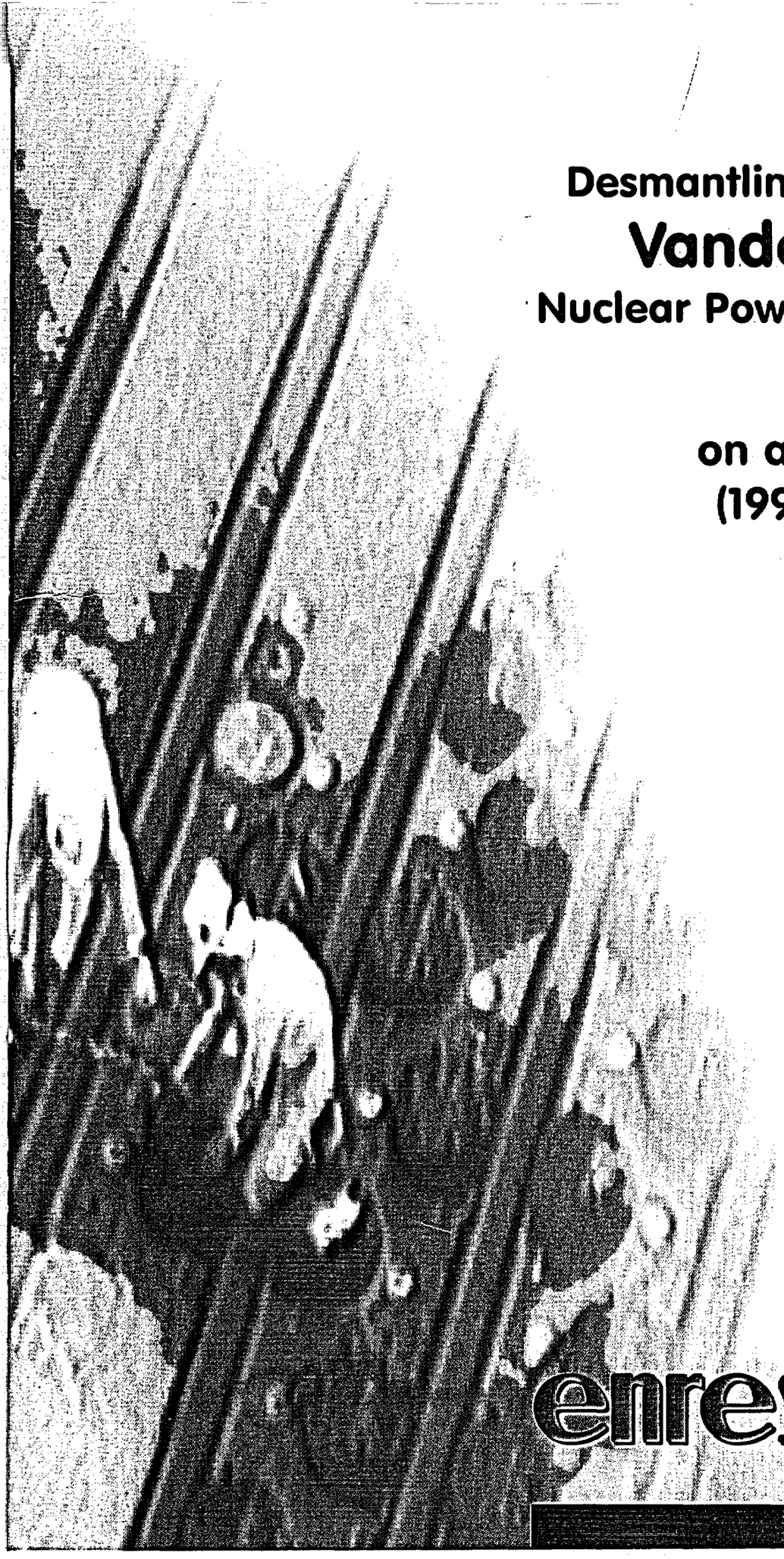

Desmantling of the Vandellós I Nuclear Power Plant

Report on activities (1998-1999)

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enresa

Antonio Colino

Chairman of the
Empresa Nacional
de Residuos Radiactivos
(ENRESA)

The dismantling of Vandellós I Nuclear Power Plant has become one of the most emblematic activities carried out by the Spanish radioactive waste management agency, both because of the scope and complexity of the task and because of the challenge involved in performing this, the first project of this type to be addressed in Spain, and one of the first in the world.

The dismantling work is being performed under the watchful eye of the leading experts in this field at national and international level, with whom ENRESA is proud to share its experience and the new technologies used during the process.

This policy of transparency and open collaboration with the scientific community is the same one as has guided our relations with the immediate environment in which we operate, the province of Tarragona and the municipal area of Vandellós i l'Hospitalet de l'Infant.

This is precisely the objective of the Report before you, which is an accurate account of the activities performed from the moment when ENRESA became the operator responsible for the Vandellós I Nuclear Power Plant, at the beginning of 1998, until the end of 1999, a milestone marking the equator of the dismantling process.

The document is a mirror of our continuous striving towards safety and quality, essential principles that underlie all of ENRESA's activities and which have guided those performed during the Dismantling Plan.

It remains only for me to express our gratitude for the trust and collaboration that our company has received at all times from the institutions and the society of Catalonia.

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A singular experience

The Vandellós I NPP, owned by the company Hispano–Francesa de Energía Nuclear, S.A. (HIFRENSA), was first coupled to the grid on 6th May 1972. The facility, located in the municipal area of Vandellós i l'Hospitalet de l'Infant (Tarragona), is Spain's only natural uranium-graphite-gas nuclear power plant, a technology developed in the United Kingdom and in France.

The plant was taken out of service as a result of a fire that occurred on 19th October 1989. Although this incident had no radiological consequences and damage was caused only to the conventional installations, the Ministry of Industry and Energy (MIE) suspended the plant's operating permit in November of that same year. Vandellós I ceased its activity after 17 years of operation and having generated 55,647 million kW, a production equivalent to the entire electricity consumption of the city of Barcelona during that period.

The high cost involved in recovering the plant led the Ministry of Industry and Energy to shut it down definitively in July 1990. This was accomplished by means of a Ministerial Order that established the conditions under which HIFRENSA was to maintain the facility in the safe shutdown mode, undertake the phase prior to dismantling and subsequently transfer ownership of the site to the Empresa Nacional de Residuos Radiactivos (ENRESA).

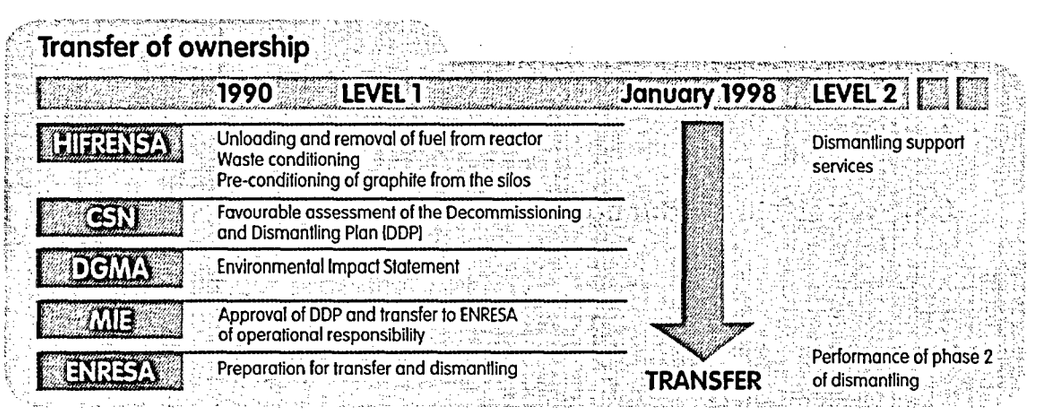
This Ministerial Order commissioned ENRESA to draw up a Decommissioning and Dismantling Plan (DDP) for the plant. After studying various alternatives, ENRESA submitted the Vandellós I Dismantling Plan to the Tarragona Provincial Delegation of the Ministry of Industry and Energy in May 1994.

Signing of the Plant ownership transfer deed before the Notary

On 28th January 1998, the Ministry of Industry and Energy approved the Vandellós I NPP Decommissioning and Dismantling Plan, in the wake of a favourable report by the Nuclear Safety Council (CSN) and the issuing of an Environmental Impact Declaration by the General Direction of the Environment (DGMA) of the Ministry of the Environment. On 4th February of that year ENRESA became the operator responsible for the plant. On completion of the dismantling, HIFRENSA, as the plant owner, will take charge of the released part of the site.

The Vandellós I NPP is the first to be dismantled in Spain and one of the first commercial power plants to be dismantled in the world. Consequently, the Dismantling Plan drawn up by ENRESA has become a pioneer undertaking, and the work performed is being tracked with interest by the experts in the sector.

Transfer of ownership



The Dismantling Plan

The Empresa Nacional de Residuos Radiactivos (ENRESA) –created by Royal Decree in 1984 to undertake responsibility for the management of radioactive wastes, the dismantling of nuclear and radioactive installations and public information- carried out an exhaustive study of the situation of the installation, the available technologies and international experiences in the decommissioning and dismantling of plants similar to Vandellós I before submitting its proposal for action.

After analyzing the existing alternatives, the Ministry of Industry and Energy opted for an initial phase including the dismantling of practically all the structures and components external to the reactor, except those required to ensure confinement. These will be dismantled along with the reactor itself after a waiting period of 25 years, thus releasing the entire site.

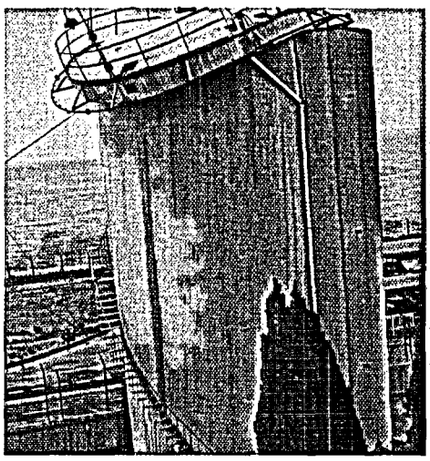
This option, similar to that adopted by the neighbouring European countries, has numerous advantages, among them the non-existence of risks of accidents due to component operating failures, due to its being a passive system, the negligible generation of secondary wastes and the low economic cost of implementation, surveillance and conservation. Furthermore, from the operational point of view, the dismantling project is considered to be technically feasible since it involves the general use of simple technologies available in Spain, as well as widely used working methodologies and tools.

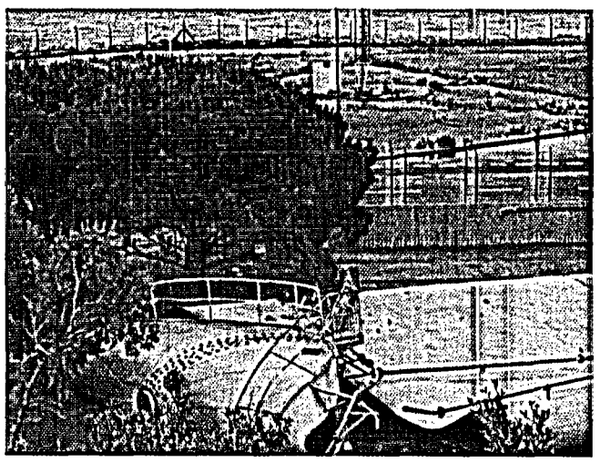
As established in the project, on completion of the initial phase the reactor pile will be suitably isolated, the residual activity contained therein being confined and decaying with time. The site, which will be reduced to 20% of the original area, will remain under surveillance throughout the latency period, in order to ensure the safe isolation of the reactor pile. In this respect, a series of activities is foreseen, aimed at maintaining the pile under safe conditions. Among these activities is the performance of studies on the conservation and degradation of the structures, and periodic leak tests.

The Decommissioning and Dismantling Plan includes a complete analysis of the environmental implications of the project. The study, approved by the Ministry of the Environment on 24th February 1997, guarantees that the impact on the soil will be limited to the plant site itself, and no radiological or conventional incidents are expected to affect the flora, fauna or groundwaters of the surroundings.

Nevertheless, as a precautionary measure, the project includes the implementation of surveillance programs designed to check for compliance with the measures required to prevent affects on the Environment.

Demolition of fuel-oil tanks





In accordance with the requirements of the International Atomic Energy Agency (IAEA), the Vandellós I Dismantling Plan contemplates the following levels of action:

LEVEL 1

Previous conditioning activities

The plant owner company, HIFRENSA, was in charge of this prior level of dismantling, which was completed in 1997.

In compliance with the Ministerial Order of July 1990, which established the definitive shutdown of Vandellós I, the owner company performed the following processes:

- Unloading of the reactor and removal of the fuel.
- Conditioning of operating wastes.
- Removal and preconditioning of the wastes in the graphite silos.

HIFRENSA removed the spent fuel (high level radioactive wastes) and sent it to France for reprocessing, and also conditioned the low and intermediate level radioactive wastes produced during plant operation. Furthermore, it was in charge of disassembling certain of the exterior conventional installations, along with the turbines and CO_2 tanks.

LEVEL 2

Dismantling of structures and preparation for reactor latency

Activities performed under the responsibility of ENRESA began in February 1998 and will finish at the end of the year 2002.

The objectives are to release 80% of the site, recovering the land for subsequent return to HIFRENSA and keeping the remaining 20% as a regulated area including the reactor pile confined in a newly constructed outdoor protection structure.

This level includes two performance phases:

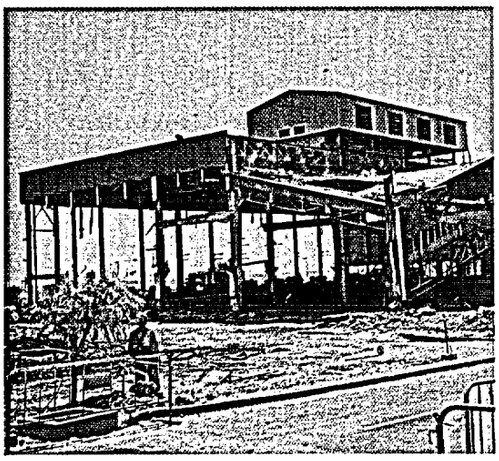
First phase

This was performed between February 1998 and February 1999, and its objectives were as follows:

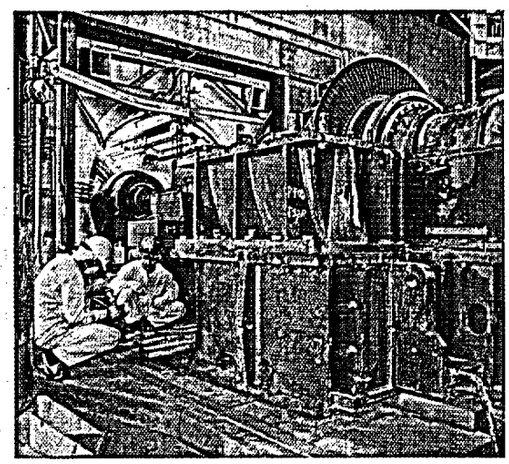
- To condition the site for disassembly work in radioactive zones.

To dismantle and remove conventional equipment and structures from the site.

Demolition of Auxiliary Plant building



Disassembly of turbo-blower



Second phase

This began in March 1999 and will finish at the end of 2002. The objectives are as follows:

- To address the Active Parts Dismantling Plan.
- To separate conventional materials from radioactive wastes.
- To control and ensure that the conventional materials are not contaminated, by means of the so-called Declassification Process.
- To dispatch low and intermediate level wastes to the El Cabril Disposal Facility.
- To dispatch conventional materials to authorized centres for recycling or disposal at authorized tips.
- To continue the dismantling of conventional zones.

LATENCY PERIOD

The non-released parts of the site will remain under the responsibility and surveillance of ENRESA for 25 years, a period considered to be sufficient for the radiological activity in the structures of the pile to decay to approximately 5% of its present levels.

At that time it will be possible to undertake Level 3 dismantling at minimum radiological costs for the personnel performing the work.

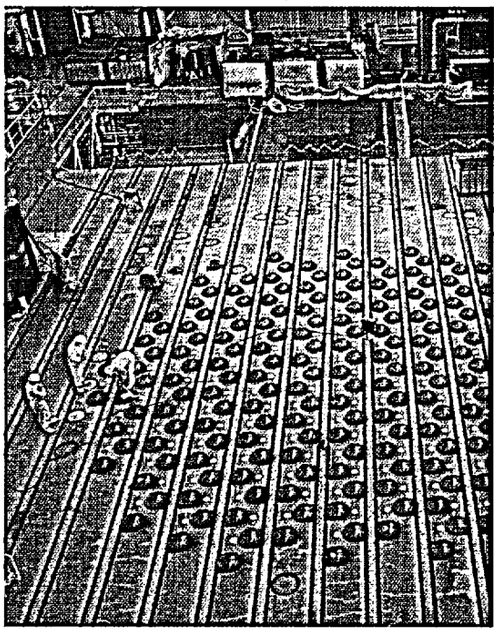
LEVEL 3

Dismantling of reactor pile

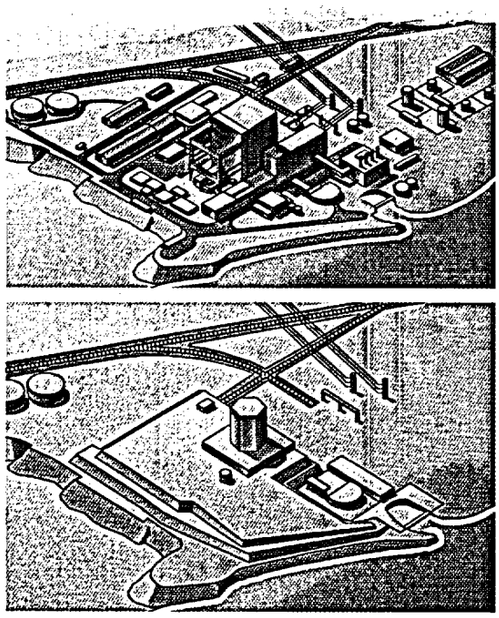
On completion of the latency period, around the year 2027, the last level of dismantling will begin. This will imply the total release of the site and its return to the owner, HIFRENSA.

The budget for Level 2 Dismantling is 14,800 million pesetas. The forecast for Level 3 is approximately 35,000 millions.

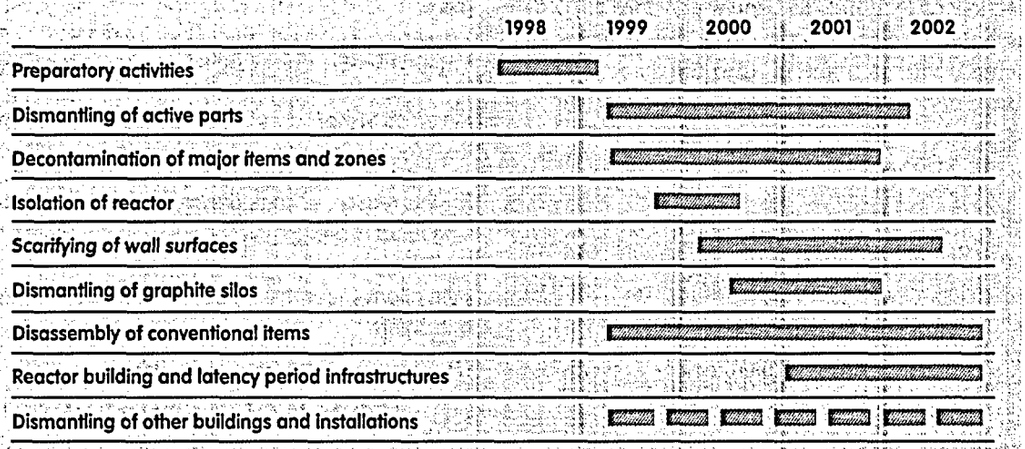
Reactor pile slab. Sealing of penetrations



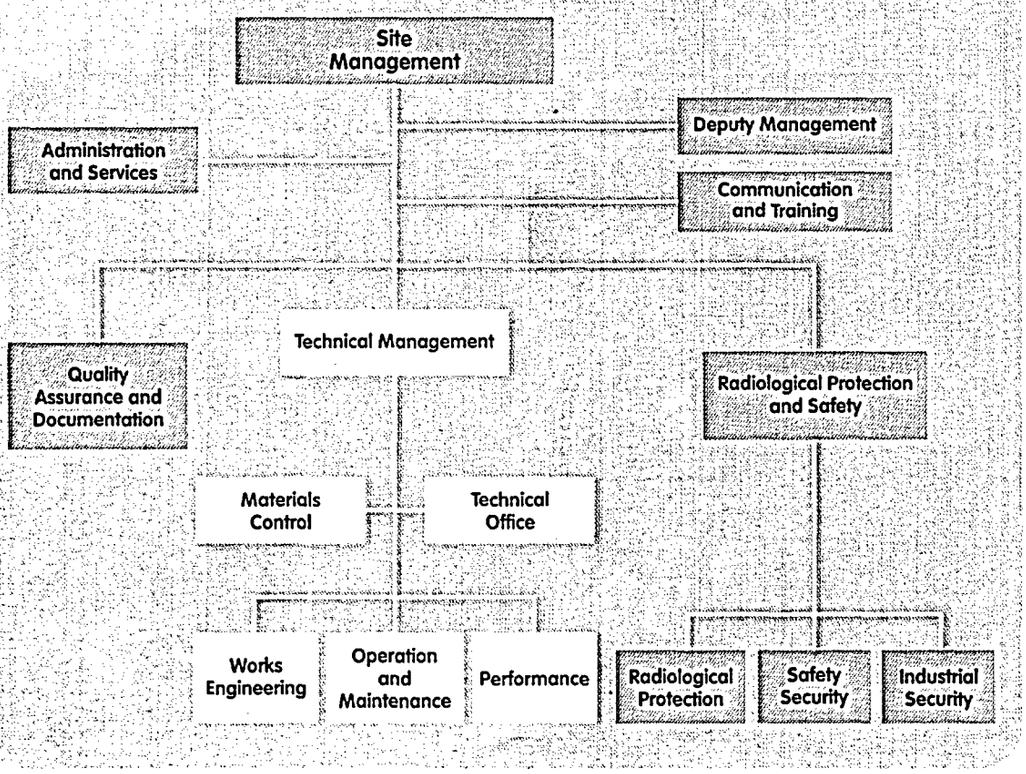
Vandellós I site at the beginning and end of Level 2



Dismantling shedule



Dismantling organizational flowchart



Safety, the essential principle

A basic objective is pursued in dismantling of the Vandellós I NPP: guaranteeing the safety of the site in the long term. This philosophy pervades the Dismantling Plan designed by ENRESA from beginning to end, and the project is being carried out on the basis of a well-studied performance protocol that guarantees the safety of the process and of all those participating in it.

The project is managed on the basis of a closely studied organizational model that, in view of the pioneering nature of the dismantling process, will become a necessary point of reference for future tasks of similar scope. In this respect, the action plan designed places priority on achieving certain high standards of quality, without renouncing the optimization of work and resources.

Consequently, in the dismantling of Vandellós I, priority is given to responsible performance and the guarantee of safety at conventional and radiological level, both on site and in the surroundings of the plant.

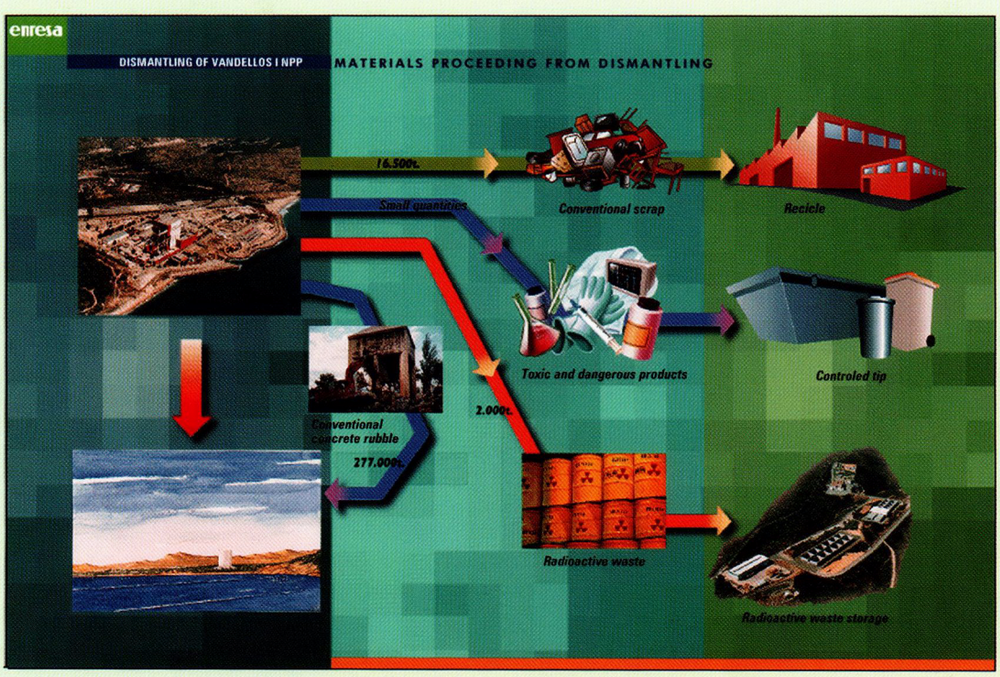
ENRESA projects its performance philosophy through a calculated methodology that is especially active in the areas of the Prevention of Occupational Risk and Radiological Protection.

For this reason, each and every one of the dismantling tasks is designed, managed and executed by multidisciplinary teams which, through their common efforts, guarantee the highest levels of quality and safety.

Philosophy and characterization of the site

Dismantling has nothing to do with demolition. Quite the contrary, dismantling is a controlled indus-

Destination of materials



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trial process that ensures compliance with the standards applied to the end products, depending on their destination.

The dismantling of this plant will give rise to 296,000 tons of material that ENRESA will be required to manage. Of these, 2,000 tons will be radioactive wastes.

Conventional materials	294,000 t
Miscellaneous materials	244,000 t
Scrap from active areas	4,000 t
Concrete from active areas	46,000 t
Radioactive wastes	2,000 t

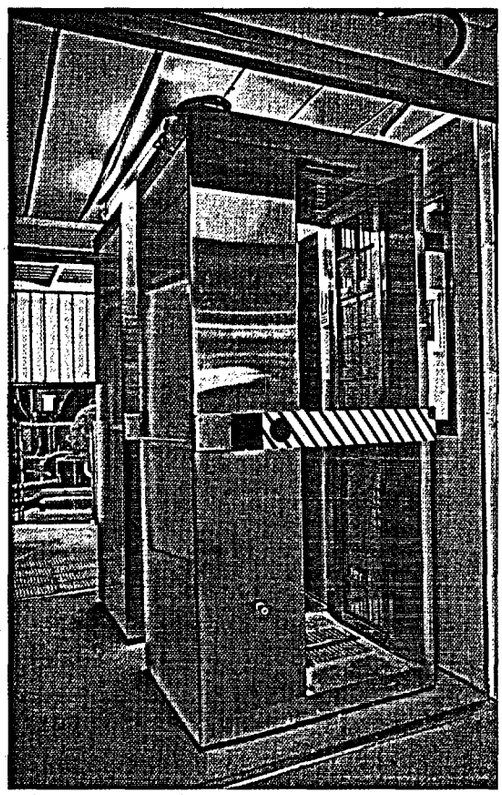
ENRESA analyzes the nature of each material and its radioactivity indexes, determining the most suitable destination for each type of component in accordance with the Nuclear Safety Council.

Specifically, in order to guarantee the safety of the materials selection process, and on the basis of its historical knowledge of the plant, ENRESA carried out a full radiological characterization of the facility when its took over the site, determining the levels of radioactivity in each area.

The three radiometric studies performed, which have implied more than 7,000 direct measurements, have made it possible to draw up a detailed radiological map of the site, facilitating the location and segregation of contaminated material.

Protection methods and working systems

Above all else, priority is given in the Vandellós I Dismantling Plan to the safety of the work scheduled and the personnel responsible for its performance. This essential premise translates into a mandatory planned operations system which leaves nothing at random, since all the performance protocols have been carefully studied and subjected to the strictest controls.



Personnel contamination detector

Implementation is guaranteed through a far- reaching, obligatory training program designed to ensure that all the collaborators and contractor companies have knowledge of the working procedures to be adhered to.

Radiological protection

All tasks performed in the active zones of the site are subjected to rigorous analysis to determine whether there is any type of radiological implication. If this is the case, the collaborator may operate only if he holds a Radiation Work Permit (RWP) establishing the radiological protection standards to be adhered to by the performing personnel. All work is subjected to prior analysis for planning of the safest way to carry it out. This is studied by the ALARA Committee and approved by the Radiological Protection Service.

Actions are taken at preventive, operational and data control levels. Mention may be made, among other actions, of work authorization, radiological surveillance, training, dose monitoring, work planning and information for the resident inspector from the Nuclear Safety Council (CSN).

ALARA program

ALARA stands for «As Low As Reasonably Achievable». It is a commitment by management to reduce doses from exposure to ionizing radiations to the lowest levels reasonably possible, taking into account social and economic factors. The program is applied to all activities and/or work performed at Vandellós I with radiological implications, and is applicable to the ENRESA organization, the contractor companies and all the professionally exposed workers intervening in processes of design, planning, performance, dismantling, decontamination and others potentially implying a radiological risk for the workers, the general public and the Environment.

The ALARA criterion, whose application is analyzed by annual audits, is therefore present at all levels of activity – projects, designs and work performance – and at all levels of the ENRESA organizational framework, through specific committees and commissions.

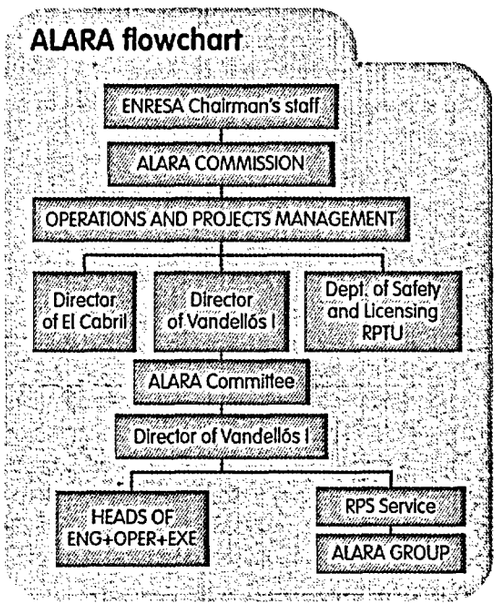
The radiological parameters (collective dose, maximum individual dose, irradiation rates and levels of surface and air-borne contamination) for the application of the ALARA methodology to a given task or activity are specified in a protocol that must necessarily be adhered to when operating in the active parts of the site.

Such work must be preceded by a study detailing the optimum way of maximizing radiation dose reduction.

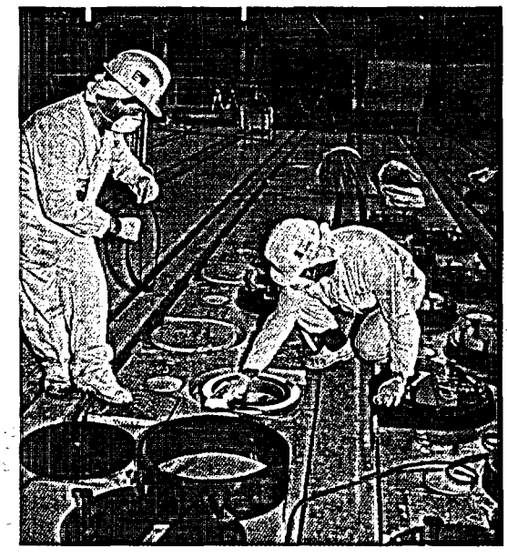
Work Authorization Request (WAR)

All activities performed at Vandellós I must first be authorized by way of the corresponding WAR. This administrative document establishes the safety-related conditions to be adhered to for each task, the personnel responsible for performance and the suitable resources for such performance.

Since March 1998, when the second level of dismantling began, 508 Work Authorization Requests have been approved.



Load well plugging operation on the reactor pile slab



Prevention of Occupational Risk

The Prevention of Occupational Risk is integrated into the set of activities and decisions taken on site, both at the level of technical processes, organization and work performance and at the hierarchical level of ENRESA and the contractor companies.

The objective is to put into practice the ENRESA commitment to achieve optimum health, safety and hygiene and occupational welfare conditions at the company's work centres.

Achieving this rests on the application of an Integrated Safety policy that emphasizes the on-going improvement of preventive action and ensures the participation of all the collaborators in the achievement of a common objective: safety.

To make this possible, ENRESA scrupulously applies the Framework Plan for the Prevention of Occupational Risk at Vandellós I. This implies periodic safety inspections at all the site installations, the signposting of all accesses to work areas and the performance of sampling, monitoring and assessment of the environmental working conditions.

Multidisciplinar teams

Success in safety management and dismantling work depends on the coordinated actuation of the different services intervening. Within this framework, the coordination and planning of the activities performed becomes a vital element for the correct functioning of the entire process.

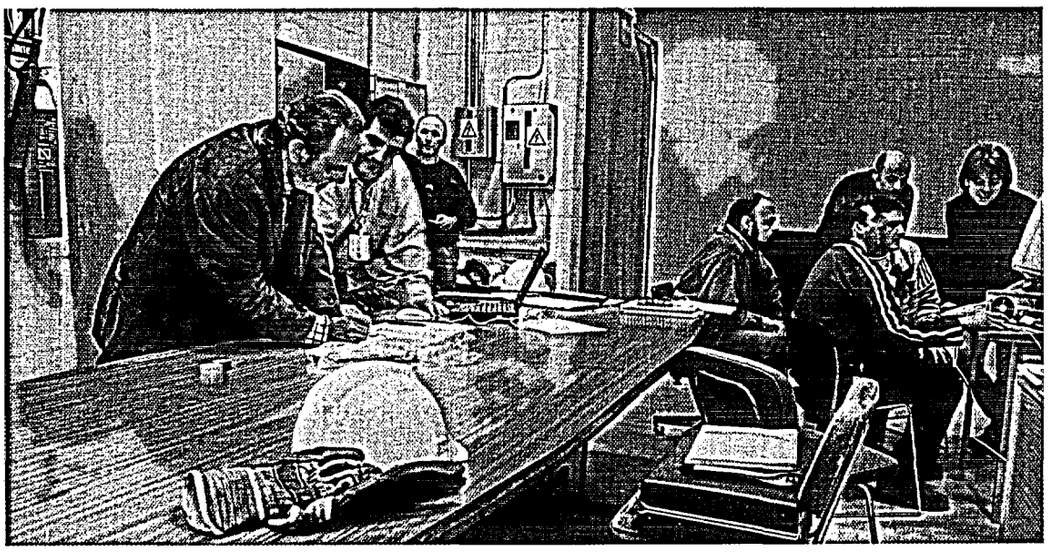
Teamwork is, therefore, one of the main dismantling activities.

Quality Assurance Program

The work performed during dismantling is subject to a Quality Assurance program designed to verify the application of procedures and standards guaranteeing good results. The Quality Assurance Service is responsible for controlling and monitoring the implementation of this program throughout performance of the Dismantling Plan.

The Service is in charge also of the quality records and for archive documentation. For this purpose it includes the Quality Inspection (Inspection and Auditing) and Documentation (Recording and Archive) sections.

Meeting of a multidisciplinary team



Materials management

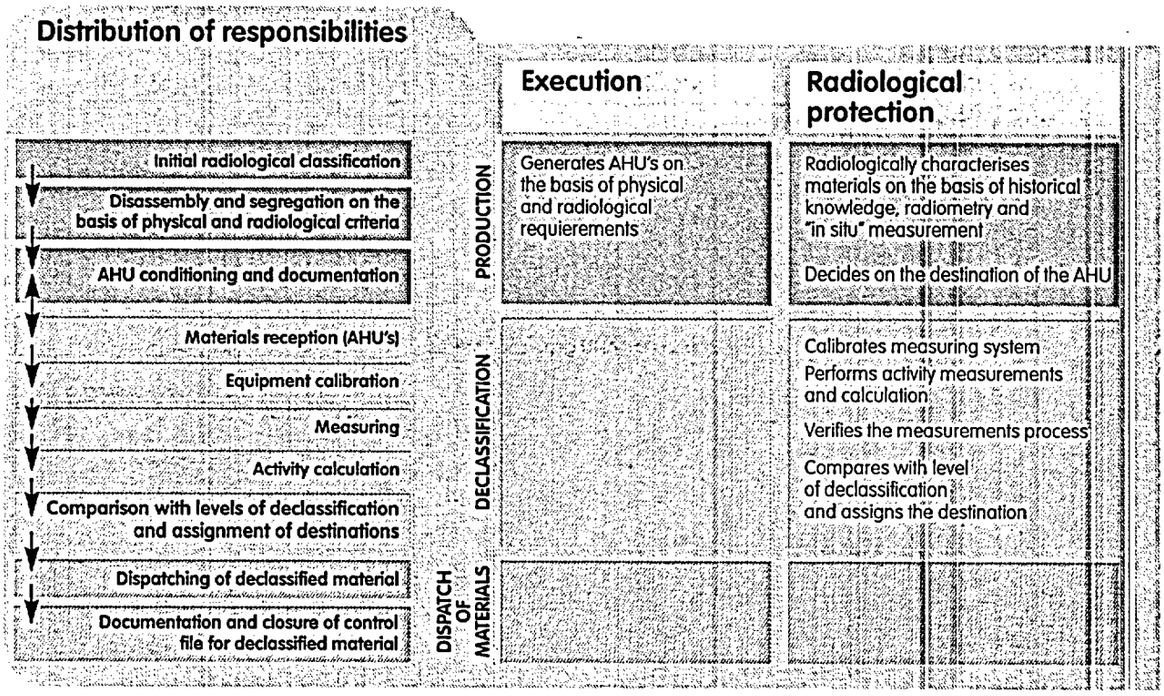
The management of materials generated during dismantling is undoubtedly one of the major tasks to be undertaken by ENRESA. In this respect, a specific inter-departmental organization model has been developed with a view to guaranteeing complete efficiency in the production, characterization and treatment of the large volume of materials generated at the site.

Specifically, during Phase 2 of the Dismantling, 296,000 tons of materials will be produced, less than 1% of which (2,000 tons) will be managed as low and intermediate level radioactive wastes. For this reason, one of the essential points of the project is the exhaustive control of all the materials arising at the site, in order to segregate those considered clean from those others that have radiological implications.

In keeping with this operational logic, the materials managed are classified into two groups: those coming from conventional zones and those from active zones. Those belonging to the first group have never been in potentially contaminated zones and as a result have no radiological implication. Consequently, the legal standards in force in Catalonia are applied for their removal from the site and subsequent recycling or disposal at authorized tips.

For their part, materials from active zones are divided into declassifiable and radioactive. Declassifiable materials are those which are candidates for eventual management as conventional wastes, on the basis of a series of historical and operational parameters. This is accomplished through the so-called Declassification Process, which is required to demonstrate the absence of levels of activity in excess of those authorized by the CSN, the regulatory body. For their part, radioactive materials are meticulously characterized and conditioned for subsequent dispatch to the Low and Intermediate Level Waste Disposal Facility at El Cabril (Córdoba).

As the different levels of materials management are performed, the materials move around the site in containers along controlled routes, in all cases accompanied by their corresponding Authorized Han-



dling Unit (AHU) docket. These dockets are completed in the different areas through which the containers circulate, and specify all the historical, radiometric and operating data that need to be known in subsequent phases to ensure optimum management.

In this respect, it should be pointed out that the management of the materials generated during the dismantling of Vandellós I implies joint efforts by all the different departments, integrated in actuation areas. Specifically, the Performance, Operations, Radiological Protection, Waste Management and Decontamination Services participate directly in the process, with their work coordinated by the Materials Control Service, dedicated exclusively to guaranteeing exhaustive control of all materials dismantled at the site.

All these departments are integrated in the Production, Declassification, Declassified/Conventional Materials Treatment and Radioactive Waste Treatment areas, such that – as shown in the table - the maximum degree of specialization be maintained throughout the process.

The objective of the Production Area is the generation of homogeneous batches of materials susceptible to being measured with the available technology, as well as the preliminary classification of materials depending on the authorized contamination limit values. The Declassification Area confirms and accredits materials initially catalogued as declassifiable and, if this is not applicable, assigns the corresponding category to them.

Finally, the Declassified/Conventional Materials Treatment and Radioactive Materials Treatment areas are in charge of the conditioning of the materials and their dispatch to authorized centres or to the El Cabril Low and Intermediate Level Waste Disposal Facility, respectively.

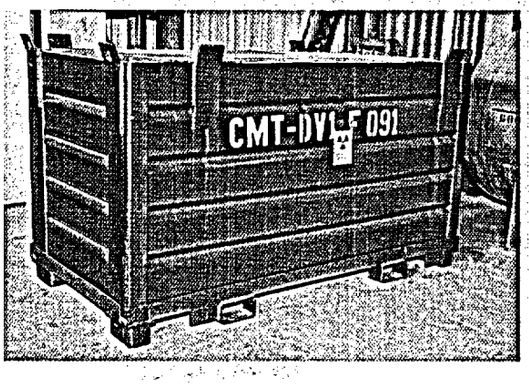
This complex process is controlled by means of the so-called Waste Management System (WMS), a computer-based corporate system that records all internal movements of the materials, from disassembly to dispatch. Furthermore, in the case of radioactive wastes, the surveillance included in the WMS continues during transport and covers up to final disposal at the El Cabril facility.

	Operation and Maintenance	Quality Assurance	Materials control
Production		Inspects the AHU generation process	Coordinates materials movements
Declassification		Inspects the AHU generation process	Receives the material (AHU's) Verifies production and measuring system prerequisites Documents and registers data
Dispatch of materials	Conditions Documents and consignes to authorized distination	Inspection dispatch	Documentary closure of file

Containers

CMT

(Metallic Transport Container). A container used for radioactive wastes from the dismantling of systems and structures in active zones. Once these container are full, they are conditioned by including a layer of concrete and are then ready for transport to the El Cabril Disposal Facility.

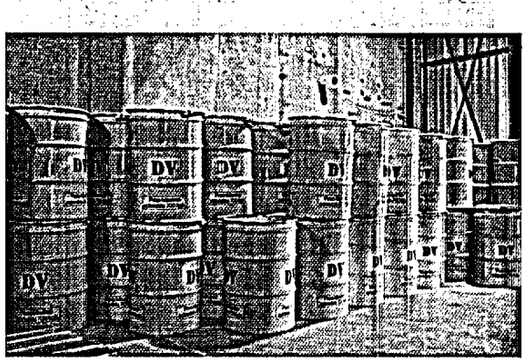


CMD

(Measurement and Declassification Container). Container used for the management of conventional and declassifiable materials. During the different phases of the process, the materials are moved in CMD's throughout the site, along previously established routes.

DV drum

(Vandellós Dismantling). Container designed for secondary radioactive wastes, such as gloves, masks, filters, etc. These are considered to be DV packages until the wastes they contain are measured and conditioned, as from which time they become DV drums and are sent to the El Cabril Disposal Facility.



Big-Bag

A bag containing non-radioactive but toxic insulation materials (glass fibre, asbestos, etc.). Although not housed in CMD's, they are also measured and controlled.

Process guarantees

In order to meet the objective of minimizing the production of radioactive wastes from Level 2 Dismantling, a rigorous segregation and decontamination plan has to be put into place, and complete efficiency must be guaranteed throughout the process. In this respect, the site has five controls that are applied to all materials considered to be candidates for declassification, in other words those coming from active zones and to be removed from the site and sent to conventional destinations. Only such meticulous treatment can ensure that all the materials removed from the plant do not exceed the levels of activity imposed by the CSN for declassification as non-radioactive wastes.

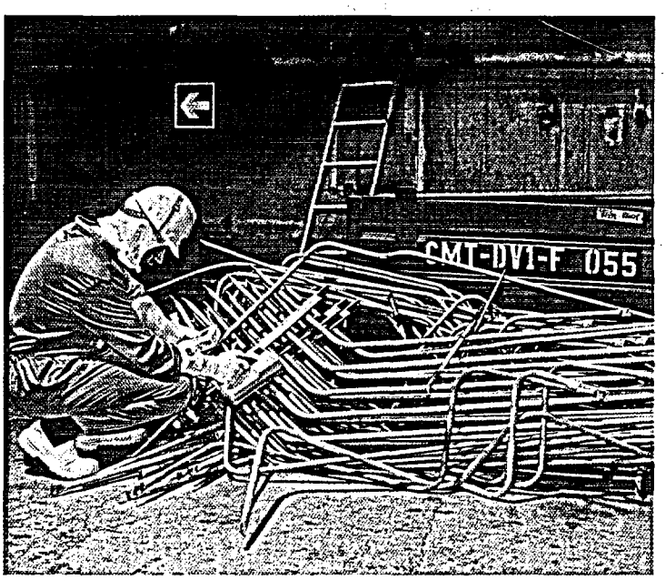
The objective of the first two controls applied to a material, item of equipment or system is planning of the disassembly work and of the protection resources for the workers involved. These controls consist of **historic knowledge** of the operation of the equipment or system and analysis of the three **radiometric studies** already performed on site.

Historic knowledge of the operation of the installation is a resource that is used as the main documentary means of determining which areas of the site are susceptible to including contaminated materials. This information may be used to perform an initial selection which, backed by analysis of the three radiometric studies, will allow time and resources to be optimized in the disassembly tasks.

For their part, the three radiometric studies, each more accurate than its predecessor, make up a real detailed radiological map of the site, since they were drawn up on the basis of more than 7,000 direct measurements performed prior to initiation of dismantling of the active parts of the plant.

The third control is aimed at checking on the spot, by means of direct measurements, which materials are radiologically clean and which are contaminated. This **in situ characterization** control is performed by the Radiological Protection technicians using portable measuring equipment and means the need to initially control all the materials in the working areas in which they are generated. Only after having obtained a positive result from these three initial controls may a material be considered to be presumably clean. In this case, it will be conditioned in its corresponding CMD (Measurement and Declassification Container) and subjected to the process of declassification. Otherwise, the material will be treated as a radioactive waste.

In order to undertake this declassification, which will allow non-contaminated materials to be managed as conventional waste, the fourth control is implemented, this being designed to certify the efficiency and quality of the process. The control consists of performing integrated measurement of the containers using a sophisticated device known as the **Box Counter**, which analyzes the radiological charge of the material contained in the CMD by means of a gamma spectrometry measuring system. Only when the box counter has ratified once more that the material does not exceed the levels established by the CSN is the latter declassified by the Radiological Protection Service.



"In situ" radiological characterisation

Box Counter

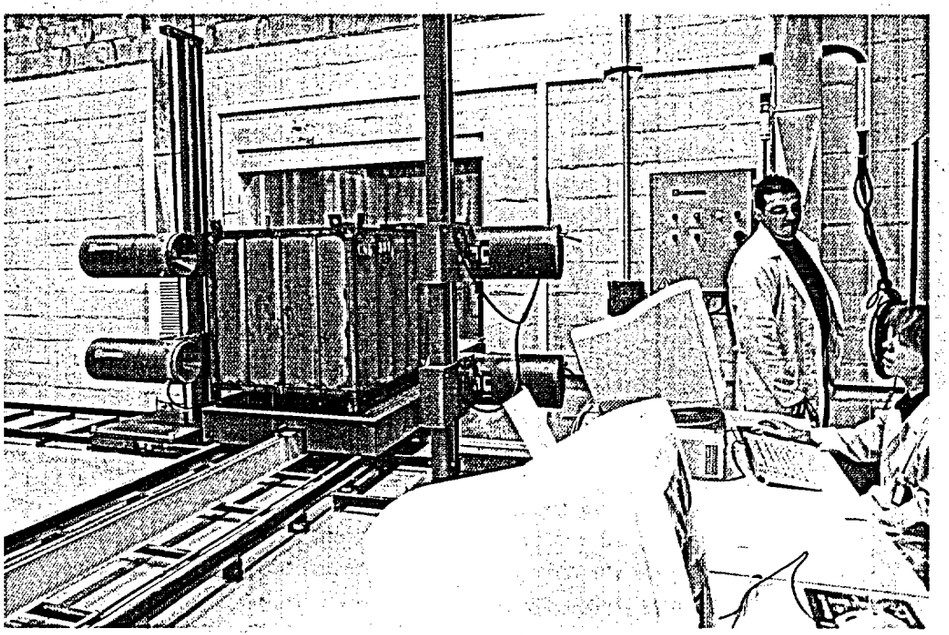
The Box Counter, developed by the US company Canberra, is a low background, gamma spectrometry detection device that identifies the isotopes existing in a sample and calculates their activity, also locating hot spots. This allows contaminated materials to be accurately segregated from those that might satisfactorily pass the declassification process.

The equipment is fitted with four coaxial semiconductor detectors of ultra-pure Germanium which, linked to three different measuring positions, acquire the spectrum of twelve segments of the container, plus the overall spectrum.

This process, controlled by a powerful computer program, provides the important advantage of allowing work to be performed at industrial scale with large-size containers, while maintaining laboratory levels of accuracy.

The results of the box counter analysis determine the declassification of a material. If the device determines that the distribution of the activity is homogeneous and lower than the minimum activity levels established by the CSN, the material will be declassified by the Radiological Protection Service. If, on the other hand, the distribution of the activity detected is homogeneous and higher than the declassification limits - or, being heterogeneous, the results for the different segments analyzed reflect activity values higher than those accepted - then the material will not be declassified and either the decontamination process will begin or the material will be managed as a radioactive waste. Finally, if the distribution of the activity is heterogeneous and the declassification levels are exceeded only in a minority fraction of the volume, this hot point will be segregated and the rest will pass again through the box counter.

Box Counter



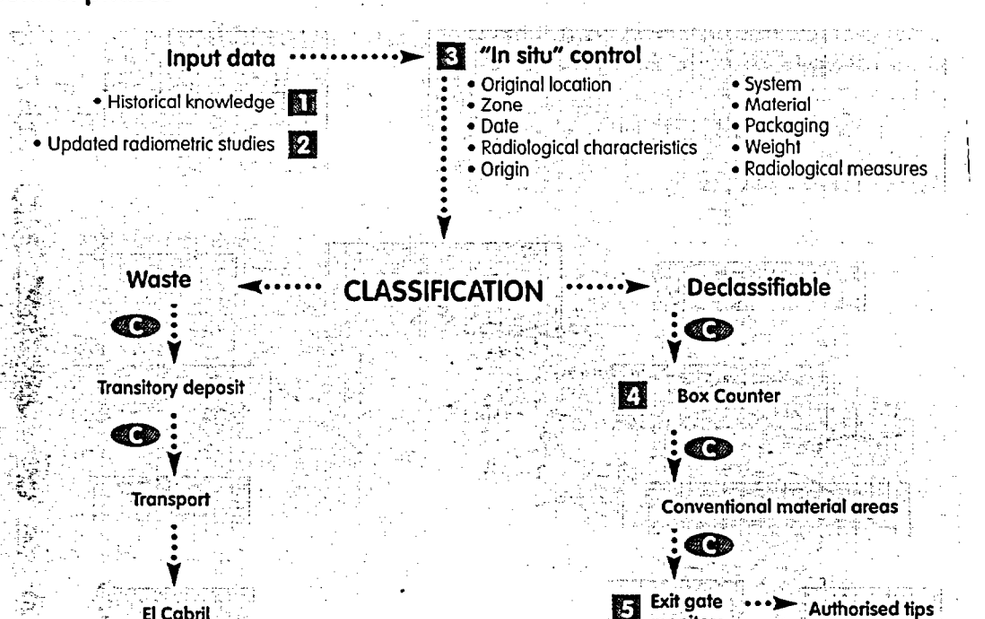
Finally, all the non-radioactive materials leaving the site are required to pass through a **large gantry**, now on the transport truck. This is located at the exit from the site and definitively checks that there are no radioactive components in the material prepared for dispatch.

Once these five controls have been performed with satisfactory results, conventional materials are given a permit to leave the site and be transported to their destination, either a recycling plant or an authorized tip. However, in keeping with the legal standards in force, all conventional wastes are required to have an Acceptance Docket subscribed between the producer, in this case ENRESA, and the company or organization responsible for subsequent management.

This acceptance docket must be submitted to the Waste Council of the Regional Government of Catalonia for validation, and must be associated with a Waste Tracking Sheet, the aim of which is to ensure that transport is carried out under suitable conditions.

Radiological control by means of a large surface gate monitor

Control phases



Support activities

The operating system used at Vandellós I is completed with a series of services in charge of ensuring optimum performance of the work and off-site projection of the tasks performed during dismantling of the plant. Specifically, ENRESA believes in personnel training and communication and in a policy of promoting local employment to transmit its operating philosophy to the different audiences.

Training

The complexity of the tasks scheduled for dismantling of Vandellós I makes it essential to have a complete Training Plan providing all the site workers with the knowledge required to ensure their safety, as regards Occupational Risk and Radiological Protection.

Since the beginning of Level 2 Dismantling, 3,961 people have attended the almost 600 courses organized by the plant Communication and Training Service. Furthermore, since February 1998, the figures on people attending, courses and course time have increased continuously, and a significant increase is forecast for the year 2000.

The objective of the Training given at Vandellós I, fully ratified and promoted by ENRESA, is to minimize the risks inherent to the facility, offering the worker all the information required to ensure safe performance of his activities. This objective is embodied in the directives of the Occupational Risk Prevention Framework Plan for the Dismantling of Vandellós I, the plant Radiological Protection Manual and the ALARA Programs for Vandellós I, which are integrated in the set of ENRESA standards. These documents promote an increase in the safety measures over and above the levels imposed by the standards in force.

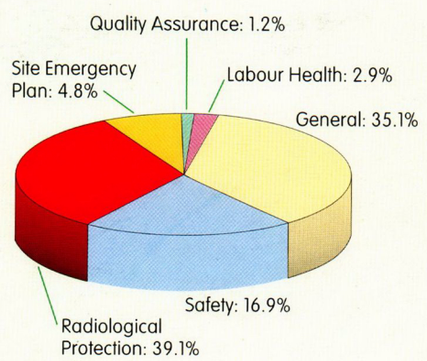
On-site Training includes both recently incorporated subcontractor company workers and those having wide experience of the plant. In this respect, one of the pillars sustaining the training consists of the recycling courses periodically given to the workers at all levels of responsibility.

By subject area, Radiological Protection is the discipline that receives most attention in the training of Vandellós I workers, amounting to almost 40% of the total. Other significant areas include Occupational Safety, General Worker Training and the Site Emergency Plan. Overall, almost 80% of the training delivered to date has consisted of courses aimed at promoting safety at work, in all its different facets.

Communication

The objective of the Vandellós I Communications Area is to inform the different social agents of

1998-2000 courses



Training course

Col

ENRESA's activities, with a view to promoting harmonious integration into the company's surroundings. In this respect, ENRESA has set up as a priority objective the establishment of seamless relationships with the media, institutions and public opinion, providing them with completely transparent information on the project and the performance of the dismantling.

ENRESA maintains contacts with the media by organizing informative seminars on the different activities involved in dismantling, in addition to promoting periodic events and working sessions. Furthermore, with a view to facilitating the work of the media to the fullest extent, the site management responds quickly to all requests for information.

ENRESA issues a number of publications promoting scientific research and a culture of responsible environmental management and informing of its activities throughout the country. Outstanding in this respect is the scientific journal «Estratos», a publication that includes relevant collaborations and that is aimed basically at professionals and at members of the public interested in waste management and the Environment.

«Enresa 3D» is a publication for the scientific community that analyzes R&D projects. Other ENRESA publications for more specific audiences are «Sierra Albarana», a magazine aimed at readers in the area surrounding the El Cabril Low and Intermediate Level Waste Disposal Facility, and «Enresa Informa», an in-house publication aimed at the company's workers and collaborators.

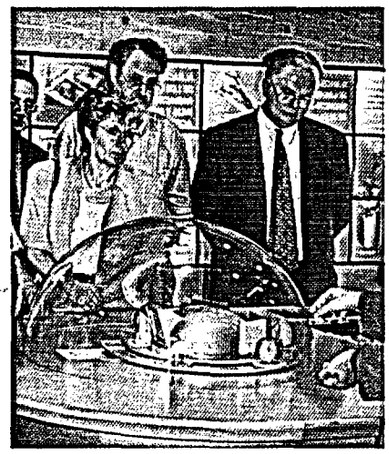
At institutional level, ENRESA strives to maintain good relationships with representatives in the area, organizing periodic meetings with the main public institutions in the surroundings and visits by governmental organizations, political parties and groups of various types.

One of the most important activities performed by the Vandellós I Training and Communications Service is undoubtedly the organization of visits by the general public, an initiative that aims to provide the surrounding population with all the necessary information on the activities carried out during dismantling, and allow these to be tracked on the spot from a series of viewing galleries located strategically around the plant.

Specifically, four such galleries have been constructed at different levels, making it possible to observe the main phases of the dismantling process, from the disassembly of equipment and systems to declassification.

This policy has given rise to 332 organized visits and to 5,890 people having passed through the site during the period May 1998 to December 1999.

Visitors centre



Visit to Vandellós I NPP

The itinerary of the visit

The visit to Vandellós I begins with an initial contact at the ENRESA Mobile Visitors Centre. This itinerant module has an exhibition room where the properties of radioactivity are explained, and a projection room that is habitually used to show ENRESA's activities by audiovisual means.

The site walk-through then begins, complementing what has been seen at the Visitors Centre and allowing the progress of the dismantling work to be observed in situ. The route includes four viewing galleries showing different phases of the work. First, the disassembly of the active parts of the installation is seen, with work on the reactor slab viewed by means of closed-circuit television. Following this, the visiting group is led to two galleries showing the treatment of the different materials during the declassification process. Finally, from a fourth gallery, the visitor may see the official declassification of materials through application of the box counter. In the last part of the visit the former Control Room of the nuclear power plant is shown, along with the new Integrated Surveillance Post, from where the day-to-day dismantling activities are controlled.

Reactor hall: viewing gallery for visitors

Materials inspection

Local employment

For ENRESA, promoting local employment is one of the main tools for integration into the area surrounding Vandellós I. For this reason, of the 384 workers that belong to the 34 contractor companies collaborating in the dismantling, 289 are from the local area, this amounting to exactly 75% of the workers at the plant.

This commitment to enhancing employment in the area guarantees ENRESA the availability of a workforce and also a highly specialized business framework, in view of the wide experience acquired over many years of collaborating with the four nuclear groups in the province.

Institutional control

The dismantling of Vandellós I implies the performance of a series of tasks that have never before been carried out in Spain, which are subject to exhaustive controls by the main competent institutions. These institutions check for correct adherence to the contents of the Vandellós I Decommissioning and Dismantling Plan, thus guaranteeing the quality of the activities performed by ENRESA.

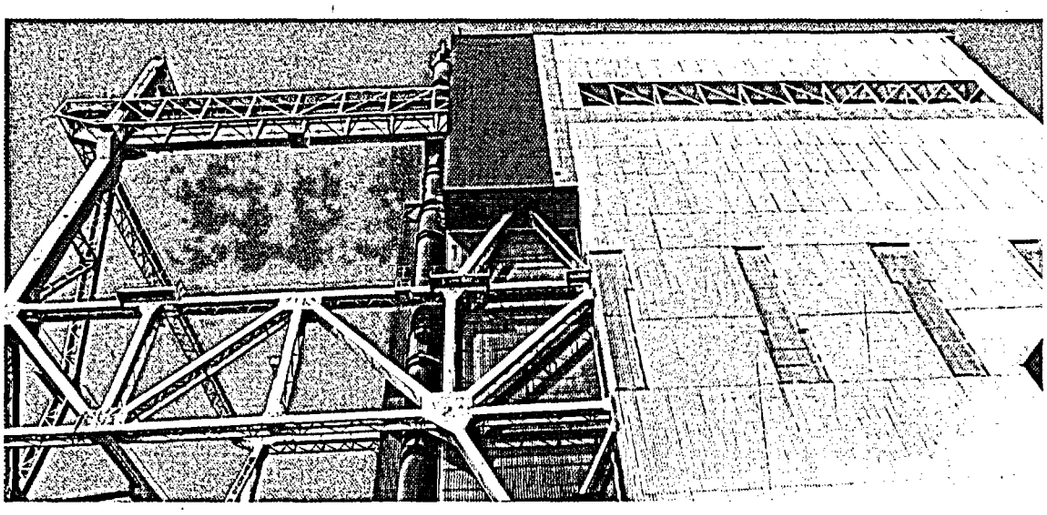
Given the nuclear nature of the site, the most important control is in the hands of the Secretariat of State for Energy and the Nuclear Safety Council (CSN), which has a resident inspector at the plant and makes periodic visits to check the progress made in dismantling on the spot. This independent organization is also in charge of analyzing each and every one of the major projects and of giving the go ahead for them once the guarantees in place are considered to have been contrasted. In this respect, mention should be made of the vital importance of the approval report issued by the CSN in relation to the recent reactor pile leak tests and to the entry into operation of the box counter, an essential device in the materials declassification process.

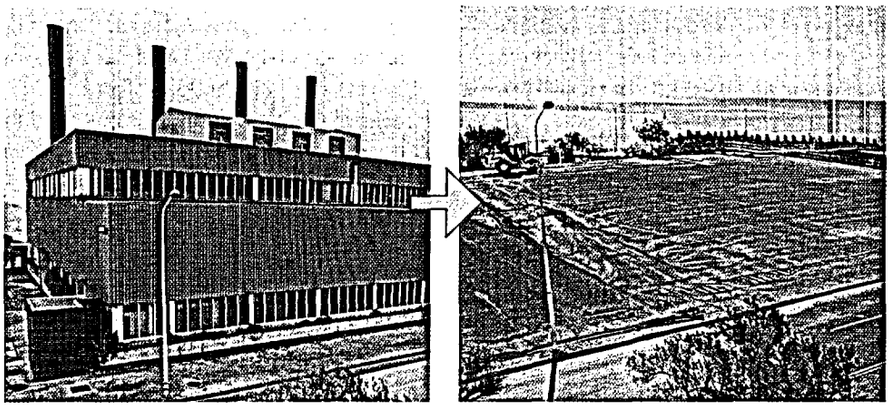
Another of the controls to which ENRESA is subjected, in compliance with the legal standards in force, is the Dismantling Information Committee, which is presided over by a representative of the Ministry of Industry and Energy and made up of representatives of the Ministry of the Environment, the CSN, the Government Delegation in Catalonia, the Regional Government of Catalonia and the Town Council of Vandellós i l'Hospitalet de l'Infant. As the main political authority for the issue at state level, this institution maintains direct contacts with Vandellós I and is even empowered to establish its own control mechanisms, which may be complemented by those emanating from the Nuclear Safety Council.

At a more restricted level, the dismantling activities are controlled by the Municipal Vandellós i l'Hospitalet de l'Infant Tracking Commission, an organization made up of members of the municipal council, representatives of ENRESA Management, and the main local groups, associations and political parties. As indicated in the statutes of this Commission, the main objective is to verify the points of origin and destination of contaminated materials and check that the works are performed with minimum risk for human beings and the Environment.

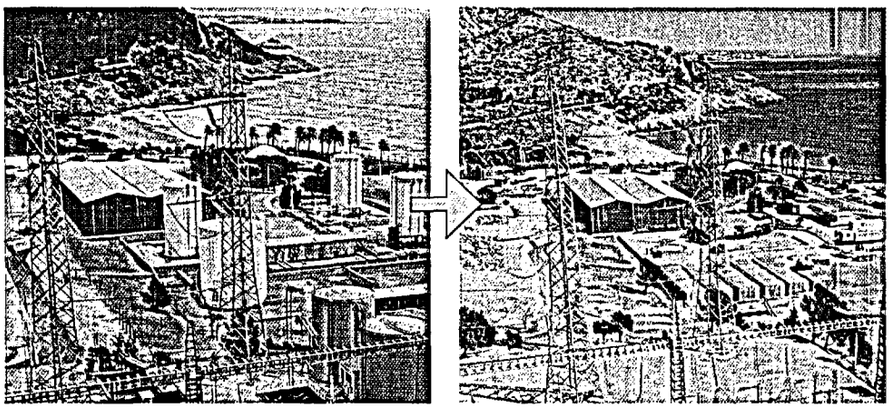
Other institutions that ENRESA periodically informs of its activities are the Regional Council of the Baix Camp, the Rovira i Virgili, University, the Professional Association of Engineers of Catalonia and the Town Councils of the neighbouring areas.

Outside of reactor hall

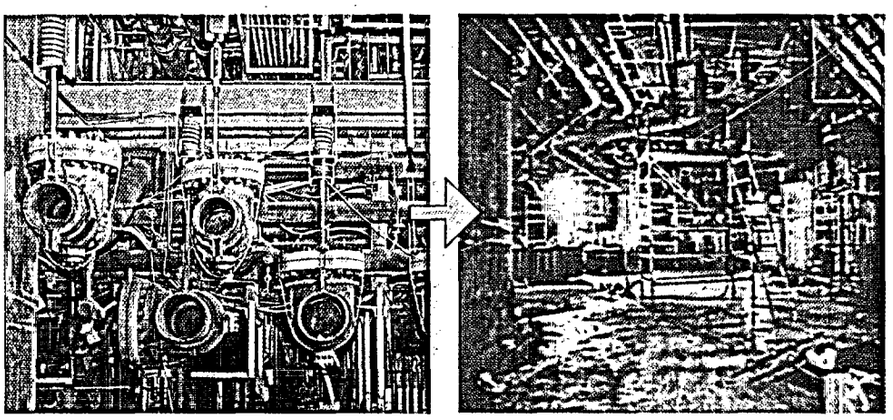




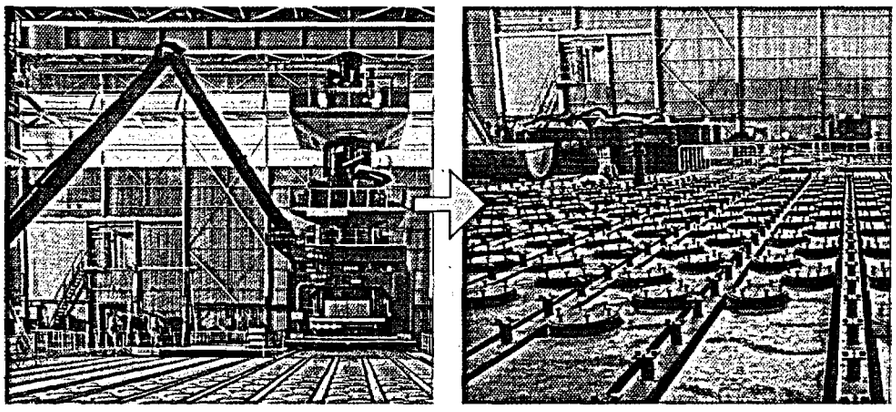
Auxiliary Plant



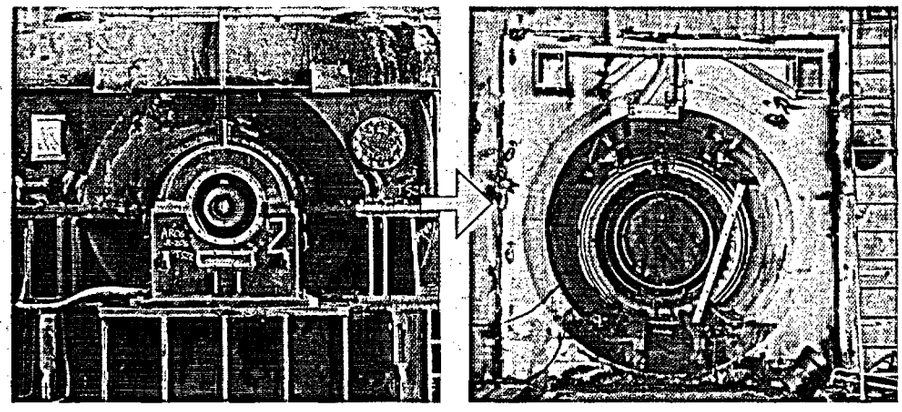
Fueloil and gasoil tanks



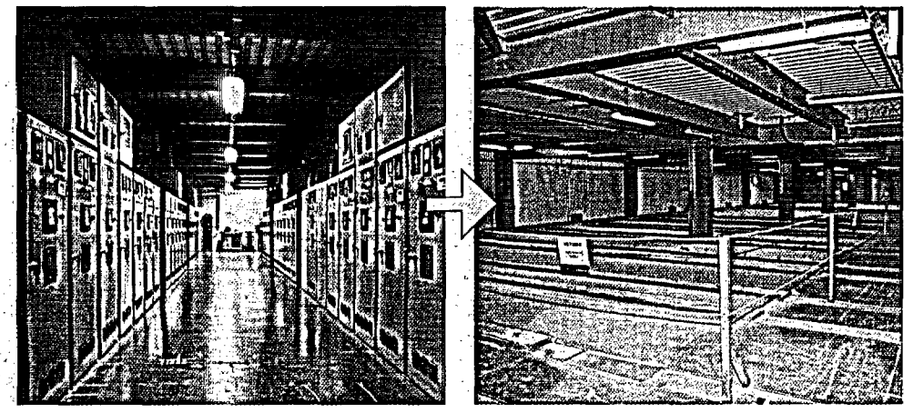
Elevation 3.5 in the reactor hall



Main Maintenance Device



Turbo-blower



Electrical auxiliaries: transformer room

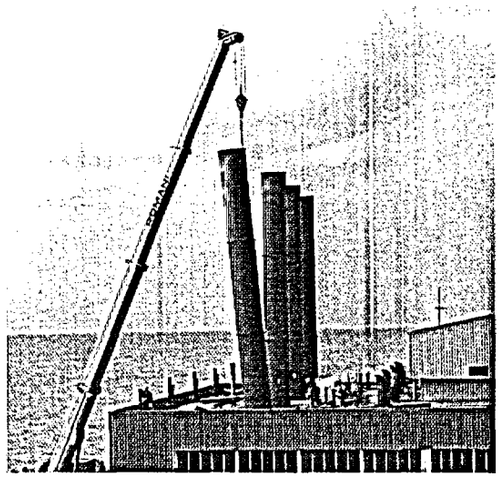
Actions performed during 1998

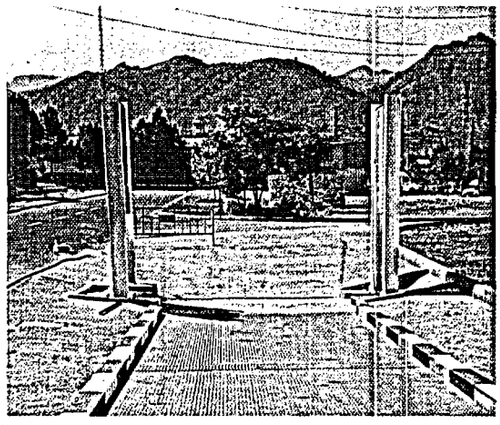
In 1998, ENRESA carried out a series of preparatory activities necessary to initiate dismantling of the active parts of Vandellós I.

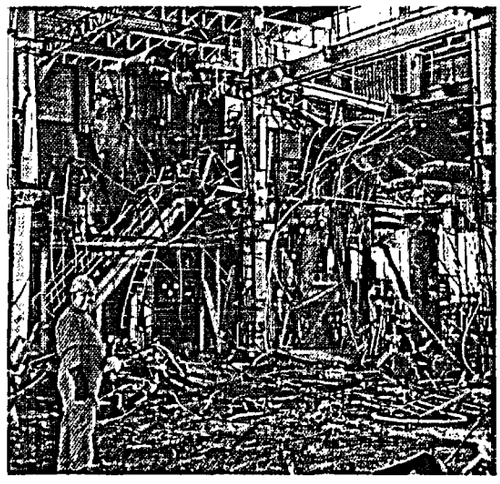
These activities consisted of implementing or modifying the systems and installations, adapting them to the Dismantling Plan. As a result, it might be said that during this stage more construction has been performed at Vandellós I than dismantling.

Certain of the most significant activities performed are listed below:

- Definitive removal from service of systems not required for dismantling.
- Removal from the plant of inflammable or toxic products that might cause a problem during the works.
- Modification of the electrical systems, including the installation of a new distribution adapted to dismantling requirements and following different routes from the previous systems.
- Incorporation of new ventilation systems ensuring the confinement of zones in which radiological work is to be performed.
- Replacement of the plant Control Room with a new Surveillance Post from which the operating systems of the facility are controlled and monitored by means of a computer-based system.
- Transfer of the Management and Administration offices to the eastern side of the site, in order to clearly separate works activities from administrative tasks. Advantage was taken of the former large materials store to house the new administration offices.
- Modification of the effluent treatment and dilution system, adapting it to the new situation required by the Dismantling Plan.



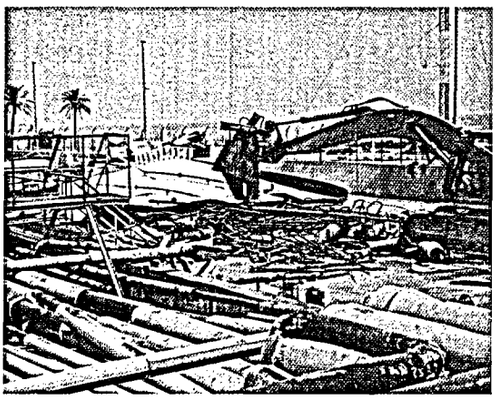


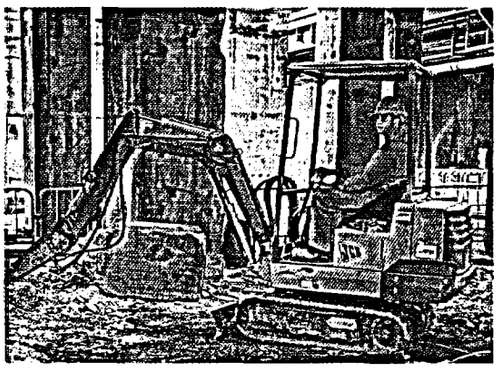


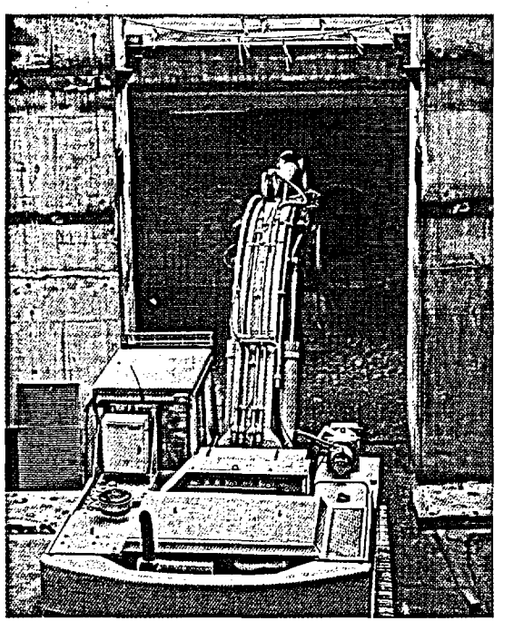
Above: Disassembly of Auxiliary Plant stacks

Middle: Weighing platform and radiological control gate monitor

Below: Dismantling of Auxiliary Plant equipment







- Modification of the materials decontamination workshop.

- Substantial modification of the fire-fighting system, with the acquisition of new equipment and the constitution and training of the fire brigade, made up of 41 people.

During 1998 important modification and infra- structural works were carried out, the following being particularly significant:

- Construction of the materials cutting and declassification workshop, a building annexed to the reactor hall and used for the reception and classification of all the materials from the radiological zones.

- Improvement to the medical service, providing it with new equipment adapted to the dismantling works.

- The new reactor hall entrance and exit radiological control station, where personnel dosimetry is carried out.

- Installation of a weighing platform and a monitor for final radiological control prior to the removal of any material from the installation, confirming the existence of radiological material.

PRELIMINARY CONVENTIONAL DISASSEMBLY

During 1998 conventional equipment and systems were also disassembled:

- The auxiliary plant, which supplied electricity to all the auxiliary services during plant operation, was disassembled. The four boilers, the four auxiliary turbine-generator sets and the compressed air installation were removed.

Above, middle and below: Conventional demolition

- The fuel tanks (fuel-oil and gasoil) and the demineralized water tanks were disassembled after having been emptied.

CONVENTIONAL DEMOLITION

Among the conventional buildings already pulled down is the auxiliary plant, which was demolished following the removal of all its components. After several cuts were made, the external wall coatings and stacks were removed and work began on demolishing the structure.

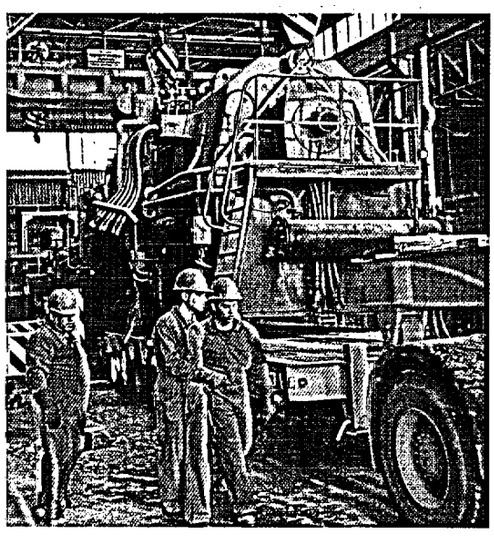
Overall, ENRESA managed 2,798 tons of conventional materials during 1998, made up basically of scrap, tank cleaning effluents, electrical cables and glass fibre and wool, among others.

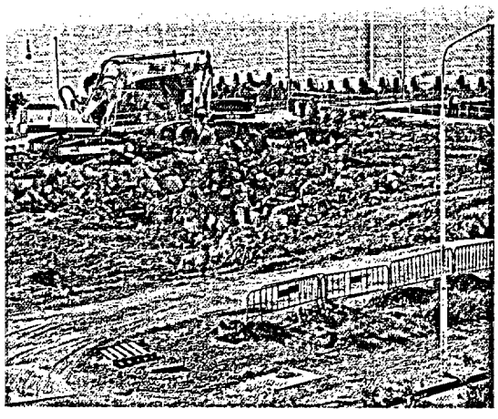
START-UP OF THE NEW SYSTEMS

The preparatory activities were completed with testing of all the systems implemented or modified during the works, evaluated by the Nuclear Safety Council. This evaluation included 15 tests, performed between 26th October 1998 and 26th January 1999.

The tests consisted of verifying the correct operation of both individual components and the systems overall, and checking that they met the requirements for which they had been designed.

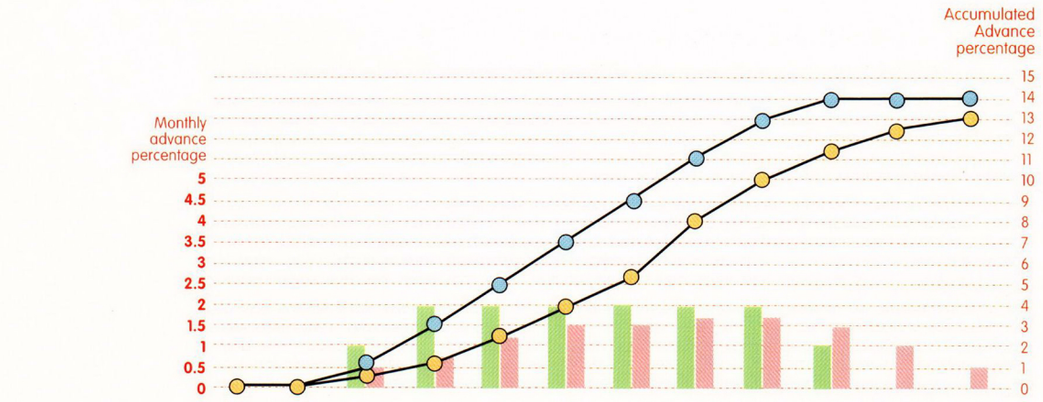
On 17th March 1999, the Nuclear Safety Council approved the test results and authorized the initiation of the dismantling work in radiological areas.





Above: New Surveillance Post
Middle: Removal of an auxiliary alternator
Below: Land replacement work

Comparative evolution of works progress. 1998



	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Monthly schedule perc.	0	0	1	2	2	2	2	2	2	1	0	0
Monthly perc. performed	0	0	0.5	0.8	1.2	1.5	1.5	1.7	1.8	1.5	1	0.5
Accum. schedule perc.	0	0	1	3	5	7	9	11	13	14	14	14
Accum. perc. performed	0	0	0.5	1.3	2.5	4	5.5	8.2	10	11.5	12.5	13

Employees and contractors. 1998

Annual average: 298 workers

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
ORGANIZATION	130	140	145	146	153	158	159	159	161	164	164	
FERROCOM		2	18	18	38	28	26	10	8			
ACS			4	19	25	26	26	42	41	63	60	48
INABENSA			6	32	38	42	59	26	26	22	7	6
SULZER					1	6	13	15	14	14	13	13
LAINSA						7	6	6	2		2	
MAESSA						9	14	12	8	6		
ENWESA						5	5	10	10	10	10	12
Others		32	68	62	70	87	74	49	40	45	44	41
TOTAL		164	236	276	318	363	381	329	308	321	300	284

Removal of materials

Origin: conventional areas

WASTES	Kg
Lubricanting oil	17,560
Hydrochloric acid	80
Waste waters and sewage	10,000
Alumina	2,360
Asbestos	460
Banall	60,860
Electric cables	64,710
Sodium carbonate	3,960
Ash	4,640
Scrap	2,064,490
Detergents	1,220
Halogenated solvents	3,000
Non halogenated solvents	3,000
Effluents and sediments from fuel tank cleaning	409,160
Electronic equipment	12,900
Foam producer	3,140
Glass fibre and wool	42,280
Sodium hydroxide	380
Paper and cardboard	4,440
Ion exchange resins	13,860
Vegetable tissues	49,500
Asphalt fabric	15,960
Transformers with PCBs	10,040
TOTAL	**2,798,000**

C03

Actions performed during 1999

Work on dismantling the active parts of Vandellós I began in 1999. This coincided with the disassembly of conventional parts of the site, including the pumping station, the auxiliary electrical building and the last phase of releasing the land corresponding to the auxiliary plant.

In general, by the end of 1999, 36.5% of the dismantling of Vandellós I had been carried out, as against the 35% that had been foreseen for the period. By zones, conventional dismantling had reached 75%, with dismantling of the active parts reaching 56%.

Furthermore, coinciding with the initiation of work in the active areas, certain tag-outs and operating modifications were performed with a view to improving the logistics of dismantling. Specifically, the following activities were performed:

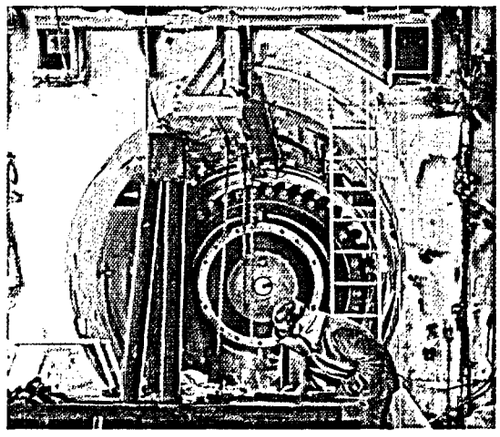
- Installation of a new modular laundry.
- Equipping of a cutting and decontamination workshop for materials management.
- Conditioning of the Power Production Installation.
- Construction of a new access to the site.
- Improvements to the drum silo enclosure.

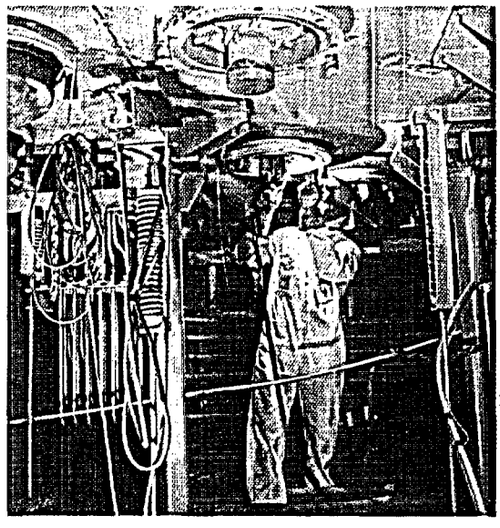
The main activities performed during 1999, in both the active and conventional zones, are detailed below:

DISASSEMBLY OF CONVENTIONAL ITEMS

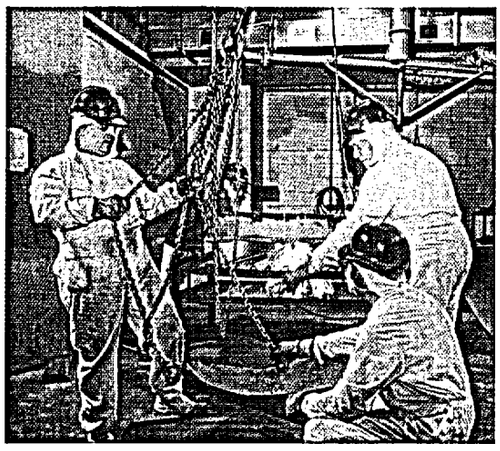
Conventional disassembly tasks were completed in exterior installations such as the administration and auxiliary electrical buildings.

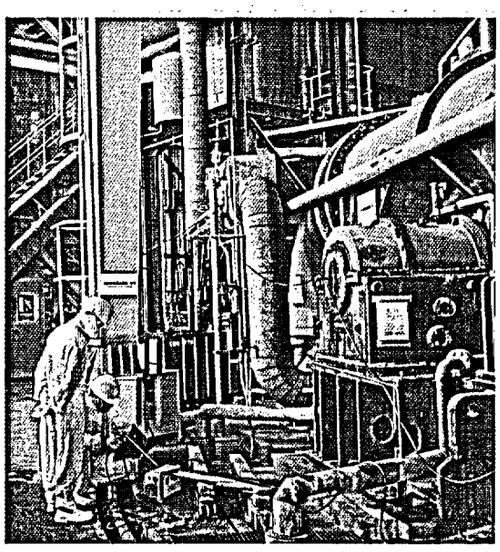
Work on the plant pumping station was completed in 1999, with 65% of the equipment and structures disassembled. Also completely disassembled were the neutralization and chlorinating pits, along with other minor exterior installations.

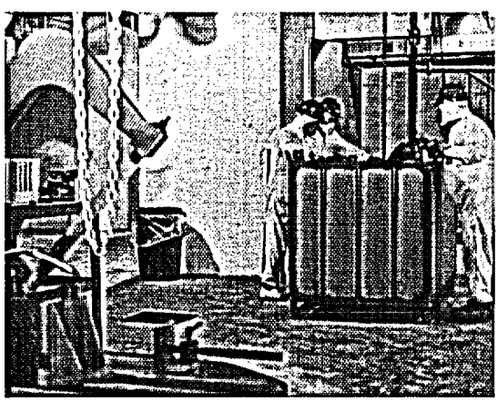




Above: Removal of a turbo-blower shaft
Middle: Filling of a CMD container
Below: Removal of feedwater piping







DISMANTLING OF ACTIVE PARTS

Since the beginning of dismantling of zones with radiological activity, in March, a large number of activities have been performed, preceded by engineering and documentation tasks, authorization by the CSN for start-up of the Active Parts Dismantling Plan and the process of on-site contractor company implementation. Although most of the activities will be completed during 2000 and 2001, important progress has been made in 1999. The following has been particularly outstanding:

- Progress amounting to 75% has been made in the reactor building, with all the appropriate disassembly and materials management operations having been carried out in the main zones. Although the reactor slab has reached 35% general dismantling, the progress made with respect to the disassembly and decontamination of the Main Maintenance Device (MMD) has been particularly significant, and has now reached more than half way. In the cavity, 70% dismantling has been performed in the peripheral areas, and 65% in the upper cavity, while in the central part isolation has been completed and 50% of the pile confinement tasks have been carried out. As regards accesses to the reactor and the turbo-blowers, it should be pointed out that decontamination and declassification of the so-called SAS AMONT and SAS AVAL have been finished and that dismantling of the blowers is well beyond 50%.
- For their part, reactor pile isolation tasks and preparation for the latency period progressed to 60% in 1999. Special mention might be made of the completion of preparatory activities and of the major progress made in plugging the slab and cavity penetrations.
- In the Auxiliary Electrical building, the water exchangers have been completely dismantled and dismantling of the CO_2 treatment and shutdown ventilation terrace has been partially performed.

Above: Cutting and classification workshop
Middle: Work in the Reactor Hall
Bellow: Filling of a CMD cask

- In the fuel building, disassembly of the East and West tanks, the converters and the Main Maintenance Device (MMD) stores has started.
- With dismantling of the pools building now 60% completed, attention might be brought to the complete decontamination and disassembly of the MEC cell and its auxiliary entrance area.
- Disassembly has not yet exceeded 20% in the Effluent Treatment and Fuel Buildings, as a result of which this now becomes a priority objective for the year 2000. Nevertheless, the Liquid Effluent Treatment System tanks and pits have been completely cleaned.

DEMOLITION OF CONVENTIONAL ITEMS

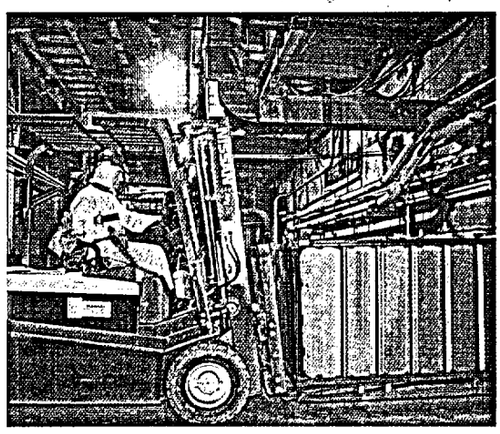
The disassembly and demolition of the demineralized water tank foundations and of the gas-oil and fuel-oil transfer pump covers have been completed in 1999. In addition, work has begun on demolishing the fuel-oil unloading bay and progress has been made in compacting of the land belonging to the power production installation and auxiliary plant, to 40% and 80% respectively.

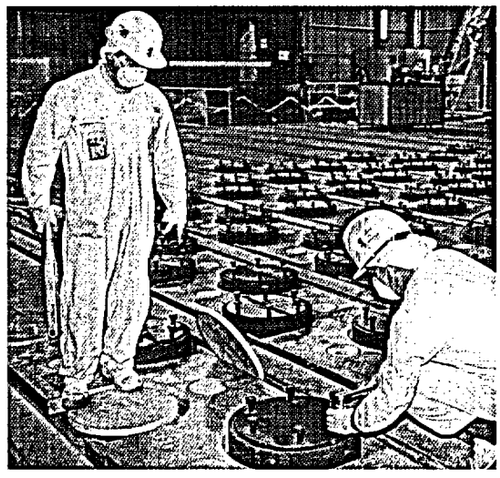
DECONTAMINATION

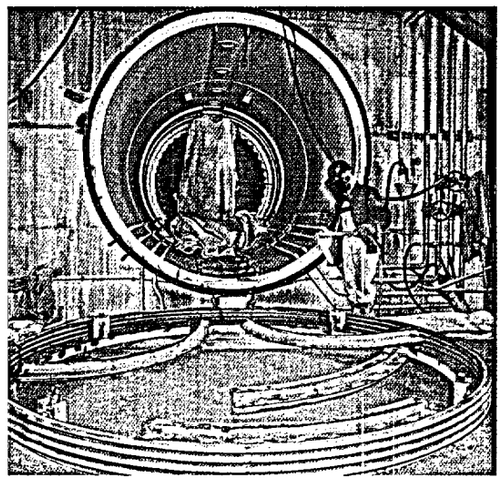
Coinciding with initiation of dismantling of the active parts, and with the activities of the cutting and decontamination workshop having started, it is estimated that 35% of in situ decontamination has been performed during 1999 on major items, and 10% of the same activity foreseen for the workshop.

REMOVAL OF MATERIALS

Finally, as regards the removal of materials, a total 2,027 tons are pending. 96% of these are housed in CMD containers for declassification and management as conventional wastes, while 3.3% (67 tons) has been managed as radioactive wastes and is pending dispatch to the El Cabril Disposal Facility.

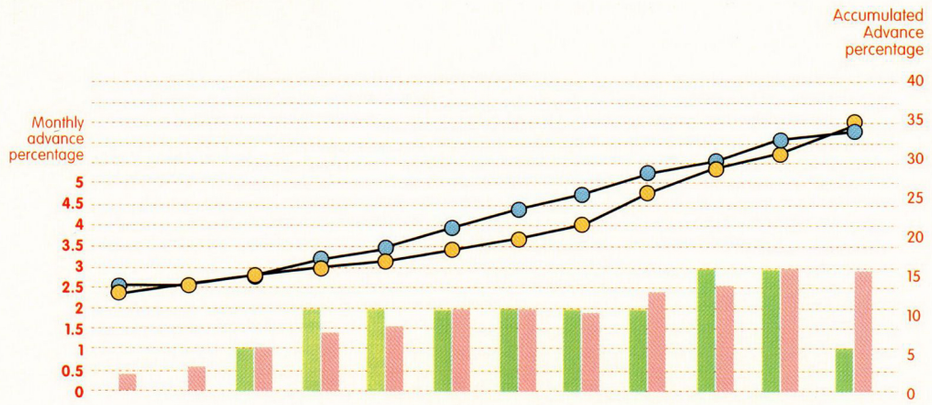






Above: Transport of materials in a CMD cask
Middle: Plugging of load orifices in the reactor slab
Below: Turbo-blower penetration

Comparative evolution of works progress. 1998



	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Monthly schedule perc.	0	0	1	2	2	2	2	2	2	3	3	1
Monthly perc. performed	0.4	0.6	1	1.4	1.6	2	2	2	24	2.6	3	3
Accum. schedule perc.	14	14	15	17	19	21	23	25	27	30	33	34
Accum. perc. performed	13.4	14	15	16.4	18	20	22	24	26.4	29	32	35

Employees and contractors. 1999

Annual average: 340 workers

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
ORGANIZATION	164	163	163	172	162	164	161	164	163	164	164	165
ACS	20	13	4	1								
SULZER	11	7	6	6	6							
INAFER	3	3	5	19	25	23	24	21	23	17	20	19
MONLAIN		4	22	52	70	91	106	103	92	92	108	105
ENSA/M/B	1	1	1	1	1	1	1	1	5	17	17	17
PROINSA					16	20	1	1	1	2	2	2
MARSEIN			10	12	16	21	18					
Others	38	38	50	64	80	79	83	70	75	75	76	69
TOTAL	**237**	**229**	**261**	**327**	**376**	**399**	**394**	**360**	**359**	**367**	**387**	**377**

C04

Removal of materials

Origin: conventional areas

WASTES	Kg
Lubricating oil	0
Hydrochoric acid	0
Waste waters and sewage	15,000
Alumina	0
Asbestos	0
Banal	65,340
Bacteria	10,640
Electrical cables	219,890
Sodium carbonate	0
Ash	0
Scrap	845,200
Detergents	0
Halogenated solvents	0
Non halogenated solvents	0
Effluents and sediments from fuel tank cleaning	0
Electronic equipment	11,770
Foam producer	0
Glass fibre an wool	5,280
Fibrocement	4,220
Graphite	5,260
Sodium hydroxide	0
Mixture of cooling gases	200
Used tyers	1,040
Paper and cardboard	5,940
Special wastes in minor quantities	2,980
Ion exchange resins	13,860
Vegetable tissues	1,780
Asphalt fabric	0
Transformers with PCB's	28,880
TOTAL	**1,237,280**

Removal of materials

Origin: actives areas

WASTES	Kg
Aluminium	2,172
Steel	1,652,980
Concrete	7,763
Equipment	20,207
Filters	4,218
Valves	6,140
Wool	55,133
Wood	2,994
Cables	87,509
Brass	63,923
Waste	7,276
Fibre	2,387
Stainless	16,548
Copper	7,599
Motors	38,069
Lead	13,655
Plastic	1,942
Miscellaneous	36,627
TOTAL	**2,027,130**

Pending declassification	**1,943,237**
Radioactive wastes	**66,987**
For decontamination	**16,906**
Total	**2,027,130**

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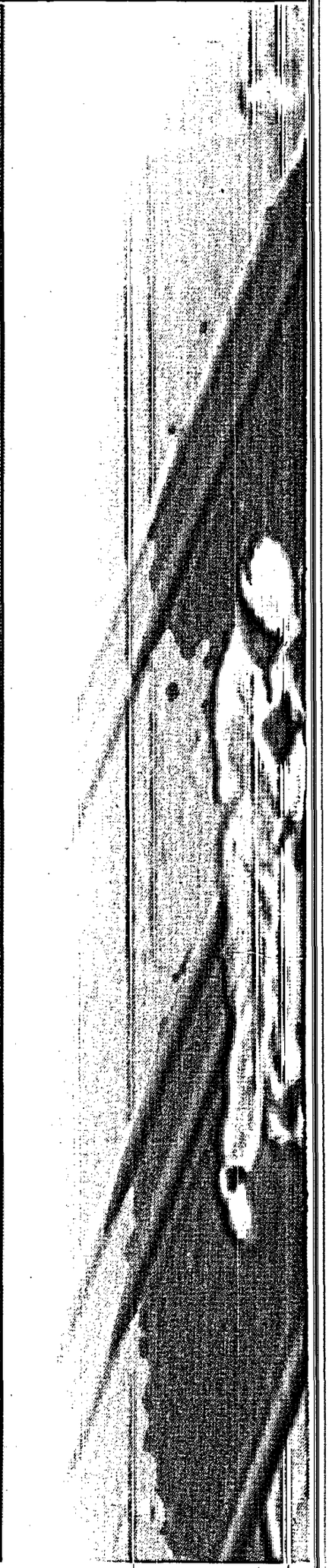

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