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Press kit

The *Centre de la Manche* Disposal Facility

1969-2009: 40 years of history

22 September 2009

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SUMMARY

The *Centre de la M*anche Disposal Facility 1969-2009: 40 years of history

Located in Digulleville, at the northwestern tip of the Cotentin Peninsula, some 20 km west of Cherbourg, in Normandy, the *Centre de la Manche* Disposal Facility (CSM) covers an area of approximately 14 hectares. The facility was the first of its kind for the surface disposal of radioactive waste.

Between 1969 and 1994, the last year any waste packages were received at the facility, the CSM accomodated **about 527,000 m³** of low-level and intermediate-level (LIL) radioactive waste. For 25 years, operating teams worked hard at improving rigour and effectiveness in the management of the facility improve in. Reflection exercises were conducted, regulatory provisions were adopted, buildings were built and techniques were implemented with a view to **generating a new industry known as radioactive-waste disposal and management.**

In 2003, the CSM entered officially in its post-closure monitoring phase for several centuries.

40 years of presence... **which Andra will perpetuate for many years ahead.**

1969-79: the first steps

Right from the very beginning, everything had to be created from scratch due to the concurrent need to organise the first deliveries of waste packages and to build the various equipment of the facility. A compacting press for packages was installed, followed by a concrete mixing plant to produce the embedding material for compacted drums and the binding agent for the first disposal structures. Waste drums were first deposited in open trenches in the ground, but that solution involved a certain number of predicaments and was rapidly replaced by disposing of waste packages on concrete plarforms or in concrete trenches, depending on their radioactive level.

The initial operating period was marked by continuous progress during which it was necessary to analyse and to correct errors, as well as to provide rapidly all required improvements. In 1976, following the overflow of a disposal cell containing tritiated-waste packages, the disposal procedure for such packages was modified: a new conditioning method was developed with specifically-designed containers for them, the acceptance levels for tritium concentrations in packages was lowered and specific controls were set in place on production sites during the waste-conditioning stage. The large majority of waste resulting from the incident was reconditioned and stored before being sent back to the producer involved.

By 1978, some 100,000 m³ had already been disposed of at the CSM.

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1979-83: THE TRANSIENT PHASE

In 1979, the creation of Andra as a specific agency responsible for radioactive-waste management within the French Atomic Energy Commission (*Commissariat à l'énergie atomique* – CEA), highlighted the significance given to the issue in the nuclear cycle.

During that period, Andra established the management rules for the future CSM; they included manufacturing procedures for waste packages, specific acceptability limits for the CSM, conditioning type, etc. In parallel, package standardisation was implemented, while the use of standard slips facilitatedthe input of computerised data and reorganised the information appearing on old supports. The industrial phase was near.

1983-94: THE INDUSTRIAL PHASE

During the industrial phase, on-site operations were rationalised and the management of disposal structures was improved especially with the creation of structures with concrete walls. From 1982 to 1985, the water-collection system was entirely redesigned. Rainwaters and seepage waters were segregated from each other. A buried separative gravity system was built with a view to recovering seepage water.

Starting in 1985, every waste producer had to be certified, which mleant they had to abide by physical requirements for every package (dimensions, drums or boxes made of soft steel, hulls or boxes made of reinforced or fibrous concrete) and provide a detailed description of its content before Andra would be allowed to take over responsibility for it. The Agency also computerised all relevant data concerning the follow-up of the package, from the control at the producer's to its monitoring in the disposal structures.

In 1991, the *Law of 30 December* granted Andra the statute of a public industrial and commercial establishment (*établissement public industriel et commercial* – EPIC), independent from waste producers. Its missions were expanded and its powers were reinforced. The same year, started the construction of the cover in order to protect the disposal facility throughout the radioactive-decay phase. The last waste package was received on 30 June 1994. During its 25 years in operation, the CSM accommodated *527,225 m^3* of radioactive waste.

THE COVER – THE MONITORING PHASE

Between 1991 and 1997, a multi-layer cover was laid over the disposal facility. Several thousands of cubic metres of materials were brought on site by lorries, and a bitumen layer was installed between several layers of sand and earth. The membrane consisted of a polyester film, selected for its elasticity and its capability to adjust to ground movements. The film was coated with bitumen in order to ensure its impermeability. All membrane strips, totalling 35 km in length, are welded together and controlled by an ultrasound system.

The purpose of the cover is to prevent water from reaching the packages and, thus, from disseminating radioactive substances in groundwaters. The cover is also designed to protect the disposal facility against all ground movements, as well as any human, animal or plant intrusions. Lastly, a series of networks (drifts, pipes and drains) is collecting all rainwaters and seepage waters throughout the site.

In January 2003, the CSM entered officially into its long-term monitoring phase. The phase will last over several centuries with a view to controlling the impact of the facility on its environment, identifying any abnormal situation and implementing any required corrective measure. Today, the impact of the facility on its environment remains very low.

Presentation of the CSM

Spread over an area of approximately14 ha, the CSM is implemented in Digulleville, at the northwestern tip of the Cotention Peninsula, some 20 km west of Cherbourg, in Normandy. The facility was commissioned in 1969 and, over the following 25 years, received *close to, 527,000 m³* low-level and intermediate-level (LIL) waste. Waste deliveries stopped at the CSM in 1994. In early 2003, the facility entered into its post-closure monitoring phase for several centuries.

Opened in 1969 by the CEA, the CSM is the first French surface disposal facility for radioactive waste. Its management was later assigned to Andra, when the Agency was instituted in 1979.

Waste disposal at the CSM

All waste being disposed of in the facility consists of solid LIL waste, including mostly residues resulting from maintenance operations (clothing, tools, filters, etc.) or from the operation of nuclear facilities (treatment of liquid effluents or filtration of gas effluents). They may also originate from site-cleanup and dismantling operations.

Since 1992, that type of waste is disposed of at the *Centre de l'Aube* Disposal Facility for LIL waste (CSFMA).

The disposal concept

At the CSM, there are two types of disposal structures:

- ***tumulus***: waste packages, whose conditioning is sufficient to ensure on its own an adequate protection against radioactivity, have been piled up in a pyramid-shaped structure. The voids between packages were filled up with gravel ;

- ***monolith***: packages have been deposited in reinforced-concrete cells and gaps were filled entirely with liquid concrete.

The cover

At the end of the operating phase, a cover consisting of several layers of gravel, earth, sand, etc., and of an impermeable membrane was laid over the disposal structures for their protection. **Those overall layers ensure the impermeability of the cover, which acts as an umbrella**, thus allowing the water to run off and to be collected through a draining system and controlled before being released ultimately. The system also prevents rainwaters from seeping down to the waste packages and from disseminating radioactivity into the environment. The area was also planted with grass in order to prevent ground erosion.

The measurements taken right after the installation of the cover between 1991 and 1997 have shown a reduction by a factor of 100 to 200 of the quantities of water reaching the disposal structures, thus demonstrating the efficiency of the cover.

Monitoring the CSM

Once the cover was installed, the CSM was officially authorised to enter into its post-closure monitoring phase by the Decree of 10 January 2003. Throughout that phase, which is scheduled to last for several centuries, Andra's objective will be to monitor the impact of the facility on its environment and to verify the behaviour of the cover in order to ensure not only its efficiency against rainwater infiltrations, but also the long-term soundness of the characteristics of the impermeable membrane over time.

The results of the monitoring programme at the CSM are available on Andra's Web site (*www.andra.fr*).

Public access

The CSM is open to the public. The Visitors' Centre is designed to illustrate Andra's missions and to display the facility's history and current events. Topical displays on the transmission of its memory and on heritage conservation are also available free of charge.

Every year more than 1,000 people discover the installations of the CSM, including tourists, students, private individuals, constituted groups, etc.

Milestones of the CSM

1967 Selection of the site.
1969 Creation decree of the CSM and commissioning by Infratome under CEA responsibility
1979 Creation of Andra within the CEA, and take-over of the CSM's management by the Agency
1991 *Law of 30 December 1991*: Andra becomes an industrial and commercial establishment
1994 Reception of the last waste package
1991-7 Installation of the cover
2003 Decree authorising the transition to the monitoring phase and order authorising releases

Monitoring the CSM

Since January 2003, the CSM has officially entered into its post-closure monitoring phase for several centuries. Andra's objective during that phase is to control the impact of the facility on its environment and to identify abnormal situations in order to implement any required corrective measures.

A regulatory monitoring plan of the CSM and of its environment has been implemented. The plan is approved by the French Nuclear Safaty Authority (*Autorité de sûreté nucléaire* – ASN) and details the scope of Andra's monitoring activities, as follows:

- the impermeability of the cover;
- releases from disposal structures;
- releases from the CSM into the environment, and
- the control of the sound operation of release installations.

The monitoring is designed to evolve towards a more and more limited surveillance, followed by a so-called "passive" monitoring phase during which Andra's permanent presence would not be necessary.

Monitoring the environment

Every year, close to 10,000 measurements are taken to ensure that the CSM only has a very low impact on its environment and to control the quality of the releases and the efficiency of the monitoring devices.

Results show that the impact of the CSM is very much lower than the regulatory exposure limit for the public (1 mSv/y).

Every year, the results of the CSM's monitoring programme are available on Andra's Web site (*www.andra.fr*).

Monitoring the cover

The cover of the CSM consists of a multi-layer structure designed to isolate the waste from potential human intrusions or from external aggressions, whether natural (e.g., rainwaters) or animal, throughout the monitoring phase. The cover is made of alternating draining and impermeable layers (gravel, earth, sand, bitumen membrane, etc.).

The overall combination of such layers ensure the impermeability of the cover. The cover acts as an umbrella, thus allowing the water to run off and to be collected and controlled before being ultimately released. Hence, the cover prevents rainwaters from seeping down to the waste packages and from disseminating their radioactivity into the environment.

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Monitoring the cover consists in verifying its efficiency against rainwater infiltrations and the soundness of the characteristics of the membrane.

In order to achieve that goal, it is necessary:

- to measure water runoffs under the membrane and to ensure that they do not exceed a specific limit of a few litres per year and per square metre of cover;
- to make visual inspections in order to verify the soundness of the membrane;
- to conduct a topogaphical survey in order to detect potential movements (landslides, subsidences);
- to collect membrane samples every 5 to 10 years and to analyse them in a laboratory in order to monitor its evolution over time (the last samples were collected in September 2005).

Observed phenomena on the cover

Two different ground movements were detected since the beginning of the monitoring activities:

- **subsidences**, or vertical displacements of the cover due to the collapse of certain older packages. During the design stage of the cover, the possibility of such phenomena had justified the use of an elastic membrane capable of deforming itself under their effect. Since the beginning of monitoring activities, several subsidences were observed. One of them was more significant than the others that occurred to the north-east of the CSM and will be the subject of repairs scheduled in October 2009. In that case, gravel should be injected under the membrane in order to fill the void induced by the collapse of the packages, and
- **landslides over the membrane on the border of the cover,** due to the excessively-steep inclination of the slopes resulting from the exiguity of the site on which the cover was installed. Securing operations involving the installation of a gravity wall at the base of the slope were carried out by Andra in order to prevent potential landslides over the road passing close to the CSM. As a complement, a fact file on the reinforcement operations proposed by Andra has been submitted to ASN's approval.

The measurements taken for environmental-monitoring purposes as soon as the cover was installed between 1991 and 1997 have shown a reduction by a factor of 100 to 200 of the quantities of water reaching the disposal structures, thus confirming the efficiency of the cover.

As in the case of measurements results being recorded regularly in the CSM's neighbouring environment, ground movements affecting the cover do not compromise its impermeability and do not induce any increase in radioactive releases towards the environment.

The memory of the CSM

Between 1969 and 1994, the CSM accommodated LIL radioactive waste, but today, the facility has entered into its monitoring phase during which Andra has the satutory obligation to preserve its memory for the next 300 years.

The purpose of preserving the memory of the CSM is to ensure that future generations are:

- **well informed about the existence and the content of the site,** notably with regard to the risk of human intrusions, especially if a social upheaval (war, disaster, etc.) occurred or led to the abandonment of the site (lack of supervision, etc.);

- **facilitated in their understanding of the observed phenomena** (abnormal presence of radioactive or non-radioactive substances in the environment, total or partial subsidence of the site, etc.) and, as required, are allowed to carry out corrective measures under sound conditions, and

- **allowed to make decisions with a full knowledge of the facts regarding the future of the site,** notably with regard not only to changes or transformations in response to technical and societal advances over the next 300 years, but also to its future after that period.

Memory preservation relies on five mechanisms, as follows:

2 so-called "active-memory" mechanisms over the short and medium terms:

- Andra's communication actions towards the public (site newsletter, visitor reception, etc.) to be maintained as long as possible during the post-clorure monitoring phase, and

- Control of the sound operation of the facility and information of local populations by the CSM's Local Information Committee (*Commission locale d'information* – CLI), and

3 so-called "passive-memory" mechanisms over the longer term:

In order to preserve and transmit the memory of the site to future generations, Andra has implemented a **long-term archiving plan** with a view to ensuring the perennity of the essential documents concerning the site. **Permanent paper was selected as the reference support,** since it is currently the only one providing enough guarantees over very long periods of time. A stable ink over time as also been selected on the basis of the recommentdation of the Research Centre on the Conservation of Graphics Documents (*Centre de recherches sur la conservation des documents graphiques*).

The archiving plan is based on a dual methodology involving both a detailed memory and a brief memory.

- **Detailed memory**

The detailed memory of the CSM contains the full series of relevant documents for a sound understanding of the site (files, reports, technical plans, etc.). It includes more than 10,000 documents (i.e., about 500,000 pages stored over slightly more than 60 liner metres. It covers all phases of the facility's lifetime. Only about 100 of those documens (less than 1%) are currently necessary for the monitoring of the facility. The paper copies of the selected original documents have all been duplicated in two copies on permanent paper using qualified equipment and products recommended by the French National Archives. One of the copies of the CSM's detailed memory was transferred to the French National Archives in 2004 and the first supplement containing the first five monitoring years was added in 2005. The second copy is identical and is kept directly at the CSM.

- **Brief memory**

The brief memory, representing a faithful summary of all important information concerning the existence of the CSM, already exists and will be distributed at a later date to all institutions providing the best guarantees for ensuring its perennity: prefectures, town halls, cadaster services, boards of notaries, etc. The first edition of the brief memory is already available on Andra's website (*www.andra.fr*). Throughout its 169 pages, it describes the most significant data concerning the CSM, and especially useful ones for decision-makers, whether local (prefect, mayors, notaries, etc.) or national (ministries, etc.) to take sound decisions, if need be, with a full knowledge of the facts. The brief memory must also ensure the preservation of the memory of the CSM among the public (notably though public associations), as well as national administrations (ASN, DRIRE, etc.) and international organisations (OECD/NEA, IAEA, etc.). The brief memory will be reassessed at every decennial review of the safety report.

The third passive-memory mechanism consists in easements (or any act to be registered in the cadaster in the near future) in order to ensure that the site and the neighbouring area will not be used in the future without a full knowledge of the facts. Such easements could be implemented at a later date.

For further information, please consult Andra's Web site (*www.andra.fr*) (under "*Safety and environment"* tab).

The CSM hosts the first meeting of DISPONET, an international exchange network on the disposal of low-level waste

On 23-25 September 2009, France will host at the CSM the first international event to be organised by the International Atomic Energy Agency (IAEA) in the framework of the Low-Level Waste Disposal Network (DISPONET), whose purpose is to share knowledge and experience on the disposal of low-level radioactive waste.

Set in place by the IAEA in September 2007, DISPONET is responsible for promoting experience exchanges and for co-ordinating help programmes with countries in which disposal is being considered for the management of low-level radioactive waste.

Topics to be addressed will include:

– the disposal of LIL-SL waste, including particularly the operating waste from the nuclear-power sector;

– the disposal of VLL waste, most of which result from the dismantling of nuclear facilities;

– issues relating to all phases throughout the lifetime of a disposal facility: administration, technologies, safety studies, monitoring and closure;

– the improvement of existing disposal facilities;

– quality assurance;

– financial aspects, and

– stakeholders and public acceptance.

The Cherbourg Seminar to be held on 23-25 September 2009 on the Environmental Monitoring of Disposal Facilities is the first major international event organised by the IAEA in the framework of DISPONET.

More than 50 participants from about 20 different countries are expected.

An adapted management method for every type of radioactive waste

There are various categories of radioactive waste depending on their toxicity and on the evolution of that toxicity over time. A classification has therefore been set up in order to ensure the sound management of every waste category over the long-term. The *French National Inventory* lists all past and future French waste. Such forecasts ensure that the overall management system will account for all waste to be produced until the end of 2030.

Very diversified radioactive waste

Characteristics vary from one waste category to the other, according to their physical and chemical nature, the level and type of radioactivity, etc.

In order take over responsibility for the waste and **to design commensurate disposal facilities with their toxicity and the evolution of that toxicity over time**, the residues are **classified by category**. In France, that classification of radioactive waste relies notably on two parameters:

the radioactivity level (or activity) of the waste, which is generally expressed in becquerels per gram (Bq/g) and corresponds to the quantity of radiation emitted by the radionuclides (radioactive atoms) contained in the waste;

the lifetime of the waste, which depends on the respective **radioactive half-life** of each radionuclide they contain. It is expressed in either years, days, minutes or seconds. The radioactive half-life corresponds to the time required for the initial activity of a given quantity of the same radionuclide to decrease by half. In that context, the waste is said to be “short-lived”, if the radioactive half-life of their major radionuclides does not exceed 31 years, and “long-lived”, when they do[1].

[1] The 31-year threshold was selected on the basis of the radioactive half-life of caesium-137 (30.05 years), a readily-measurable fission product, which is representative of the overall fission products contained in radioactive waste.

Other criteria (e.g., chemical composition) may have an impact on the classification of a specific type of waste.

In France, radioactive waste is divided into five categories:

Very-low-level waste (VLL)

Low-level and intermediate-level short-lived waste (LIL-SL)

Low-level long-lived waste (LL-LL)

Intermediate-level long-lived waste (IL-LL)

High-level waste (HL)

A well-controlled management

Similarly to many other countries, France has selected disposal as the long-term management solution for radioactive waste. The dispocal facilities designed by Andra are adapted to the nature of every waste category. Hence, those facilities are able to contain durably the substances present in the waste throughout their radioactive decay.

Today, there are two surface disposal facilities for VLL and LIL-SL waste respectively, representing close to 90% of the total volume of radioactive waste being produced in France. In the case of the other waste categories (LL-LL, IL-LL and HL), adapted disposal facilities are currently under study.

Classification of French radioactive waste in relation to the management method

(Reference: 2009 edition of the *French National Inventory*)

Very-low-level (VLL) waste	**Very-short-lived (VSL) waste** Consisting mainly of hospital waste, they are first managed on the production sites through radioactive decay, and then as conventional waste	**VLL waste** Surface disposal at the C*entre de l'Aube* VLL Waste Disposal Facility Waste volumes in 2007: **231,688 m³** (including 89,331 m³ disposed of) Waste volumes in 2007**: 869,311 m³**	
Low-level (LL) waste		**LIL-SL waste*** Surface disposal at the *Centre de l'Aube* Disposal Facility for LL/IL Waste, which superseded the CSM (now shut down and placed under monitoring). Volume in 2007: **792,695 m³** (including 735,278 m³ disposed of) Volume in 2030: **1,174,193 m³**	**LL-LL waste** Project for a shallow disposal facility (at a depth of 15-200 m) under study. Commissioning scheduled around 2019. Waste volumes in 2007: **82,536 m³** volume in 2030**: 151,876 m³**
Intermediate-level (IL) waste		**IL-LL waste** Project for a deep repository at 500 m under study Commissioning scheduled in 2025 Volume in 2007: **41,757 m³** Volume in 2030**: 51,009 m³**	
High-level (HL) waste		**High-level waste** Project for a deep repository at 500 m under study Commissioning scheduled in 2025 Volume in 2007: **2,293 m³** Volume in 2030: **5,060 m³**	
	Very short-lived (VSL) waste Radioactive half-life < 100 days	**Short-lived (SL) waste** Radioactive half-life ≤ 31 years	**Long-lived (LL) waste** R Radioactive half-life > 31 years

* Some waste contain an excessive quantity of tritium (radioactive hydrogen) must be stored before disposal in order to allow for the decay of that tritium, whose radioactive half-life is about 12 years.

Andra

The French National Radioactive Waste Management Agency (*Agence nationale pour la gestion des déchets radioactifs* – Andra) is a State organisation responsible for developing, implementing and guaranteeing safe solutions to protect current and future generations against the impact of French radioactive waste over the short and long terms. In order to achieve that goal, France, similarly to many other countries, has opted for the disposal of such waste in adapted industrial facilities.

Andra constitutes a public industrial and commercial establishment pursuant to the *Law of 30 December 1991*. Its mission was expanded by the *Planning Act of 28 June 2006 Concerning the Sustainable Management of Radioactive Materials and Waste*. It is fully independent from the producers of radioactive waste and is placed under the supervision of the Ministries for Energy, the Environment and Research.

Andra's activities

Andra's mission is divided into five activities, as follows:

1. **Study and design of management solutions** for waste categories pending an industrial system;

- Shallow disposal facility (15-200 m in depth) for low-level long-lived –LL-LL) waste, and

- Deep reversible repository (500 m in depth) for high-level (HL) and intermediate-level long-lived (IL-LL) waste, the commissioning of which is scheduled in 2025 in the Meuse/Haute-Marne Districts, subject to prior approval;

2. **Operation** of two surface disposal facilities, located in the Aube District, for very-low-level (VLL) and low-level and intermediate-level short-lived (LIL-SL) waste, respectively; **monitorinng** of the *Centre de la Manche* Disposal Facility, the first French disposal facility, which is now closed after reaching its maximum disposal capacity;

3. **Collection** of waste outside the nuclear-power sector (generated by hospitals, research laboratories, universities, etc.) and of radioactive items dating mostly from 1920 to 1940 and held by private individuals;

4. **Cleanup,** at the request of the public authorities or owners, of old sites contaminated with radioactivity, when the responsible entity is defaulting, and

5. **Publication** every three years of the ***French National Inventory of Radioactive Materials and Waste.***

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Andra's missions of general interest

The *Planning Act of 28 June 2006* assigned specific missions of general interest to Andra, for which the funding is guaranteed by a public subsidy.

Those different missions have a threefold objective, as follows:

- **Preparation and publication every three years of the *French National Inventory of Radioactive Materials and Waste*:**

The Inventory serves as a reference tool for the management of French radioactive waste; it provides information on the location, the nature, as well as the current and future volumes of radioactive materials and waste throughout France.

- **Collection and take-over of old radioactive items held by private individuals:**

Those radioactive items originate from the radium industry, ment which was very active between 1920 and 1940 to manufacture many everyday objects (lipstick, skin-care creams, luminescent alarm clocks, etc.) or medical and paramedical equipment (radium needles, needle covers, radioactive probes, water fountains, etc.). Today, those items may still be found in private homes or in collections, or may even have been forgotten in attics. In 2009, Andra launched an information campaign for the sake of elected officials, firemen and waste-treatment unions. Every year, Andra services collect about 100 radioactive items.

- **Cleanup of sites contaminated with radioactivity, in cases of defaulting responsible entity**

In most cases, the sites were polluted by old activities that were carried out between 1920 and 1940 outside the nuclear-power (extraction of radium for medical or parapharmaceutical purposes, mining, etc.). Polluted sites are described as areas where radioactive substances have been handled or stored without any form of control, thus inducing the dissemination of such substances and involving a potential health risk depending of the current use of the site. Today, prospecting operations are conducted in order for Andra teams to identify, to secure and to clean up those sites. At the end of 2007, France accounted for 24 sites pending or undergoing cleanup. In cases where cleanup activities generate radioactive waste, which represents a yearly volume of about 300 m^3, the waste is taken over in accordance with an adapted procedure.

In April 2007, the **National Assistance Commission for Radioactive Matters (*Commission nationale des aides dans le domaine radioactif* – CNAR)** was created under the aegis of Andra's Board. That commission constitutes an orientation and decision-making tool for allocating the public subsidy: free or highly-assisted take-over of radioactive items, definition of priorities for the rehabilitation of sites contaminated with radioactivity.

Andra's funding

Andra

Key figures (on 31 December 2008)

416 paid employees

6 sites:

- 1 **head office** in Châtenay-Malabry (Hauts-de-Seine District);
- 3 **disposal facilities** (2 in the Aube District, 1 in the Manche District);
- 1 **underground research laboratory** in the Meuse/Haute-Marne Districts, and
- 1 **technological exhibition hall** in the Meuse/Haute-Marne Districts.