparative tables and graphs for France, Denmark, and Germany

Table 9 compares the average emissions of the **127** operating plants of France to the national standards for each emissionccion.n French soil, as reported by IREP.

Table 9.: Average yearly emissions of all French WTE plants, in mg/Nm^3 (except for mercury and dioxins) (Year: 2006; *Source :IREP)*

	Particulate Matter	**SO_2**	**NO_x**	**CO**	**Mercury Micrograms per Nm3**	**Dioxin ng TEQ/Nm^3**
Average Value	5	21	258	7.1	4.7	0.05
Regulated Value	10	50	200	50	10	0.1
%of E.U. and French standard	50%	48%	125%	14%	47%	50%

Table 9 shows, that with the exception of NOx, all other emissions, on the average, were less than 50% of the standard values. The following tabulation shows NOx emissions by plant, in the year 2006. Table 10 shows the plants that in 2006 exceeded the allotted NOx emissions.

Dioxin emissions: : According to the Ministry of Ecologie spreadsheet that is shown as Appendix to this report, in 2006 only six out of the 127 French WTEs, exceeded the dioxin standard. After completion of this thesis by Yohann Benhamou, the Earth Engineering Center obtained the dioxin emissions reported by these plants in 2009. The smallest of these plants has been closed and all others had 2009 dioxin emissions below the E.U. and French standard of 0.1 ng TEQ per standard cubic meter of stack gas.

V. Conclusions

The total tons of MSW combusted in the operating 127 WTE plants of France are 16.1 million tons. All of these plants meet the particulate matter, mercury,dioxins, and all other emission standards of E.U. and France, with the exception of NOx where the average WTE emission is about 20% higher than the standard of 200 mg NOx/Nm3 of stack gas.

A detailed analysis of the 127 French WTE plants showed that in 2006 only six plants exceeded the E.U. standard for dioxin emissions from WTE (0.1 ng TEQ/Nm3). However, as of 2009 all operating WTE plants in France met this standard. The average of dioxin emissions of all French WTE facilities was less than 50% of the French standard, that is less than 0.05 ng TEQ/Nm3. For the 16 million tons of MSW combusted in France annually, the corresponding total amount of dioxins emitted by all French WTE plants in one year is calculated to be only 4 (four) grams TEQ.

This study showed that there is very poor communication to the public and access to information with regard to WTE emissions, in France. This has led to an erroneous perception by the public and the French intelligentsia, as witnessed by the published conclusions of the 2007 Grenelle de l'Environement.

Appendix 1. Interviews and information provided by experts in France

Interview with M. François NICOL, head of the Department « Energétique et Procédés », VEOLIA Environnement Recherche et Innovation

Interview with Ange NZIHOU, head of Research Group on Waste Treatment and Beneficial Use at the RAPSODEE research center, Ecole des Mines d'Albi-Carmaux, France:

Prof. Ange Nzihou discussed with the author people's opinion on WTE plants in France. Before 1991, there were no precise emission standards documents enacted for particulate matter and therefore, these particles were the one that were the most absorbing pollutants such as heavy metals or nanofuranes and would then get into the atmosphere and contaminate the environment and affect human health. Therefore, in the old generation of WTE plants, there was a risk for people living next to these plants, risk due to heavy metals, furanes and dioxins.

This is what has contributed to creating poor perception for WTE plants, and since there has not been adequate information disseminated to the public in recent years, people are ignorant of the progress made, and ignorance is the first step to fear.

There are therefore two main problems that lead to that opinion : First, the lack of information provided and, second, the lack of communication. According to Prof. Nzihou, many plants do not post their emissions' record on their website because they are afraid about this information beibng misused by opponents to incineration.

Prof. Ange Nzihou truly believes that incineration is essential in order to deal with the landfill space constraints that France will experience in the years to come.

References provided by Prof. Armelle Vardelle, E.N.S.I.L., Universite de Limoges, Limoges, France

Prof. Vardelle provided the most crucial source to this study : The master spreadshhet of the Ministry of Ecologie on all French industrial sources of air emissions

Directive n°2000/76/CE du Parlement européen et du Conseil du 4 décembre 2000 sur l'incinération des déchets.

French Ministry of Ecology website : http://www.ecologie.gouv.fr/-Dechets-.html

ADEME's website: http://www.ecologie.gouv.fr/Les-reseaux-de-mesure-de-la.html

http://www.developpement-durable.gouv.fr/energie/renou/biomasse/incineration-om.htm

References provided by M. Luc Valaize, representative of WTE plants to Confederation of European WTE Planrs (CEWEP)

www.incineration.org

References provided by Bettina Kamuk, Market Director/Project Director at Ramboll

Document from Teknik & Miljø: Affald-Reform, Politik og inspiration page 44-46

References provided by Cindy Letrouve, in charge of the registry on polluting emissions, Ministry of Ecology, France

Excel file gathering the emissions from all the operating plants in France.

Acknowledgements

This work would not be possible without the help and support of these people, for whom I would like to thank :

Professor N.J Themelis : for his assistance and support throughout the process and for the reviews and constructive advice.

Professor Ange Nzihou, who helped me a lot in finding the data I was looking for.

I would also like to thank my family and friends for their support in writing this thesis.

APPENDIX 1, . Regional Environmental Agencies (DREAL) contacted by e-mail in French, requesting WTE emission data (only one response was received)

dreal-pays-de-la-loire@developpement-durable.gouv.fr,
webmestre.dreal-npdc@developpement-durable.gouv.fr,
dreal-HNormandie@developpement-durable.gouv.fr,
Dreal-picardie@developpement-durable.gouv.fr,
webmestre.dreal-champard@developpement-durable.gouv.fr,
dreal-lorraine@developpement-durable.gouv.fr,
webmestre.dreal-alsace@developpement-durable.gouv.fr,
dreal-franche-comte@developpement-durable.gouv.fr,
dreal-bourgogne@developpement-durable.gouv.fr,
diren-centre@developpement-durable.gouv.fr,
dreal-HNormandie@developpement-durable.gouv.fr,
DRE-Bretagne@developpement-durable.gouv.fr,
dreal-poitou-charentes@developpement-durable.gouv.fr,
patrick.auzanet@developpement-durable.gouv.fr,
DREAL-Auvergne@developpement-durable.gouv.fr,
webmestre-dreal@developpement-durable.gouv.fr,
dreal-paca@developpement-durable.gouv.fr,

contact.dreal-langrous@developpement-durable.gouv.fr,
courrier.dreal-midi-pyrenees@developpement-durable.gouv.fr,
DREAL-aquitaine@developpement-durable.gouv.fr,
DREAL-corse@developpement-durable.gouv.fr
Subject: Request for information to To Regional DREA

APPENDIX 2. Emission Data Obtained from Spreadsheet provided by Ministry of Ecology (see References above; the Excel Spreadsheet is shown as three pages in the following three pages).

Name of plant	Plant location	Year of start-up	Capacity tons/year	Capacity tons/day	PM kg/year	SO2 kg/year	Nox kg/year	CO kg/year	Mercury kg/year	Heavy metals kg/year	Dioxins kg/year	Dioxins ng/Nm3
Agen	Pessac	1991	43800	120	32	179	23872	399		0.089		
Angers #1 unit	Sainte Gemmes sur Loire-Angers	1974	43800	120	676	2768	145317	7033	1.700	0.102	0.000005	0.024658
Angers #2 unit	Sainte Gemmes sur Loire-Angers	1974	43800	120	676	2768	145317	7033	1.700	0.262	0.000005	0.024658
Angers #3 unit	Sainte Gemmes sur Loire-Angers	1974	43800	120	676	2768	145317	7033	1.700	0.370	0.000005	0.024658
Angoulême	Angoulême	1986	36792	101	181	362	56952	435	0.029	0.144	0.000380	2.065666
Annecy #1 unit	Cran Gevrier	1986	36792	101	116	97	14219	1040		0.128		
Annecy #2 unit	Cran Gevrier	1994	52560	144	116	97	14219	1040		0.070		
Annecy #3 unit	Cran Gevrier	2001	52560	144	116	97	14219	1040		0.040		
Antibes #1 unit	Antibes	1970	83220	228	1162	3473	31136	4440	0.750	4.570	0.000027	0.065655
Antibes #2 unit	Antibes	1970	83220	228	1162	3473	31136	4440	0.750	4.570	0.000027	0.065655
Argenteuil #1 unit	Argenteuil	1975	65700	180	3748	1176	52719	2490	7.470	66.500	0.000014	0.043836
Argenteuil #2 unit	Argenteuil	1975	65700	180	3748	1176	52719	2490	7.470	66.500	0.000014	0.043836
Argenteuil #3 unit	Argenteuil	1998	78840	216	3748	1176	52719	2490	7.470	66.500	0.000014	0.036530
Argenteuil #4 unit	Argenteuil	2006	131400	360	3748	1176	52719	2490	7.470	66.500	0.000014	0.021918
Arras	Arras	2004	28908	79			98547	6800		38.550		
Aureade	Veuve	2006	109500	300	86	6500	65931	1509	0.004	0.289	0.000004	0.006738
Aurillac	Aurillac	1988	8760	24	57	229	8534	82	0.073	0.371	0.000001	0.022831
Avignon #1 unit	Vedène	1995	52560	144	8978	8658	116208	3587	3.200	0.299	0.000032	0.121766
Avignon #2 unit	Vedène	1995	52560	144	8978	8658	116208	3587	3.200	0.072	0.000032	0.121766
Avignon #3 unit	Vedène	1996	52560	144	8978	8658	116208	3587	3.200	0.061	0.000032	0.121766
Bayet #1 unit	Saint Pourcain sur Sioule	1982	35040	96	141	51	8747	376	0.420	0.104		
Bayet #2 unit	Saint Pourcain sur Sioule	1988	43800	120	141	51	8747	376	0.420	0.047		
Belfort #1 unit	Bourogne	2002	54312	149	6	698	70500	113735	2.500	0.148	0.000009	0.031301
Belfort #2 unit	Bourogne	2002	54312	149	6	698	70500	113735	2.500	0.317	0.000009	0.031301
Bellegarde s.V. #1 unit	Bellegarde sur valserine	1998	70080	192	461	3563	96046	2834	1.520	4.320	0.000142	0.405251
Bellegarde s.V. #2 unit	Bellegarde sur Valserine	1998	70080	192	461	3563	96046	2834	1.520	4.320	0.000142	0.405251
Benesse Maremne #1 unit	Benesse-Maremne	1972	26280	72	784	643	30337	1325	0.100	1.000	0.000006	0.043379
Benesse Maremne #2 unit	Benesse-Maremne	1985	39420	108	784	643	30337	1325	0.100	1.000	0.000006	0.028919
Besançon #1 unit	Besançon	1976	26280	72	171	314	74854	4716	0.190	2.700	0.000002	0.012542
Besançon #2 unit	Besançon	2002	35040	96	171	314	74854	4716	0.190	2.700	0.000002	0.009406
Bessières #1 unit	Bessières	2000	99864	274	1631	7428	115704	4509	2.250	81.570	0.000016	0.031042
Bessières #2 unit	Bessières	2000	99864	274	1631	7428	115704	4509	2.250	81.570	0.000016	0.031042
Blois #1 unit	Blois	2000	48180	132	140	8668	317	4350	0.700	0.016	0.000010	0.041511
Blois #2 unit	Blois	2000	48180	132	140	8668	287	4350	0.700	0.008	0.000010	0.041511
Bordeaux #1 unit	Bègles	1998	96360	264	542	6547	7370	9952	18.000	24.000	0.000008	0.015567
Bordeaux #2 unit	Bègles	1998	96360	264	542	6547	7370	9952	18.000	24.000	0.000008	0.015567
Bordeaux #3 unit	Bègles	1998	96360	264	542	6547	7370	9952	18.000	24.000	0.000008	0.015567
Born 2	Pontenx-les-Forges	1997	46428	127	523	3542	91386	2850	0.300	0.010	0.000001	0.003015
Bourg d'oisans	Livet	1998	21900	60	12	1368	30644	59	1.250	0.130	0.000002	0.014612
Bourg Saint Maurice	Bellentre	1991	28908	79	319	170	22856	420	0.650	1.200	0.000002	0.010827
Bourgoin Jallieu #1 unit	Bourgoin Jallieu	1986	43800	120	844	4269	47057	2592	3.840	0.034	0.000014	0.063927
Bourgoin Jallieu #2 unit	Bourgoin Jallieu	1995	52560	144	844	4269	47057	2592	3.840	0.079	0.000014	0.053272
Brest #1 unit	Brest	1988	78840	216	682	5364	40616	7085	3.240	0.034	0.000001	0.002867
Brest #2 unit	Brest	1988	78840	216	682	5364	40616	7085	3.240	0.025	0.000001	0.002867
Briec #1 unit	Briec de l'Odet	1996	17520	48	243	2301	40652	1254	1.320	0.036	0.000008	0.086758
Briec #2 unit	Briec de l'Odet	1996	17520	48	243	2301	40652	1254	1.320	0.028	0.000008	0.086758
Brive #1 unit	Brive la Gaillarde	1973	30660	84	2223	77	43	12		0.062		
Brive #2unit	Brive la Gaillarde	1973	30660	84	2223	77	43	12		0.062		
Brive #3 unit	Brive la Gaillarde	1973	30660	84	2223	77	43	12		0.062		
Caen #1 unit	Colombelles	1971	70080	192	1	455	40769	2323	2.540	0.013	0.000006	0.017123
Caen #2 unit	Colombelles	1972	70080	192	1	455	40769	2323	2.540	0.052	0.000006	0.017123
Carhaix	Carhaix	1994	35040	96	287	1524	33469	70	0.620	0.065	0.000000	0.000588
Carrières sur Seine #1 unit	Carrières sur Seine	1977	87600	240	2700	7286	42001	3309	10.390	0.137	0.000008	0.018240
Carrières sur Seine #2 unit	Carrières sur Seine	1988	87600	240	2700	7286	42001	3309	10.390	0.209	0.000008	0.018240
Carrières-sous-Poissy #1 unit	Carrières sous Poissy	1998	65700	180	530	4270	11290	7080	2.950	0.055	0.000006	0.018874
Carrières-sous-Poissy #2 unit	Carrières sous Poissy	1998	65700	180	530	4270	11290	7080	2.950	0.102	0.000006	0.018874
Cergy #1 unit	Cergy Pontoise	1995	91980	252	820	8963	74780	6949	20.500	0.394	0.000008	0.017443
Cergy #2 lpant	Cergy Pontoise	1995	91980	252	820	8963	74780	6949	20.500	0.595	0.000008	0.017443
Chambéry #1 unit	Chambéry	1977	36792	101	20	2930	34300	1320	0.570	0.105	0.000002	0.008891
Chambéry #2 unit	Chambéry	1977	36792	101	20	2930	34300	1320	0.570	0.018	0.000002	0.008891
Chambéry #3 unit	Chambéry	1996	52560	144	20	2930	34300	1320	0.570	0.017	0.000002	0.006223
Chartres 2 #1 unit	Mainvilliers	1999	65700	180	299	7945	191432	6205	1.316	0.404	0.000014	0.041108
Chartres 2 #2 unit	Mainvilliers	1999	65700	180	299	7945	191432	6205	1.316	0.391	0.000014	0.041108
Chateaudun	Chateaudun	1976	29784	82	1442	522	48134	3950	1.560	0.016	0.000006	0.036933
Chaumont #1 unit	Chaumont	1998	43800	120	636	13153	60311	3871	0.011	0.087	0.000002	0.008630
Chaumont #2 unit	Chaumont	1998	43800	120	636	13153	60311	3871	0.011	0.036	0.000002	0.008630
Chedde-Passy	Passy	1995	65700	180	201	3802	43444	974	0.530	0.055	0.000001	0.002131
Cluses/Marignier	Marignier	1991	43800	120	111	56	11815	3228	0.100	0.152	0.000000	0.000890
Colmar #1 unit	Colmar	1988	52560	144	800	2200	77600	2600	2.000	0.110	0.000005	0.018645
Colmar #2 unit	Colmar	1988	52560	144	800	2200	77600	2600	2.000	0.120	0.000005	0.018645
Concarneau #1 unit	Concarneau	1989	34164	94	475	7883	62175	1688	0.350	0.073	0.000005	0.027105
Concarneau #2 unit	Concarneau	1989	34164	94	475	7883	62175	1688	0.350	0.594	0.000005	0.027105
Créteil #1 unit	Créteil	2000	131400	360	3546	5387	75850	12580	19.529	0.330	0.000000	0.000152
Créteil #2 unit	Créteil	2000	131400	360	3546	5387	75850	12580	19.529	1.040	0.000000	0.000152
Créteil 3r unit	Créteil	1994	17520	48	3546	5387	75850	12580	19.529		0.000000	0.001142
Dieppe #1 unit	Rouxmesnil-Bouteilles	1971	21900	60	1923	8035	86750	4392	0.731	0.122	0.000004	0.035341
Dieppe #2 unit	Rouxmesnil-Bouteilles	1971	21900	60	1923	8035	86750	4392	0.731	0.122	0.000004	0.035341
Dijon #1 unit	Dijon	1974	100740	276	1175	3609	55000	29000	8.000	0.078	0.000002	0.003971
Dijon #2 unit	Dijon	1974	100740	276	1175	3609	55000	29000	8.000	0.039	0.000002	0.003971
Dinan 2 #1 unit	Taden	1998	70080	192	167	5525	208267	2251	4.400	0.129	0.000170	0.485160
Dinan 2 #2 unit	Taden	1998	70080	192	167	5525	208267	2251	4.400	0.047	0.000170	0.485160
Douchy #1 unit	Douchy les Mines	1977	48180	132	860	68	66000	3200	7.100	0.041	0.000002	0.009132
Douchy #2 unit	Douchy les Mines	1977	48180	132	860	68	66000	3200	7.100	0.041	0.000002	0.009132
Epinal #1 unit	Rambervillers	1983	30660	84	116	2054	145567	6213	7.358	0.321	0.000028	0.180691
Epinal #2 unit	Rambervillers	1983	30660	84	116	2054	145567	6213	7.358	0.321	0.000028	0.180691
Epinal #3 unit	Rambervillers	2002	52560	144	116	2054	145567	6213	7.358	0.063	0.000028	0.105403
Esiane	Villers-Saint-Paul	2004	96360	264	254	3912	137211	3449	2.447	0.105	0.000003	0.006372

Esiane	Villers-Saint-Paul	2004	96360	264	254	3912	137211	3449	2.447	0.101	0.000003	0.006372
Evreux Sud #1 unit	Guichainville	2003	49056	134	584	3650	23164	1851	2.401	0.029	0.000004	0.017939
Evreux Sud #2 unit	Guichainville	2003	49056	134	584	3650	23164	1851	2.401	0.013	0.000004	0.017939
Gien #1 unit	Gien	1999	43800	120	340	900	68610	3250	0.031	1.540	0.000006	0.026575
Gien #2 unit	Gien	1999	43800	120	340	900	68610	3250	0.031	1.540	0.000006	0.026575
Grenoble #1 unit	Tronche	1974	72270	198	1260	2207	67929	4189	1.600	0.176	0.000017	0.047046
Grenoble #2 unit	Tronche	1974	72270	198	1260	2207	67929	4189	1.600	0.138	0.000017	0.047046
Grenoble #3 unit	Tronche	1996	72270	198	1260	2207	67929	4189	1.600	0.230	0.000017	0.047046
Haguenau #1 line	Schweighouse sur Moder	1990	43800	120	237	2011	30121	2473	0.563	0.115	0.000005	0.022817
Haguenau #2 line	Schweighouse sur Moder	1990	43800	120	237	2011	30121	2473	0.563	0.090	0.000005	0.022817
Halluin #1 unit	Halluin	2000	127020	348	1240	21440	109800	14680	1.550	0.087	0.000020	0.032184
Halluin #2 unit	Halluin	2000	127020	348	1240	21440	109800	14680	1.550	0.119	0.000020	0.032184
Halluin #3 unit	Halluin	2000	127020	348	1240	21440	109800	14680	1.550	0.081	0.000020	0.032184
Henin-Beaumont #1 unit	Henin-Beaumont	1972	52560	144	1208	2770	101000	3300	2.270	0.152	0.000007	0.025114
Henin-Beaumont #2 unit	Henin-Beaumont	1974	52560	144	1208	2770	101000	3300	2.270	0.070	0.000007	0.025114
Ivry #1 unit	Paris	1969	438000	1200	12300	56900	201300	45900	4.180	0.126	0.000173	0.079178
Ivry #2 unit	Paris	1969	438000	1200	12300	56900	201300	45900	4.180	0.098	0.000173	0.079178
La Rochelle #1 unit	Rochelle	1988	35040	96	414	2312	53405	1632	1.950	0.120	0.000002	0.012785
La Rochelle #2 unit	Rochelle	1988	35040	96	414	2312	53405	1632	1.950	0.140	0.000002	0.012785
Labeuvrière #1 unit	Labeuvrière	1979	43800	120	500	3700	34400	4583	1.020	0.100	0.000017	0.077626
Labeuvrière #2 unit	Labeuvrière	1979	43800	120	500	3700	34400	4583	1.020	0.024	0.000017	0.077626
Labeuvrière #3 unit	Labeuvrière	1979	87600	240	500	3700	34400	4583	1.020	0.040	0.000017	0.038813
Lagny #1 unit	St Thibault des Vignes	1985	70080	192	1105	3182	421	16739	8.980	0.156	0.000010	0.029680
Lagny #2 unit	St Thibault des Vignes	1995	105120	288	1105	3182	421	16739	8.980	0.151	0.000010	0.019787
Lamballe	Planguenoual	1993	51684	142	481	8505	93315	847	11.800	0.100	0.000004	0.017317
Lasse Sivert	Lasse	2004	109500	300	213	10812	38273	34	6.650	0.127	0.000001	0.002320
Le Mans #1 unit	Mans	1973	70080	192	32620	809	126050	15070	0.400	0.194	0.000029	0.081621
Le Mans #2 unit	Mans	1991	78840	216	32620	809	126050	15070	0.400	0.103	0.000029	0.072552
Le Mans #3 unit	Mans	2003	105120	288	32620	809	126050	15070	0.400	0.179	0.000029	0.054414
Limoges #1 unit	Limoges	1989	43800	120	815	5913	76770	4447	5.040	0.130	0.000020	0.091781
Limoges #2 unit	Limoges	1989	43800	120	815	5913	76770	4447	5.040	0.100	0.000020	0.091781
Limoges #3 unit	Limoges	1992	43800	120	815	5913	76770	4447	5.040	0.002	0.000020	0.091781
Lons-le-Saunier	Lons-le-Saunier	1994	43800	120	260	518	64838	540	0.230	0.150	0.000011	0.049932
Lunel #1 unit	Lunel-Viel	1999	70080	192	262	1790	175799	4582	6.020	0.180	0.000003	0.007728
Lunel #2 unit	Lunel-Viel	1999	70080	192	262	1790	175799	4582	6.020	0.141	0.000003	0.007728
Lyon Nord #1 unit	Rillieux	1989	105120	288	380	9858	39606	12452	4.710	0.087	0.000010	0.019420
Lyon Nord #2 unit	Rillieux	1989	105120	288	380	9858	39606	12452	4.710	0.200	0.000010	0.019420
Lyon Sud #1 unit	Lyon 7ème 69007	1989	105120	288	2735	434	54073	15195	20.770	0.124	0.003500	6.659056
Lyon Sud #2 unit	Lyon 7ème 69007	1989	105120	288	2735	434	54073	15195	20.770	0.227	0.003500	6.659056
Lyon Sud #3 unit	Lyon 7ème 69007	1989	105120	288	2735	434	54073	15195	20.770	0.345	0.003500	6.659056
Mantes #1 unit	Guerville	1997	35040	96	244	2207	52708	12019	1.456	0.061	0.000004	0.024543
Mantes #2 unit	Guerville	1997	35040	96	244	2207	52708	12019	1.456	0.037	0.000004	0.024543
Mantes #3 unit	Guerville	1997	35040	96	244	2207	52708	12019	1.456	0.037	0.000004	0.024543
Martiniquaise #2 unit	Fort de France	2002	61320	168	440	275	77734	1032	2.290	0.091	0.000009	0.029909
Massy #1 unit	Massy	1985	48180	132	1193	154000	4010	1435	0.800	0.219	0.000011	0.044458
Massy #2 unit	Massy	1986	48180	132	1193	154000	4010	1435	0.800	0.207	0.000011	0.044458
Maubeuge #1 unit	Maubeuge	1980 closed in 2002		0	559			2570	2.810			
Maubeuge #2 unit	Maubeuge	1980 closed in 2002		0	559			2570	2.810			
Maubeuge #3 unit	Maubeuge	2001	48180	132	559	2816	64740	2570	2.810	0.252	0.000001	0.005396
Maubeuge 4th unit	Maubeuge	2001	48180	132	559	2816	64740	2570	2.810	0.167	0.000001	0.005396
Melun #1 unit	Vaulx-le-Penil	2003	70080	192	1681	6538	93229	4834	1.590	0.066	0.000010	0.028082
Melun #2 unit	Vaux-le-Penil	2003	70080	192	1681	6538	93229	4834	1.590	0.070	0.000010	0.028082
Messanges	Messanges	1976	26280	72	329	451	21743	399	0.050	0.120	0.000001	0.008371
Metz #1 unit	Metz 57000	2001	70080	192	467	1739	70297	5049	0.569	0.065	0.000004	0.011416
Metz #2 unit	Metz 57000	2001	70080	192	467	1739	70297	5049	0.569	0.105	0.000004	0.011416
Montargis	Amilly	1969	24528	67	120	197	29376	601	0.344	3.367	0.000003	0.024959
Montauban	Montauban	1986	43800	120	660	191	33076	2118	2.010	0.137	0.000002	0.009178
Montbéliard #1 unit	Montbéliard	1988	35040	96	319	805	62708	3245	0.446	0.130	0.000005	0.025685
Montbéliard #2 unit	Montbéliard	1988	35040	96	319	805	62708	3245	0.446	0.148	0.000005	0.025685
Monterau Fault Yonne	Monterau Fault Yonne	1973	28032	77	450	895	11351	564	0.920	0.121	0.000877	6.257135
Monthyon #1 unit	Monthyon	1998	61320	168	2219	3878	111023	18446	11.519	0.077	0.000106	0.344814
Monthyon #2 unit	Monthyon	1998	61320	168	2219	3878	111023	18446	11.519	0.046	0.000106	0.344814
Monthyon #3 unit	Monthyon	1998	35040	96	2219	3878	111023	18446	11.519	0.050	0.000106	0.603425
Mourenx	Mourenx	1990	17520	48	134	31	9695	26	0.080	0.220	0.000006	0.071918
Mulhouse #1 unit	Sausheim	1999	91980	252	909	10125	123215	18958	2.020	0.130	0.000099	0.215699
Mulhouse #2 unit	Sausheim	1999	91980	252	909	10125	123215	18958	2.020	0.180	0.000099	0.215699
Nancy energie #1 unit	Ludres	1995	70080	192	477	702	30378	5306	1.317	0.220	0.000012	0.034332
Nancy energie #2 unit	Ludres	1995	70080	192	477	702	30378	5306	1.317	0.205	0.000012	0.034332
Nantes #1 unit	Nantes	1987	83220	228	289	2391	57288	5169	14.480	0.158	0.000007	0.016799
Nantes #2 unit	Couëron	1994	61320	168	132	2752	30152	3265	2.500	0.076	0.000019	0.060708
Nantes (#2 unit)	Nantes	1987	83220	228	289	2391	57288	5169	14.480	0.155	0.000007	0.016799
Nantes ouest #1 unit	Couëron	1994	61320	168	132	2752	30152	3265	2.500	0.076	0.000019	0.060708
Nevers	Fourchambault	2002	52560	144	101	1557	24505	983	0.540	0.135	0.000005	0.017542
Nice #1 unit	Nice	1977	105120	288	4914	5098	507000	20090	11.000	0.180	0.000014	0.026826
Nice #2 unit	Nice	1977	105120	288	4914	5098	507000	20090	11.000	0.180	0.000014	0.026826
Nice #3 unit	Nice	1982	105120	288	4914	5098	507000	20090	11.000	0.120	0.000014	0.026826
Nice #4 unit	Nice	1998	157680	432	4914	5098	507000	20090	11.000	0.120	0.000014	0.017884
Nîmes Evolia	Nîmes	2004	122640	336	255	2742	22140	853	3.347	0.052	0.000004	0.006409
Noyelles s. L. #1 unit	Noyelles-sous-Lens	1973	58692	161	791	4300	184613	6051	32.990	0.026	0.000015	0.051455
Noyelles s. L. #2 unit	Noyelles-sous-Lens	1973	58692	161	791	4300	184613	6051	32.990	0.035	0.000015	0.051455
Paille	Surgères	1981	30660	84	420	104	48776	12	1.055	0.110	0.000007	0.047619
Pau #1 unit	Lescar	1987	43800	120	360	3525	92712	3446	13.732	0.010	0.000008	0.037580
Pau #2 unit	Lescar	1990	52560	144	360	3525	92712	3446	13.732	0.020	0.000008	0.031317
Pithiviers	Pithiviers	1985	28470	78	179	3139	20329	335	0.890	0.013	0.000001	0.005669
Plouharnel	Plouharnel	1971	36792	101	84	84	39800	973	0.630		0.000004	0.023212
Pluzunet	Pluzunet 22140	1997	61320	168	294	843	28356	374	8.550	0.055	0.000002	0.005545
Poitiers #1 unit	Poitiers	1984	35040	96	149	146	54018	3175	1.800	0.104	0.000006	0.033676
Poitiers #2 unit	Poitiers	1984	35040	96	149	146	54018	3175	1.800	0.175	0.000006	0.033676
Pontarlier	Pontarlier	1989	43800	120	4038	3496	69234	473	0.480	0.074	0.000001	0.005831
Pontcharra	Pontcharra	1977	23652	65	349	100	25333	973	0.870	0.110	0.000002	0.019449

Pontivy	Pontivy	1990	35040	96	558	1443	44345	1885	0.403	0.266	0.000000	0.001998
Pontmain #1 unit	Pontmain	1983	26280	72	805	5914	73318	2342	1.000	0.022	0.000001	0.006979
Pontmain #2 unit	Pontmain	2003	35040	96	805	5914	73318	2342	1.000	0.017	0.000001	0.005234
Rambouillet #1 unit	Ouarville	2000	70080	192	729	3452	206961	1878	12.630	0.093	0.000004	0.012272
Rambouillet #2 unit	Ouarville	2000	70080	192	729	3452	206961	1878	12.630	0.096	0.000004	0.012272
Reims Remival #1 unit	Reims 51689	1989	56940	156	140	6844	106847	3968	11.510	0.041	0.000008	0.026944
Reims Remival #2 unit	Reims 51689	1989	56940	156	140	6844	106847	3968	11.510	0.063	0.000008	0.026944
Rennes #1 unit	Rennes	1968	43800	120	14	14112	111920	10299	8.200	0.035	0.000006	0.026301
Rennes #2 unit	Rennes	1968	43800	120	14	14112	111920	10299	8.200	0.103	0.000006	0.026301
Rennes #3 unit	Rennes	1996	70080	192	14	14112	111920	10299	8.200	0.016	0.000006	0.016438
Rochefort #1 unit	Echillais	1990	21900	60	4911	2040	36596	1455	1.253	0.210	0.000000	0.004475
Rochefort #2 unit	Echillais	1990	21900	60	4911	2040	36596	1455	1.253	0.056	0.000000	0.004475
Rosier d'Egletons	Rosier d'Egletons	1997	46428	127	183	1736	50974	255	2.140	0.130	0.000002	0.009219
Rouen 2 #3 unit	Grand Quevilly	2000	127020	348	4583	12865	88129	19747	3.710	0.007	0.000024	0.037506
Rouen 2 #1 unit	Grand Quevilly	2000	127020	348	4583	12865	88129	19747	3.710	0.005	0.000024	0.037506
Rouen 2 #2 unit	Grand Quevilly	2000	127020	348	4583	12865	88129	19747	3.710	0.005	0.000024	0.037506
Rungis #1 unit	Rungis	1985	74460	204	3586	1517	23618	13102	3.450	0.007	0.000018	0.049396
Rungis #2 unit	Rungis	1985	74460	204	3586	1517	23618	13102	3.450	0.005	0.000018	0.049396
Saint Ouen #1 unit	Saint Ouen 93400	1990	245280	672	5000	65177	147386	48000	39.000	0.103	0.000032	0.025930
Saint Ouen #2 unit	Saint Ouen 93400	1990	245280	672	5000	65177	147386	48000	39.000	0.114	0.000032	0.025930
Saint Ouen #3 unit	Saint Ouen 93400	1990	245280	672	5000	65177	147386	48000	39.000	0.126	0.000032	0.025930
Saint-Jean-d. F. #1 unit	Saint-Jean-De-Folleville	1970	70080	192	1174	4439	43201	3628	7.990	0.037	0.000035	0.099886
Saint-Jean-d. F. #2 unit	Saint-Jean-De-Folleville	1975	70080	192	1174	4439	43201	3628	7.990	0.043	0.000035	0.099886
Saran #1 unit	Saran	1995	61320	168	770	2500	151441	467	1.200	0.050	0.000005	0.015003
Saran #2 unit	Saran	1995	61320	168	770	2500	151441	467	1.200	0.056	0.000005	0.015003
Sarcelles #1 unit	Sarcelles	1978	87600	240	125	4211	33714	5475	2.670	0.066	0.000010	0.022831
Sarcelles #2 unit	Sarcelles	1978	87600	240	125	4211	33714	5475	2.670	0.390	0.000010	0.022831
Sens	Sens	1988	26280	72	552	4387	23572	976	1.285	0.110	0.005200	######
Sète	Sète	1992	49056	134	664	1591	20598	6	0.615	0.170	0.000005	0.022138
St Pierre d'oléron #1 unit	St Pierre d'oléron	1974	43800	120	101	521	17063	1185	0.562	0.052	0.000001	0.004018
St Pierre d'oléron #2 unit	St Pierre d'oléron	1974	43800	120	101	521	17063	1185	0.562	0.064	0.000001	0.004018
Strasbourg #1 unit	Strasbourg	1975	98988	271	2099	282	67519	29	4.600	0.140	0.000018	0.036368
Strasbourg #2 unit	Strasbourg	1975	98988	271	2099	282	67519	29	4.600	0.140	0.000018	0.036368
Strasbourg #3 unit	Strasbourg	1975	98988	271	2099	282	67519	29	4.600	0.140	0.000018	0.036368
Strasbourg #4 unit	Strasbourg	1975	98988	271	2099	282	67519	29	4.600	0.140	0.000018	0.036368
SYCTOM Isséane #2 unit	Issy-les-Moulineaux	2010	267180	732	3500	9600	101000	3100	3.000		0.000500	0.374280
SYCTOM Isséane #1 unit	Issy-les-Moulineaux	2010	267180	732	3500	9600	101000	3100	3.000		0.000500	0.374280
SYTEVOM	Noidans-le-Ferroux	2007	87600	240	265	28	28675	636	1.330		0.000001	0.001142
Thivernal Grigon #3 unit	Thivernal-Grignon	1993	128772	353	4966	6514	203264	20566	5.530	0.082	0.000050	0.077657
Thivernal-Grignon #1 unit	Thivernal-Grignon	1974	88476	242	4966	6514	203264	20566	5.530	0.057	0.000050	0.113025
Thivernal-Grignon #2 unit	Thivernal-Grignon	1974	88476	242	4966	6514	203264	20566	5.530	0.097	0.000050	0.113025
Thonon les Bains	Thonon les Bains	1988	43800	120	187	1003	894	33	1.650	0.256	0.000000	0.000236
Tignes	Tignes	1985	13140	36	261	1280	16476	652	0.590	0.105	0.000001	0.010654
Toulon #1 unit	Toulon	1984	105120	288	356	16051	188145	12231	0.290	0.102	0.000010	0.019639
Toulon #2 unit	Toulon	1984	105120	288	356	16051	188145	12231	0.290	0.177	0.000010	0.019639
Toulon #3 unit	Toulon	1983	122640	336	356	16051	188145	12231	0.290	0.089	0.000010	0.016833
Toulouse #1 unit	Toulouse Mirail	1969	87600	240	262	24019	6137	158	0.220	0.402	0.000000	0.000391
Toulouse #2 unit	Toulouse Mirail	1969	70080	192	262	24019	6137	158	0.220	0.187	0.000000	0.000489
Toulouse #3 unit	Toulouse Mirail	1975	70080	192	262	24019	6137	158	0.220	0.864	0.000000	0.000489
Toulouse #4 unit	Toulouse Mirail	1997	122640	336	262	24019	6137	158	0.220	0.247	0.000000	0.000279
Tronville en Barrois	Tronville en Barrois	1983	35040	96	209	1046	29996	809	3.520	0.253	0.000004	0.023973
UIOM de Brive #3 unit	Saint-Pantaléon-de-Larche	1973	30660	84	118	1269	98470	5984	8.728	0.062	0.000001	0.005095
UIOM de Brive #1 unit	Saint-Pantaléon-de-Larche	1973	30660	84	118	1269	98470	5984	8.728	0.062	0.000001	0.005095
UIOM de Brive #2 unit	Saint-Pantaléon-de-Larche	1973	30660	84	118	1269	98470	5984	8.728	0.062	0.000001	0.005095
UIOM de Calce #1 unit	Calce	2003	96360	264	811	15419	67916	8142	5.470	0.200	0.000006	0.012453
UIOM de Calce #2 unit	Calce	2003	96360	264	811	15419	67916	8142	5.470	0.100	0.000006	0.012453
UIOM de Cenon #1 unit	Cenon	1984	70080	192	29	172	68265	7253	0.640	0.067	0.000002	0.006478
UIOM de Cenon #2 unit	Cenon	1984	70080	192	29	172	68265	7253	0.640	0.012	0.000002	0.006478
UIOM Inova	Saint-Benoît-La-Forêt	1983	24528	67	363	1070	33855	3014	0.328	0.021	0.000001	0.004664
Valenciennes #1 unit	Saint Saulve	1977	48180	132	459	18740	107099	6388	0.240	0.873	0.000003	0.011208
Valenciennes #2 unit	Saint Saulve	1977	48180	132	459	18740	107099	6388	0.240	0.444	0.000003	0.011208
Valenciennes #3 unit	Saint Saulve	1977	48180	132	459	18740	107099	6388	0.240	0.285	0.000003	0.011208
Vaulx #1 unit	Vaux-le-Penil	2003	70080	192	1681	6538	93229	4834	1.590	0.066	0.000010	0.028082
Vaulx #2 unit	Vaux-le-Penil	2003	70080	192	1681	6538	93229	4834	1.590	0.070	0.000010	0.028082
Vernou-en-Sologne	Vernou-en-Sologne	1986	20148	55	277	246	9696	69	2.480	0.189	0.000001	0.005460
Vert le Grand #1 unit	Vert le Grand	1999	122640	336	2400	40296	76721	7697	14.490	0.094	0.000016	0.025277
Vert le Grand #2 unit	Vert le Grand	1999	122640	336	2400	40296	76721	7697	14.490	0.048	0.000016	0.025277
Villefranche #1 unit	Villefranche sur Saône	1984	39420	108	250	3490	47710	470	0.100	0.167	0.000013	0.066464
Villefranche #2 unit	Villefranche sur Saône	2002	56940	156	250	3490	47710	470	0.100	0.065	0.000013	0.046013
Villejust #1 unit	Villejust	1972	52560	144	420	3800	22150	1500	5.491	0.084	0.000004	0.014699
Villejust #2 unit	Villejust	1984	70080	192	420	3800	22150	1500	5.491	0.036	0.000004	0.011025
Vitré	Vitré	1988	35040	96	200	80	20502	545	1.750	0.156	0.000002	0.010451
Total Capacity			**17201136**	**47126**								
Total number of units				**248**								
Total number of plants				**128**								
Average Values					**1637**	**7268**	**77550**	**7177**	**5**	**2.486**	**#####**	**#####**
Regulated Values					**150000**	**150000**	**100000**	**500000**	**10**	**200**	**0.0001**	**0.1**

:Not Available

Source: French Ministry of Ecology