JOINT ASSESSMENT OF SPECIFIC SITES AD HOC GROUP

Vandellos Site

JASS Ad-Hoc Group Meeting Findings

Vandellos 11-14 December 2002

Version 4.0

(24th January 2003)

0. INTRODUCTION

0.1 Record of the Meeting

The fourth and last JASS Ad-Hoc meeting has taken place in Vandellos, Spain, on December 11rd to 14th, 2002.

The assessment is being conducted in accordance with the dispositions set out in the NSSG-4 Attachment 8.

The JASS ad-hoc group took note of the various presentations by the European proponent team (for the Vandellos Site) in the fields applicable to the JASS.

In order to properly assess the submitted documentation, the ad-hoc group had also the opportunity to visit the proposed site location and the neighbouring community.

The ad-hoc group jointly drafted the findings that follow and that will be the basis, together with the analyses of other site proposals, for the final JASS report to be submitted to the Negotiators.

The present document may be updated on the basis of additional material requested by the Ad-Hoc group or supplied by the proponent team and made available in a timely manner.

0.2 The Vandellos Site

The proposed Site is located (see figure 1) in the Autonomous Region of Catalonia, Spain. It is located on the seashore, 46 km south of the city of Tarragona, between the towns of “l’Ametlla de mar” and “l’Hospitalet de l’Infant”. The Barcelona-Valencia railway line divides the site into two plots measuring approximately 49 ha and 21 ha (in total 70 ha). The land area will be made available free of charge by the Spanish government for ITER use for the duration needed for the ITER Project. The proponent also offered the availability of 2 additional parcels of land for construction lay-down, if required, each about 25 ha, one north, the other south, both located 2-3 km from the Site. The provided land area satisfies the ITER needs (see figures 2 and 3).

The proposed ITER Site has the following significant physical attributes:

- Access – equipment can be delivered to the site by road, rail, ocean-going ships, and barges. A dedicated dock is connected to the site through a private road.
- Geotechnical – Limestone is found at a depth ranging between 18.5 m and 27 m below grade, with well-cemented conglomerates above.
- Hydrogeological – groundwater level is located approximately 21 m below grade level.
- Seismic – The seismic characteristics of the Site are similar to the generic design assumptions.
- Meteorological – the weather conditions are favourable and well within the design assumptions.
- Water supply – the Site is served by local water supply.
- Heat Sink - Given the proximity of the Site to the sea both cooling towers and seawater cooling options can be implemented.

A wide set of geological data of Vandellos site were already available from the geological investigations carried out for the adjacent Vandellos I and II Nuclear Power Plants and the recent works for the high speed train. In addition to this, a complementary geological investigation has been developed at ITER site with a number of boreholes particularly concentrated in the Tokamak building area. This geological study shows that limestone is found at a depth ranging between 18.5 m and 27 m below grade, with well-cemented conglomerates above. The bearing capacity of these conglomerates has been tested and found to be at least 190 t/m^2. The bearing capacity of the limestone is greater.

The neighbouring 400 kV substation, located at 2 km distance of the site, is an important node on the Spanish power grid. Two 400 kV, 600 MVA lines, formerly connecting the Vandellos I Nuclear Power Plant (NPP) to the 400 kV substation, still exist and are out of service at present. Both pulsed and steady state requirements will be met by these lines. The connected grid provides a secure supply, which can satisfy ITER’s steady state and pulsed power demands with a high level of reliability

The coastal situation of the proposed ITER site and the presence of a dedicated roll-on/roll-off dock by the Vandellos II NPP, present favourable features regarding the transport of ITER large and heavy components during the construction phase. The dock is connected to the site through a private road (~2km long), so that the schedule for transporting the largest components to site will not be subject to external conditions. In the past, the existing dock has been utilized to unload heavy components (up to 450 t) for the Vandellos and Ascó Power Plants.

Spain has many Nuclear Facilities in operation and where there are well-established regulations concerning licensing and waste disposal. No new specific administrative procedures or regulations will have to be developed for ITER.

The proposed Site is located ~ 46 km (~ 30 min. drive) south of Tarragona and ~134 km (~75 min. drive) from Barcelona. The site is accessible by A7/E15, a 4-lane motorway running south from Barcelona to Tarragona and then going further south past Tarragona to L’Hospitalet de l’Infant, the town which is ~5 km north of the Vandellos site. Access to international travel is via Barcelona Airport or the Valencia Airport (~2 hour drive).

Over the last 20-25 years, Spain and more specifically the Tarragona region has been growing at one of the highest rates in Europe. This growth has been based, to a certain extent, on the development of big civil works including the third generation of Spanish nuclear power plants. Chemicals and energy are the key industries in Tarragona's production base, representing approximately 42.5% of industrial GDP. Housing prices in the last 2 years have grown by approximately 13% per year.

European industries participated in the construction and operation of several fusion devices and the R&D projects undertaken during the ITER EDA. Therefore there is a proven domestic industrial capability in all areas of the ITER project. Also in many other fields of science and technology, Europe is at the forefront with examples like CERN, European Space Agency, the European Space Observatory, Arianespace, etc.

The Catalonia region is well known for the variety of lifestyle options it offers. It has a mild climate and provides a safe and secure environment for families. There are a variety of cultural attractions throughout the Catalonia region including theme parks, museums, festivals, performing arts and concerts. There are also a variety of sports and recreational activities accessible to the public throughout the year.

Figure 1: Location of the Vandellos proposed Site in Catalonia

Figure 2: Aerial photo of the proposed ITER Site on the Mediterranean coast

Figure 3: Plan view of the proposed Site

1.0 TECHNICAL ASPECTS

1.1 SITE REQUIREMENTS

1.1.A Land

1.1.A.1 Land Area

Requirement The ITER site shall be up to 40 hectares in area enclosed within a perimeter. All structures and improvements within the perimeter are the responsibility of the ITER project. Land within the perimeter must be committed to ITER use for a period of at least 30 years.

Bases The minimum area for the ITER site is predicated on sufficient area for the buildings, structures and equipment with allowances for expansion of certain buildings if required for extension of the ITER programme.

The time period is specified to cover the construction (~10 years) and operations (~20 years) phases. Beyond that, the requirements for any decommissioning will be the responsibility of the Host Country.

JASS Criteria

1) Location, area
2) Present ownership and status, required to fit the site requirements, if any
3) Duration of use, transfer of ownership or lease
4) Constraints on use, if any
5) Proposal on specific site layout

The proposed Site is located in the Autonomous Region of Catalonia, Spain. It is located on the seashore, 46 km south of the city of Tarragona, between the towns of “l’Ametlla de mar” and “l’Hospitalet de l’Infant”. The Barcelona-Valencia railway line divides the site into two plots measuring approximately 49 ha and 21 ha (in total 70 ha).

The 49 ha area, that will host the ITER facility, is between a) a motorway running along the west boundary of the Site at a minimum distance of ~50m from the Site boundary, and b) the railway line.

The 21 ha area, on the opposite side of the railway line and on the seashore, will be used for infrastructure and construction lay-down. It was previously used for some facilities of Vandellos I Nuclear Power Plant (NPP), currently being dismantled.

The two plots can communicate under the railway line bridge.

The proponent also offered the availability of 2 additional parcels of land for construction lay-down, if required, each about 25 ha and 2-3 km, one north and the other south from the Site.

The land which constitutes the Vandellos ITER site is of public and private ownership. The owners of the private property are registered in the official land register in “l’Hospitalet de l’ Infant”, the consortium “Asociación Nuclear Ascó-Vandellos” is the main owner.

The land area will be made available free of charge by the Spanish government for ITER use for the duration needed for the ITER project.

There will be no specific constraint on the use of the land.

As a result of a topographic analysis, grade elevation of the site has been set at 22 m above sea level.

All nuclear buildings will be at this elevation.

The Vandellos Site satisfies all the requirements on land for siting ITER.

Additional information is available in Section 4.

1.1.A.2 Geotechnical Characteristics

Requirement The ITER site shall have foundation soil bearing capacity adequate for building loads of at least 25 t/m^2 at locations where buildings are to be built. Nevertheless, it is expected that it will be possible to provide at the specific location of the Tokamak Building means to support the average load of 65t/m^2 at a depth of 25m. The soil (to a depth of 25 m) shall not have unstable surrounding ground features. The building sites shall not be susceptible to significant subsidence and differential settlement.

Bases The ITER Tokamak is composed of large, massive components that must ultimately be supported by the basemat of the structures that house them. Therefore soil bearing capacity and stability under loads are critical requirements for an acceptable site. The Tokamak Building is composed of three independent halls on separate basemats, but served by the same set of large, overhead bridge cranes. Crane operation would be adversely affected by significant subsidence and differential settlement.

JASS Criteria

1) Complete geotechnical profile of the site. Geotechnical studies of the site should be referenced and available for examination by the JASS assessment team.
2) Proximity of a stable bedrock layer should be quantified, as should the estimated bearing capacity of this layer.
3) Demonstrate the manner in which excavation will take place for the concrete buildings, and to outline conceptual options for foundation structures. Excavation quantities should be estimated for construction at the site

A wide set of geological data of Vandellos site were already available from the geological investigations carried out for Vandellos I and II Nuclear Power Plants and the recent works for the high speed train. In addition to this, a complementary geological investigation has been developed at ITER site with a number of boreholes particularly concentrated in the Tokamak building area.

The geological study shows that, at the specific location of the Tokamak building, limestone is found at a depth ranging between 18.5 m and 27 m below grade, with well-cemented conglomerates above. The bearing capacity of these conglomerates has been tested and found to be at least 190 t/m^2. The bearing capacity of the limestone is greater.

The boreholes in the areas foreseen for general buildings show that the substratum is either conglomerates or limestone, or gravels, with a bearing capacity well over 25 t/m^2.

The excavation for the Tokamak Building will require the use of heavy excavation equipment, and occasionally light blasting.

A first estimate of the volume of excavation in this area is 430,000 m^3 whereas the approximate volume of fill is 400,000 m^3.

1.1.A.3 Water Supply

Requirement The ITER site host shall provide a continuous fresh water supply of 0.2 m^3/minute average and 3 m^3/minute peak consumption rates. The average daily consumption is estimated to be about 200 m^3. This water supply shall require no treatment or processing for uses such as potable water and water makeup to the plant de-mineralised water system and other systems with low losses.

Bases The ITER plant and its support facilities will require a reliable source of high quality water. The peak rate of 3 m^3/minute is specified to deal with conditions such as leakage or fires. This water supply is not used for the cooling towers or other uses which may be satisfied by lower quality, "raw" water.

JASS Criteria

1) Capacity of potable water and industrial water
2) Plan of the water supply and the system
3) Status of the water supply
4) Sources of the water supply, and restrictions, if any

A potable water pipeline of the Ebro river-Tarragona transfer is available at the proposed Site. At present, a contract between the company responsible for the dismantling of Vandellos I NPP (ENRESA) and the company in charge of the concession and exploitation of this source of water (Consorcio de Aguas de Tarragona, CAT) allows 400 m^3 of daily potable water supply to Vandellos I NPP.

This would allow for a raw water supply of 400 m^3 /day for uses such as potable water and water makeup to the de-mineralised water plant and other systems with low losses, as specified by ITER requirements.

The host will provide all connections to the fence of the ITER site.

1.1.A.4 Sanitary and Industrial Sewage

Requirements The ITER site host shall provide sanitary waste capacity for a peak ITER site population of 1000. The host shall also provide industrial sewage capacity for an average of 200 m^3/day.

Bases The ITER project will provide sewer lines to the site perimeter for connection to sewer service provided by the host. The peak industrial sewage rate is expected to be adequate to deal with conditions such as leaks and drainage of industrial sewage stored in tanks until it can be analyzed for release. Rainwater runoff is not included in industrial sewage.

JASS Criteria

1) Industrial sewage capacity
2) Plan of the sewage system
3) Status
4) Regulations on industrial sewage

Regarding sanitary sewage, a new system will be provided to achieve the required capacity during both construction and operation phases.

As far as industrial sewage concerns, the total wastewater generated by ITER shall be treated as required and finally discharged to the sea. See also section 1.2.B.1

The industrial waste flow will be composed by an average of 200 m^3/day coming from ITER facilities, plus desalination plant rejection (if the desalination plant is needed: see Section 1.1.B).

For cooling water, see Section 1.1.B.

1.1.B Heat Sink

Requirements The ITER site shall have the capability to dissipate, on average, 450 MW (thermal) energy to the environment.

Bases ITER and its associated equipment may develop heat loads as high as 1200 MW (thermal) for pulse periods of the order of 500 s. The capability to dissipate 1200 MW should be possible for steady state operation which is assumed to be continuous full power for one hour. Duty Cycle requirements for the heat sink at peak loads will not exceed 30%. The average heat load would be no more than 450 MW for periods of 3 to 6 days.

JASS Criteria
1) The maximum energy allowed to dissipate to the environment
2) Regulations and/or restrictions on energy dissipation to the environment

The Vandellos ITER Site satisfies the ITER heat sink requirements for both cooling towers and seawater cooling options. The latter taking advantage of the location of the site, close to the sea.

In the case of the cooling towers option, some savings, in the towers, can be applied as compared to the reference design as a consequence of the favourable climatic conditions. Nonetheless a specific water desalination system will need to be built for the cooling water makeup.

In case of the seawater option, the sea, as a huge heat sink, allows flexibility of the system for possible upgrades to reject a higher heat.

See also Section 1.2.B

1.1.C Energy and Electrical Power

ITER Plant Steady State Electrical Loads

Requirement The ITER site shall have the capability to draw from the grid 120MW of continuous electrical power. Power should not be interrupted because of connection maintenance. At least two connections should be provided from the supply grid to the site.

Bases The ITER Plant has a number of systems which require a steady state supply of electrical power to operate the plant. It is not acceptable to interrupt this power supply for maintenance of transmission lines, therefore the offsite transmission lines must be arranged such that scheduled line maintenance will not cause interruption of service. This requirement is based on the operational needs of the ITER Plant.

Maintenance loads are considerably lower than the peak value because heavy loads such as the Tokamak heat transfer and heat rejection systems will operate only during preparations for and actual pulsed operation of the Tokamak.

JASS Criteria

1) Capacity of the steady state electrical power supply
2) Number of lines
3) High Voltage Supply Scheme
4) Status of the supply
5) Construction power requirements need to be defined and addressed for the site
6) High voltage network and its capacity

In Vandellos, ITER will be connected to the neighbouring 400 kV Vandellos Substation, located 2 km from the site, which is an important node of the Spanish power grid.

Six 400 kV lines are currently connected to this node resulting in a minimum short circuit power of 13.5 GVA. There are three nuclear power plant units in the area generating power for the 400 kV network: Vandellos II (1082 MW) and Ascó Units 1 and 2 (1028 MW and 1015 MW). In the future two combined cycle units (Plana del Vent, 400 MW each) will be installed in the vicinity of the Vandellos site and connected to the same substation.

Two 400 kV, 600 MVA lines, formerly connecting Vandellos I NPP to the 400 kV substation, still exist and are out of service at present. Both pulsed and steady state requirements will be met by these lines, which follow the path required for connecting ITER to the grid and can be used without any modification.

During the construction phase, power will be initially obtained from the 25 kV line presently supplying Vandellos I decommissioning works, and in a later stage, when the power demand will increase, from the 400 kV lines available at the site.

The existing network is capable to satisfy all ITER requirements.

See also Section 1.2.C.

1.1.D Transport and Shipping

1.1.D.1 Maximum Size of Components to be Shipped

Requirement The ITER Site shall be capable of receiving shipments for components having maximum dimensions (not simultaneously) of about:

- Width - 9 m
- Height - 8 m
- Length - 15 m

Bases In order to fabricate the maximum number of components, such as magnet coils and large transformers, off site, the ITER site must have the capability of receiving large shipments. For the reference case, it is assumed that only Poloidal Field Coils will be manufactured on site, unless the possibility of transporting and shipping these large coils is proven feasible. For the same reason, it is also assumed that the CS will be assembled on site from six modules, unless it proves feasible that the Assembly may be supplied as one large and complete unit. The cryostat will be assembled on site from smaller delivered parts. The width is the most critical maximum dimension and it is set by the Toroidal Field Coils which are about 9 m wide. The height is the next most critical dimension which is set by the 40° Vacuum Vessel Sector. A length of 15 m is required for the TF coils. The following table shows the largest (~100 t or more) ITER components to be shipped:

Largest ITER Components to be Shipped

Component	Pkgs	Width (m)	Length (m)	Height (m)	Weight (T) Each Pkg
TF Coils	18	9	14.3	3.8	280
VV 40° Sector	9	8	12	8	575
CS Modules	6	4.2	4.2	1.9	100
Large HV Transformer	3	4	12	5	250
Crane Trolley Structure*	2	(14)	(18)	(6)	(600)

* Crane dimensions and weight are preliminary estimates.

PF Coils and CS Assembly**

Component	Pkgs	Width (m)	Length (m)	Height (m)	Weight (T) Each Pkg
PF-1	1	9.5	9.5	2.4	200
PF-2	1	18.5	18.5	1.9	200
PF-3	1	25.5	25.5	1.2	300
PF-4	1	26.0	26.0	1.2	450
PF-5	1	18.2	18.2	2.4	350
PF6	1	10.8	10.8	2.4	300
CS Assembly	1	4.2	18.8	4.2	850

** **Note that transportation and shipping of the PF Coil and of the CS Assembly are not requirements, but could be considered an advantage**.
Note, too, that the PF Coils dimensions are for the coil and connection box envelope, and that for each coil there are vertical protrusions of ~1.5 – 1.8 m for the terminals.

JASS Criteria

1) Availability of the port where the heavy and large components can be landed. (The maximum size of the ship which can be docked, availability of the landing facilities and the customhouse, etc.)
2) The allowable maximum size and weight of the transportable components.
3) Map of the transport route from the port to the site
4) Status of the route and reinforcement of the port, roads and bridges, if any
5) Constraints, if any, on the transport of large and/or heavy components due to site topography.

The Vandellos site is accessible by road, railroad, ocean going ships and barges.

The coastal situation of the proposed ITER site and the presence of a dock by the Vandellos II NPP, present favourable features regarding the transport of ITER large and heavy components during the construction phase.

The dedicated dock is connected to the site through a private road (~2km long), so that the schedule for transporting the largest components to site will not be subject to external conditions. In the past, the existing dock has been utilized to unload heavy components (up to 450 t) for the Vandellos and Ascó Power Plants.

The existing private road has enough capability for the transport of the heaviest components with some modifications. The proposed Site allows the possibility to transport the largest PF coils with some additional modifications to the dock and road.

For the transport of smaller items the existing railway line or public roads can be used. Equipment items up to 300 t can also be transported by rail. The neighbouring A-7 motorway provides additional options.

1.1.D.2 Maximum Weight of Shipments

Requirement The ITER Site shall be capable of receiving about a dozen of components (packages) having a maximum weight of 600 t and approximately 100 packages with weight between 100 and 600 t each.

Bases In order to fabricate the maximum number of components, including magnet coils, off site, the ITER site must have the capability of receiving very heavy shipments. The single heaviest component (Vacuum Vessel Sector) is not expected to exceed 600 tonnes. All other components are expected to weigh less.

JASS Criteria
None specified

See section 1.1.D.1.

1.1.E External Hazards and Accident Initiators

No Compulsory Requirements.

General

There are no compulsory requirements.

1.1.F Infrastructure

No Compulsory Requirements

General

There are no compulsory requirements.

1.1.G Regulatory and Decommissioning

Details of the regulatory framework for ITER will depend on the Host Country. At a minimum the Host's regulatory system must provide a practicable licensing framework to permit ITER to be built and to operate including, in particular the following:

1. the transport of about 25 kg tritium during the course of ITER operations
2. the acceptance and safe storage of activated material arising from operation and decommissioning.

The agreement with the Host should provide for the issue of the liability for matters beyond the capacity of the project that may arise from ITER construction, operation and decommissioning.

JASS Criteria

1) Experience and expertise of the tritium transport.
2) Regulations on the tritium transport.
3) Plan on how tritium will be shipped to the proposed site over the life of the project.
4) Arrangements to cover liabilities beyond the capacity of the project needs to be covered in the description.
5) Regulations, practices and plan for the deactivation, storage and decommissioning of ITER and its materials.

In Spain only type-A (0.1 g) tritium containers have been transported so far, but for the reasons outlined below tritium transportation to this site should not present any problem.

- In Spain, there is experience in transportation of radioactive materials and spent fuel from the numerous nuclear power plants operating.
- Tritium can be transported to Vandellos under the existing Spanish legal framework, similar to international ones, for the transportation of radioactive material. Moreover, in Vandellos, tritium can be directly delivered to the site by sea.
- As no tritium sources exist in Spain, the ITER required supply over its operational lifetime will come from the international market. Packages of B(U)-type can be used (more than 0.1 g and up to 330 g).

ITER would be subject to financial responsibility for nuclear liabilities as established in the Nuclear Energy Act (25/1964) with a range of liability capping between 6 M€ and 150 M€, depending on the radiological risk. Above these amounts, under the responsibility of the operator, the victims would be compensated according to the Paris convention.

Radioactive waste management and decommissioning activities are concentrated under the responsibility of one single agency, ENRESA, which was set up in 1984 as a state-owned company (80% CIEMAT, 20% Finance's Ministry). ENRESA's main missions are a) The collection, transport, treatment, storage and disposal of the radioactive wastes generated in Spain, b) The decommissioning of disused nuclear and radioactive facilities, c) The environmental restoration of all the nuclear facilities, including uranium mines and mills.

Actual experience on decommissioning projects is available. Special mention might be made of the work corresponding to the dismantling of the 500 MW gas-graphite type Vandellos I nuclear power plant (located close to the proposed ITER site). The works will be completed in the first quarter of 2003 and a large part of the site (about 80%) will be released.

See also Section 5.

1.2 SITE DESIGN ASSUMPTIONS

The following assumptions have been made concerning the ITER site. These site design assumptions are uniformly applied to all design work until the actual ITER Site is selected.

1.2.A Land

1.2.A.1 Land Area

Assumption During the construction it will be necessary to have temporary use of an additional 30 hectares of land adjacent to or reasonably close to the compulsory land area. It is assumed this land is available for construction laydown, field engineering, pre-assembly, concrete batch plant, excavation spoils and other construction activities.
During operating phases, this land should be available for interim waste storage, heavy equipment storage and activities related to maintenance or improvement of the ITER Plant.

Bases The assumptions made for the cost and schedule estimates are based on construction experience which uses an additional area of 25 hectares. Only a very limited amount of vehicle parking space (5 hectares) is allocated to the compulsory area, whereas similar amount will be required to satisfy temporary needs during construction.

JASS Criteria

1) Location and area of additional land used to support construction
2) Present ownership and present state, required work to fit the Site Requirements, if any
3) Duration of use, transfer of ownership or lease
4) Constraints on use, if any
5) Proposal on the specific site layout

See also point 1.1.A.

A sufficient amount of land is available to meet ITER's needs including satisfactory temporary needs during construction.

1.2.A.2 Topography

Assumption The ITER site is assumed to be a topographically "balanced" site. This means that the volumes of soil cuts and fills are approximately equal over the compulsory land area in Requirement A.1. The maximum elevation change for the "balanced" site is less than 10 m about the mean elevation over the land area in the compulsory requirement.

JASS Criteria

1) Map of the site, difference of elevations
2) Plan of the land preparation, including areas set aside to handle soil storage.

See also section 1.1.A

The land will be prepared by the Host to accommodate ITER. The approximate volume of excavation in the nuclear area is 430,000 m^3 and the approximate volume of fill is 400,000 m^3.

As a result of a topographic analysis, 22 m above sea level is proposed as grade elevation of the site. The entire nuclear area will be at this elevation.

1.2.A.3 Geotechnical Characteristics

Assumption The soil surface layer at the ITER Site is thick enough not to require removal of underlying hard rock, if present, for building excavations, except in the area under the Tokamak Building itself, at an excavation level of about 25 m.

JASS Criteria

1) Soil Configuration and characteristics

See Section 1.1.A.2

1.2.A.4 Hydrological Characteristics

Assumption Ground water is assumed to be present at 10 m below nominal grade, well above the Tokamak building embedment of up to 16m below nominal grade. This assumption will require engineered ground water control during the construction of the Tokamak building pit.

JASS Criteria

1) Known groundwater characteristics and control experience at the entire site, supported by site inspection reports available for review by JASS assessment team
2) Plan for management of groundwater during and after excavation/construction

The results of the geological analysis (see also Section 1.1.A.2) show that the groundwater level is located approximately at sea level (+1 m), or approximately 21 m below grade. The ITER assumptions are met but groundwater management may be required.

1.2.A.5 Seismic Characteristics

Assumption The ITER seismic design specifications for the applicable Safety Importance Class (SIC) are based on an assumed seismic hazard curve. Using the IAEA seismic classification levels of SL-2, SL-1, and SL-0 and the assumed seismic hazard curves, the following seismic specifications are derived:

SIC	IAEA level	Return Period (years)	Peak** Ground Acc.
1*	SL-2S 85% tile	10^4	0.4
2,3	SL-2 50% tile	10^4	0.2
3	SL-1 50% tile	10^2	0.05
4***	SL-0	short	0.05

* No ITER components in this class
** Peak Ground Acceleration is for both horizontal and vertical components in units of the gravitational acceleration, g.
*** SIC 4 components, the seismic specifications are not derived probabilistically - local (uniform) building codes are applied to this class. A peak value of 0.05g is assumed equal to the SL-1 peak value.

Bases Safety assessments of external accident initiators for facilities, particularly when framed in a probabilistic risk approach, may be dominated by seismic events. Assumed seismic hazard curves are used in a probabilistic approach which is consistent with IAEA recommendations for classification as a function of return period. The selection of the assumed seismic hazard curve is relevant to regions of low to moderate seismic activity. Prior to site selection, specification of the peak horizontal and vertical ground acceleration provide the ITER designers guidelines according to the methodology to be used for seismic analysis, which will rely on a specified Ground Motion Design Response Spectrum and a superposition of modal responses of the structures (according to NRC recommendations). After site selection the actual seismic specifications will be used to adjust the design, in particular by adding seismic isolation, if necessary.

JASS Criteria
1) Seismic design approach/guideline; e.g. deterministic/probabilistic, seismic classes, levels, and design standard
2) Seismic design conditions(data); e.g. Historical records of earthquakes, data of active faults, design seismic motion, and location of seismic excitation
3) Specification and assessment of Seismic isolator, if necessary

In order to license ITER in Spain, the Spanish licensing authority, the Nuclear Safety Council (CSN), requires an individual site-dependent seismic study.

In Vandellos two Response Spectra are considered.

- The first to be used for design purposes, is based on the estimation of seismic hazard using a conventional procedure (NRC 10CFR100 Appendix A), and provide consistently lower spectral acceleration values than those assumed in the ITER generic design (ZPA=0.16g vs. 0.2g).
- A second is obtained by considering paleoseismicity and will be used in the probabilistic risk assessment to establish the ultimate margins. While, in this case, the spectrum is more intense at Zero Period (ZP), its strength is less than the ASME/NRC design assumption for frequencies below 10Hz. As the building main mode is about 4Hz and the main modes of the tokamak below that, the response of building and tokamak will be within the generic assumption.

No paraseismic isolators are required for the proposed Site.

1.2.A.6 Meteorological Characteristics

Assumption A general set of meteorological conditions are assumed for design of buildings, civil structures and outdoor equipment, as follows:

- Maximum Steady, Horizontal Wind ≤ 140 km/hr (at 10 m elevation)
- Maximum Air Temperature ≤ 35 °C (24 hr average ≤ 30 °C)
- Minimum Air Temperature ≥ -25 °C (24 hr average ≥ -15 °C)
- Maximum Rel. Humidity (24 hr average) ≤ 95% (corresponding vapour pressure ≤ 22 mbar)
- Maximum Rel. Humidity (30 day average) ≤ 90% (corresponding vapour pressure ≤ 18 mbar)
- Barometric Pressure - Sea Level to 500 m
- Maximum Snow Load - 150 kg/m^2
- Maximum Icing - 10 mm
- Maximum 24 hr Rainfall - 20 cm
- Maximum 1 hr Rainfall - 5 cm
- Heavy Air Pollution (Level 3 according to IEC 71-2)

Bases The assumed meteorological data are used as design inputs. These data do not comprise a complete set, but rather the extremes which are likely to define structural or equipment limits. If intermediate meteorological data are required, the designer estimates these data based on the extremes listed above. Steady winds apply a static load on all buildings and outdoor equipment.

JASS Criteria

1) Temperature
2) Humidity
3) Rain fall
4) Wind velocity
5) Snow fall
6) Atmospheric pressure (elevation)
7) Availability of meteorological database of site characteristics over a period of years.

All meteorological design assumptions are met in the Vandellos Site.

1.2.B Heat Sink

Water supply and industrial sewage for Heat Rejection System

Assumption The JCT has selected forced draft (mechanical) cooling towers as a design solution until the ITER site is selected. At 30% pulse duty cycle (450 MW average heat rejection) the total fresh ("raw") water requirement is about 16 m^3/minute. This water makes up evaporative losses and provides replacement for blowdown used to reduce the accumulation of dissolved and particulate contaminants in the circulating water system. During periods of no pulsing the water requirement would drop to about 5 m^3/minute.
Each blowdown action will lead to a peak industrial sewage rate of 3000 m^3/day.

Bases The actual ITER Site could use a number of different methods to provide the heat sink for ITER, but for the purposes of the site non-specific design, the induced draft (mechanical) cooling towers have been assumed. These cooling towers require significant quantities of fresh water ("raw") for their operation. For 450 MW average dissipation, approximately 16 m^3/minute of the water is lost by evaporation and drift of water droplets entrained in the air plume, and by blowdown. This water also supplies make up to the storage tanks for the fire protection system after the initial water inventory is depleted. Cooling towers may not be suitable for an ITER site on a seacoast or near a large, cool body of fresh water. Therefore open cycle cooling will be considered as a design option.

JASS Criteria

1) Cooling Tower System:
   - Water supply capacity and restrictions for the cooling system;
   - Capacity of the drainage and blowdown flow for the cooling system; and
   - Seasonal air temperatures and humidity levels, wet bulb temperatures.
2) Sea Water Cooling System/Once through Cooling System:
   - Distance from the coast;
   - Allowable increment in the temperature of the sea water; and
   - Average water temperatures and seasonal variations.

Given the proximity of the Site to the sea both cooling towers and seawater cooling options have been considered.

Cooling towers option

Based on the local climatic data, the need of 8 cells (6+2 additional), in a back-to-back configuration, along with a hot basin of 12,000 m^3 has been determined as sufficient.
For supplying the make-up water for the cooling towers, a desalination plant of adequate capacity will have to be built (not included in the ITER base cost). Due to the high quality of the water obtained in such a way, in order to get the concentration ratio considered by ITER the water flow required is ~840 m^3/h, instead of the 960 m^3/h assumed in the generic ITER design.

Seawater cooling

As the site is located a few hundred meters away from the coast, a seawater cooling option with an intermediate loop has been studied. Such a system is considered advantageous from some standpoints:

- Should ITER require dissipating higher power than expected, it could be accommodated more easily.
- The seawater temperature is lower than air (both dry and wet bulb) and more stable during the course of seasonal changes.
- An intermediate closed loop between the environment (sea) and the PHTS heat exchangers limits the possible releases in case of primary heat exchanger tube leakage.

The seawater Cooling System proposed consists of seawater intake facilities, seawater pumps (with a flow rate of 50,000 m^3/h), and heat exchangers located close the shore. An intermediate loop (Circulating Water System) between the seawater heat exchangers and the ITER heat exchangers will be required.

The seawater intake and outfall have been foreseen taking into account the main sea currents and the Spanish regulations. The seawater will be taken at 750 m from the coast, at a depth of 20 m. According to Spanish legislation, the discharge outlet must be at least 500 m away from the seashore on low tide. For the cooling water, common practice requires a delta T, between outlet and surrounding water, of 8 degrees.

1.2.C Energy and Electrical Power

1.2.C.1 Electrical Power Reliability During Operation

Assumption The grid supply to the Steady State and to the Pulsed switchyards is assumed to have the following characteristics with respect to reliability:

Single Phase Faults – a few tens/year 80%: t < 1 s
\- a few / year 20%: 1 s < t < 5 min
where t = duration of fault

Three Phase Faults - a few/year

Bases ITER power supplies have a direct bearing on equipment availability which is required for Tokamak operation. If operation of support systems such as the cryoplant, TF coil supplies and other key equipment are interrupted by frequent or extended power outages, the time required to recover to normal operating conditions is so lengthy that availability goals for the Tokamak may not be achieved. Emergency power supplies are based on these power reliability and operational assumptions.

See also section 1.1.C

The standard protection scheme for critical nodes in the Spanish transmission network is a redundant, double protection system with double independent communication. The electrical power reliability has been shown to satisfy the site design assumptions by a large margin.

Number of Three Phase and Single Phase Failures in the 400 kV Network

	1999	**2000**	**2001**
km of 400 kV lines	14278	14659	14856
Single phase failures for every 100 km of line	2.6	3	2.1
Three phase failures for every 100 km of line	0	0.01	0.01

1.2.C.2 ITER Plant Pulsed Electrical Supply

Assumption A high voltage line supplies the ITER "pulsed loads". The following table shows the "pulsed load" parameters for the ITER Site:

Characteristic	Values
Peak Active Power* ,#	500 MW
Peak Reactive Power	400 MVar
Power Derivative*	200 MW/s
Power Steps*	60 MW
Fault Level	10-25 GVA
Pulsed Power Period**	1000 s
Pulse Repetition time	1800 s

from which up to 400 MW is a quasi steady state load during the sustained burn phase, while the remaining 80 – 120 MW has essentially pulse character for plasma shape control with a maximum pulse duration of 5 – 10 s and an energy content in the range of 250 – 500 MJ.

* These power parameters are to be considered both positive and negative. Positive refers to power from the grid, while negative refers to power to the grid. Power variations will remain within the limits given above for the maximum power and for the power derivatives.

** The capability to increase the pulse power period to 3600 s is also assumed.

Bases The peak active power, the peak reactive power and the power steps quoted above are evaluated from scenarios under study. Occasional power steps are present in the power waveform. The supply line for pulsed operation will demand a very "stiff" node on the grid to meet the assumption.

JASS Criteria

1) High voltage lines (plan)
2) Capacity of pulse electrical power supply (active and reactive)
3) Demonstrate that the site meets the criteria listed in the site assumptions through a technical study in conjunction with the electrical system operator: Impact of voltage, reactive power and system harmonics should also be addressed; Impact of ITER pulses of various lengths (from a few seconds to 3000 s), on the steady state power supply, and on grid
4) If a supplemental system is required, what are the design options and impacts on ITER, with respect to additional facility requirements, modifications to site interfaces, additional land area, potential additional hazards, impacts on ITER operation, etc.

See also section 1.1.C.2.

In Vandellos, ITER would be connected to the neighbouring 400 kV Vandellos Substation which is an important node on the Spanish power grid and is located 2 km far from the site. Two 400 kV, 600 MVA lines, formerly connecting Vandellos I NPP to the 400 kV substation, still exist and are out of service at present. These lines follow the path required for connecting ITER to the grid and can be used without any significant modification. Both steady state and pulsed power supplies will be provided by these 400 kV lines.

The capability of the high voltage grid at Vandellos area has been analysed, taking into account the ITER requirements and assumptions. The results of the study demonstrate that, regarding grid voltage and frequency variations, the ITER requirements and assumptions are met.

The Spanish grid operator presently requires a power factor of 0.95 to standard consumers. If this restriction were applied to ITER, it would imply an increase of the reactive power compensator capability up to 750 Mvar.

The voltage variations resulting from the case without the activation of the Active Power Shedding (APS) system are within allowable limits. The maximum active power variation in the Vandellos NPP generator is less than 7 % (in case of a plasma disruption) , and remains within the range for which turbine-generator manufacturers do not foresee fatigue problems.

The different analyses performed have led to the conclusion that the APS system is not required.

1.2.E External Hazards and Accident Initiators

1.2.E.1 External Hazards

Assumption It is assumed the ITER Site is not subject to significant industrial and other man-made hazards.

Bases External hazards, if present at the ITER site, must be recognized in safety, operational and environmental analyses. If these hazards present a significant risk, mitigating actions must be taken to ensure acceptable levels of public safety and financial risk.

JASS Criteria

If any

1) Aircraft and air routes
2) Factories, industrial complexes, and nuclear facilities

The Vandellos site has no special requirements with regard to external hazards. The proposed site is adjacent to the nuclear generating station but will be outside the emergency evacuation zone. Because of this it will benefit from increased security including the diversion of local air traffic. There is no airport within a radius of 30 km. The closest airport is in Reus, 33 km to the northeast.

Man-made hazards, such as transportation of hazardous material via the Railway line or via the Highway were examined as part of the licensing process for Vandellos Nuclear Power Plant, which is at a similar distance to these ways compared with ITER. The fundamental risk stemming from these infrastructures is the transport of hazardous substances. At present, most hazardous materials transported through the area of study are shipped by land, mainly along the A7 motorway, although some are also transported by rail. The evaluation of the accidents following the US NRC has shown occurrence probabilities lower than 10^{-6} per year (limit considered acceptable in nuclear regulations).

1.2.E.2 External (Natural) Accident Initiators

Assumption It is assumed the ITER Site is not subject to horizontal winds greater than 140 km/hr (at an elevation of 10 m) or tornadic winds greater than 200 km/hr. The ITER Site is not subject to flooding from streams, rivers, sea water inundation, or sudden runoff from heavy rainfall or snow/ice melting (flash flood). All other external accident initiators except seismic events are assumed below regulatory consideration.

Bases The wind speeds specified in this requirement are typical of a low to moderate risk site. Tornadic winds apply dynamic loads of short duration to buildings and outdoor equipment by propelling objects at high speeds creating an impact instead of a steady load. The design engineer uses the tornadic wind speed in modeling a design basis projectile which is assumed to be propelled by the tornado. This design basis is important for buildings and structures that must contain hazardous or radioactive materials or must protect equipment with a critical safety function.

ITER is an electrically intensive plant, which would complicate recovery from flooded conditions. This assumption does not address heavy rainfall or water accumulation that can be diverted by typical storm water mitigation systems. For the purposes of this assumption, accidents involving fire, flooding and other initiators originating within the ITER plant or its support facilities are not considered external accident initiators.

JASS Criteria

1) Historical records of hazard caused by strong winds and high water.
2) Historical records of floods.
3) Historical records of land slides.

There are no historical data on floods for this basin. However, a hydro-meteorological study has been performed to evaluate flood hazards, taking into account that ITER is located in the seasonal basin of the Bassa Nova ravine, formed by several small gullies. The morphological parameters of the basin have been evaluated, obtaining a natural drainage surface of 2.7 km^2. The maximum probable water flows have been calculated based on precipitation data, with a hydro-meteorological model. No flood risk is contemplated since the basic drainage water system for the plant will be able to evacuate the calculated peak flows.

There are no historical records of landslides on the site. The geological studies performed for the site show no traces of landslides and given the soil characteristics this kind of risk should not pose any restrictions.

1.2.F Infrastructure

General Bases The ITER Project is sufficiently large and extended in duration that infrastructure will have a significant impact on the outcome. Industrial, workforce and socioeconomic infrastructure assumptions are not quantitatively stated because there are a variety of ways these needs can be met. The assumptions are fulfilled if the actual ITER site and its surrounding region already meets the infrastructure needs for a plant with similar technical, material and schedule needs as ITER requires.

1.2.F.1 Industrial

Assumption It is assumed the ITER Site has access to the industrial infrastructure that would typically be required to build and operate a large, complex industrial plant. Industrial infrastructure includes scientific and engineering resources, manufacturing capacity and materials for construction. It is assumed the ITER Site location does not adversely impact the construction cost and time period nor does it slow down operation. The following are examples of the specific infrastructure items assumed to be available in the region of the site:

- Unskilled and skilled construction labor
- Facilities or space for temporary construction labor
- Fire Protection Station to supplement on-site fire brigade
- Medical facilities for emergency and health care
- Contractors for site engineering and scientific services
- Bulk concrete materials (cement, sand, aggregate)
- Bulk steel (rebar, beams, trusses)
- Materials for concrete forms
- Construction heavy equipment
- Off-site hazardous waste storage and disposal facilities
- Industrial solid waste disposal facilities
- Off-site laboratories for non-radioactive sample analysis

Bases Efficiency during construction and operation of a large, complex industrial facility varies significantly depending on the relative accessibility of industrial infrastructure. Accessibility to infrastructure can be demonstrated by comparable plants operating in the general region of the site.

JASS Criteria

1 Engineering resources and mfg capacity:

1) Accessibility to the industrial infrastructure with integrated experience in large projects especially for power plants and fusion facilities. The infrastructure would include:
   - Capability for fabrication of large components (e.g. vacuum vessel, PF coils, etc.);
   - High speed international communication network available to ITER;
   - Pool of neighbouring research oriented companies and their experience and competence relevant to a big project;
   - Facilities for supplying construction materials and equipment to the ITER site;
   - Off-site laboratories for non-radioactive analysis and their capacity; and
   - Handling requirements and restrictions on hazardous waste handling and disposal.

2 Scientific and research resources:

1) Already existing research facilities in the field of fusion, nuclear, and science.
2) Advanced computational facility, academically informative environment.
3) Broad and stable community support for the fusion research.

European industries have participated in the construction and operation of several fusion devices and the R&D projects undertaken during the ITER EDA. Therefore there is a proven European industrial capability in all areas of the ITER project. Europe is amongst the leading countries in the development of nuclear fusion and it does so at a number of scientific and research institutes. Also in many other fields of science and technology, Europe is at the forefront with examples like CERN, European Space Agency, the European Space Observatory, Arianespace, etc.

The European Fusion Program includes 21 contracts of associations with Euratom, and a total of about 1700 professionals.

A high-speed communication system is already in place in the Tarragona area with a capacity of 2.5Gbps. Additional expansions are expected to the site.

Along the last 20-25 years, Spain and more specifically the Tarragona region have been growing at one of the highest rates in Europe. This growth has been based, to a certain extend, on the development of big civil works like the construction of thousands of kilometres of highway roads, the third generation of Spanish nuclear power plants (where Spanish industries participated with 85% of the construction), the high velocity train network, the Olympic Games at Barcelona, the World Expo in Seville and a number of big scientific projects (the Grantecan telescope at the Canary Islands, the TJ-II stellarator at Madrid, the synchrotron radiation source at Barcelona…).

Chemicals and energy are the key industries in Tarragona's production base, representing approximately 42.5% of industrial GDP. The concentration of a number of chemical companies, logistics and transport services specializing in the chemical industry and a workforce that is particularly qualified in this area, given the region's long history in the chemicals field, offer important economies of scale and concentration in the province of Tarragona.

The construction industry in Catalonia is one of the most developed of the whole range of Catalan industries. An industry that accounts for nearly 7% of Catalan GDP and employs more than 200,000 workers.

Catalonia has a highly qualified workforce, especially in respect of professionals qualified in the more technical and technological fields, and the number of science and engineering majors has grown considerably in recent years, representing nearly 45% of the student body. In a radius of 250 km around the site there are around 20 universities. Catalonia has 13 universities, two of which are in Tarragona: Rovira i Virgili University (URV) and the International University of Catalonia.

The existence of needs common to ITER in areas such as the petrochemical and nuclear industries (maintenance, engineering, etc.) facilitates the existence of an experienced and fully operational auxiliary sector.

Fire protection and emergency medical services are available in the neighbouring Nuclear Power Plant site.

See also Chapter 4.

1.2.F.2 Workforce

Assumption It is assumed that a competent operating and scientific workforce for the ITER Plant can be recruited from neighbouring communities or the workforce can be recruited elsewhere and relocated to the neighbouring communities.

It is also assumed that ITER has the capability for conducting experiments from remote locations elsewhere in the world. These remote locations would enable "real-time" interaction in the conduct of the experiments, while retaining machine control and safety responsibilities at the ITER Site Control Facility.

Bases The workforce to operate, maintain and support ITER will require several hundred workers. The scientific workforce to conduct the ITER experimental program will also require several hundred scientists and engineers. The assumption that these workers and scientist/engineers come from neighbouring communities is consistent with the site layout plans which have no provisions for on-site dormitories or other housing for plant personnel.

A significant scientific workforce must be located at the ITER Site as indicated in the Assumptions. However, this staff can be greatly augmented and the experimental value of ITER can be significantly enhanced if remote experimental capability is provided. The result of the remote experiment is that scientific staffs around the world could participate in the scientific exploitation of ITER without the necessity of relocation to the ITER Site.

Remote experimental capability is judged to be feasible by the time of ITER operation because of advances in the speed and volume of electronic data transfers that are foreseen in the near future.

JASS Criteria

1) Define the pool of site engineering and scientific services and staff available to support ITER construction and operation with reference to their experience
2) Define the pool of construction labour available at or near the ITER site with reference to their experience, and the facilities needed to maintain and house the required workers drawn from this base

See 1.2.F.1

1.2.F.3 Socioeconomic Infrastructure

Assumption The ITER Site is assumed to have neighbouring communities which provide socioeconomic infrastructure. Neighbouring communities are assumed to be not greater than 50 km from the site, or one hour travel. Examples of socioeconomic infrastructure are described in the following list:

- Dwellings (Homes, Apartments, Dormitories)
- International Schools from Kindergarten to Secondary School
- Hospitals and Clinics
- Job Opportunities for Spouses and other Relatives of ITER workers
- Cultural life in a cosmopolitan environment

Bases Over the life of the ITER plant, thousands of workers, scientists, engineers and their families will relocate temporarily or permanently to the communities surrounding the ITER site. These people could comprise all the nationalities represented by the Parties. This "world" community will present special challenges and opportunities to the host site communities.

To attract a competent international workforce international schools should be provided. Teaching should be partially in the mother tongue following programmes which are compatible with schools in each student's country of origin. All parties should assist with the international schools serving these students.

The list of examples is not intended to be complete but it does illustrate the features considered most important. The assumed 50 km distance should maintain reasonable commuting times less than one hour for workers and their relatives.

JASS Criteria

See 1.2.F.1 and Section 2 (Socio-Cultural Aspects)

1.2.G Regulatory and Decommissioning

1.2.G.1 General Decommissioning

Assumption During the first phase of decommissioning, the ITER operations organization places the plant in a safe, stable condition. Dismantling may take place decades after the "deactivation" phase. Dismantling of ITER is assumed to be the responsibility of a new organization within the host country. The ITER operations organization will provide the new organization all records, "as-built prints", information and equipment pertinent to decommissioning. Plant characterization will also be provided for dismantling purposes after "deactivation".

Bases Experience and international guidelines (IAEA Safety Series No. 74, 1986, “Safety in Decommissioning of Research Reactors”) stress the importance of good record keeping by the operations organization as a key to decommissioning success.

JASS Criteria

See Section 1.1.G and Section 3 (Licensing Aspects) and Section 5.2 (Decomissioning costs)

1.2.G.2 ITER Plant "Deactivation" Scope of Work

Assumption The ITER operations organization will develop a plan to put the plant in a safe, stable condition while it awaits dismantling.

Residual tritium present at the end of ITER operations will be stabilized or recovered to secure storage and/or shipping containers.

Residual mobile activation products and hazardous materials present at the end of ITER operations will be stabilized or recovered to secure storage and/or shipping containers such that they can be shipped to a repository as soon as practical.

ITER deactivation will include the removal of in-vessel components and their packaging in view of long-term storage. This removal from the vacuum vessel will be done by personnel and remote handling tools, trained for maintenance during the previous normal operation.

Liquids used in ITER systems may contain activation products, which must be removed before they can be released to the environment or solidified as waste. It is assumed that all liquids will be rendered to a safe, stable form during the "deactivation" phase, and afterwards no more cooling will be necessary

ITER "deactivation" will provide corrosion protection for components which are vulnerable to corrosion during the storage and dismantling period, if such corrosion would lead to spread of contamination or present unacceptable hazards to the public or workers.

Bases It is recommended (IAEA Safety Series No. 74, 1986) that all radioactive materials be rendered into a safe and stable condition as soon as practical after the cessation of operations.

JASS Criteria

See Section 1.1.G and Section 3 (Licensing Aspects) and Section 5.2 (Decomissioning costs)

1.2.H Construction Phase

General requirements for the construction phase (except land) are very dependent on local practice. However, water, sewage and power supplies need to be provided at the site for a construction workforce of up to 3000 people.

JASS Criteria

1) Provision of potable water, sewage (3000 men)
2) Provision of electrical power during the construction
3) Demonstration of general familiarity with the requirements associated with a large construction site. Accordingly, the availability of adequate site facilities, construction offices, temporary construction buildings, amenities buildings, etc. needs to be demonstrated

See section 1.1.A.3 for potable water

See section 1.1.C for electrical power

2.0 SOCIO-CULTURAL ASPECTS

2.A ACCESS AND TRANSPORT

2.A.1 Highway Transport

Assumption The ITER Site is accessible by a major highway, which connects to major ports of entry and other centres of commerce

JASS Criteria

1. Major streets access
2. Highway access
3. Transport restrictions for large/heavy components.
4. Commuting distances and times from major centres, ports etc.

2.A.2 Air Transport

Assumption The ITER Site is located within reasonable commuting time from an airport with connections to international air service.

JASS Criteria

1. Access to international airports
2. Number of international flights

2.A.3 Rail and Waterway transport

Assumption It is assumed the ITER site will have rail and waterway access. The railway is assumed to connect to major manufacturing centres and ports of entry.

JASS Criteria

1. Major railway access
2. Major waterway access
3. Transport restrictions for large/heavy components

Information in this section is provided by the Government of Catalonia.

See also section 1.1.A for land description and 1.1.D for transport and shipping.

1) Road transport

The JASS Ad-hoc Group visited the proposed Site, located ~ 46 km (~ 30 min. drive) south of Tarragona and ~134 km (~75 min. drive) from Barcelona Airport. This enabled the Group to observe the access and transport conditions.

The proposed Site is accessible by A7/E15, a 4-lane motorway running south from Barcelona to Tarragona and then going further south past Tarragona to L'Hospitalet de l'Infant, the town which is ~5 km north of the Vandellos site. There is an exit from the motorway at L'Hospitalet de l'Infant.
A frequent, regular public bus service is available from Barcelona Airport to Tarragona, and from Tarragona to L'Hospitalet de l'Infant. There is also a bus service directly between Barcelona Airport and

L'Hospitalet de l'Infant.

In addition, there is a private bus service from the train station at L'Hospitalet de l'Infant to the Vandellos site at the beginning and end of the working day. This service could be extended to the ITER staff under an agreement between the Organization and the operator of the bus service.

To drive on the roadways, ITER non-European personnel and their dependants require either an international driver's license, if staying for a short period of time, or a Spanish driver's license. If staying for a period longer than 1 year, it is necessary for non-EU citizens to obtain a Spanish driver's license. This requires taking the home country driver's license to the office of the Director General for Traffic, where it will be converted to a Spanish driver's license. Car insurance is compulsory and insurance companies recognize an individual's driving record from countries of origin where reciprocal arrangements are in place.

2) Air Transport

Access to international travel is via Barcelona Airport (~75 min. drive) or the Valencia Airport (~2 hour drive). For example, there are frequent flights to the airports in London, Paris, Frankfurt, Madrid and Amsterdam. There is a local airport at Reus (~ 25 min. drive) that has a regular service to Madrid and some international flights. In two years, an AVE (Alta Velocidad Espanola) from Tarragona to Barcelona Airport (~ 30 min.) and to Madrid (~ 2 hours 20 min.) will offer other transfer options.

3) Rail and Waterway Transport

For personal transport, there is a rail network for daily transportation between local centres such as L'Hospitalet de l'Infant, Cambrils, Salou, Tarragona, Reus and beyond to Barcelona. The AVE will be available in two years for services from Tarragona to Barcelona, Madrid and other European cities.
Docking facilities are available at the Tarragona Port and Barcelona. In addition, there are ferry services from Barcelona to nearby Mediterranean islands.

2.B SOCIAL INFRASTRUCTURE and LIVING CONDITIONS

Assumption The ITER Site is assumed to have neighbouring communities which provide socio-economic infrastructure. Neighbouring communities are assumed to be not greater than 50 km from the site, or one hour travel. Examples of socio-economic infrastructure are described in the following list:

1. Dwellings (Homes, Apartments, Dormitories)
2. International Schools from Kindergarten to Secondary School
3. Hospitals and Clinics
4. Job Opportunities for Spouses and other Relatives of ITER workers
5. Cultural life in a cosmopolitan environment

JASS Criteria

1) Living environment
2) Education (international schools, facilities)
3) Hospital and clinics
4) International cultural environment in neighbouring cities.
   - Name of the City, population
   - Summary of the urban function
   - Job opportunities for spouses of ITER workers.
   - Variety of lifestyle options
   - Safety and security
   - Cost effectiveness
   - Local services
   - Local worship options
   - Access to international travel
   - Cultural attractions
5) Serviced provided for long and short term visitors from abroad including volunteers‘ supports

Information in this section is provided by the Government of Catalonia.

1) Living Environment

The practical locations for ITER family residents are expected to be in the area near the site – Tarragona, Reus, Cambrils, Salou, and L'Hospitalet de l'Infant, or in the Barcelona area – for example Sitges. There is a wide variety of accommodation available for rental or purchase in these areas. Average housing costs for the Tarragona area range from 160,000€ (150 m^2) - 230,000€ (250 m^2) for a single-family house, or 540 – 750€ (90 – 120 m^2) per month for rental accommodation. Apartments can be obtained at a lower cost and villas at a higher cost depending on an individual family's preference. Housing costs in Barcelona are approximately double those in the Tarragona area. In the last two years (2001, 2000), housing prices in the area have increased an average of ~13% per year. Any foreign national is free to rent or purchase accommodation. There are a number of new housing and apartment developments in the area.

2) Education

Public education is free for all residents of Spain and is available between the ages of 3 and 18. For age 3 - 5 and 17 – 18 it is voluntary, and it is compulsory between the ages of 6 and 16. This education is given in Catalan and Spanish. English is taught as the first foreign language and training in a second language is optional.

There are two routes to higher education after the age of 16 with approximately equal proportions. One route leads to upper level vocational training and the other leads to university. Transfer from the upper level vocational training to the university training is possible.

The secondary school university route leads to a Spanish Bachillerato (Higher Education Leaving Certificate). This certificate is of the same level as a European Baccalaureate and is recognized by universities in other countries.

There is a commitment to establish an international school in the Tarragona area. The Spanish government would appeal to the Board of the European School to establish a European School. This request could include additional Japanese, Russian and other sections as needed in order to provide continuity with the home country school programme. A European School would lead to a European Baccalaureate. This option would be free for the children of European participants in ITER. There is a precedent for the schooling to also be free for children of non-European participants.

Alternatively, the Catalan Government, in cooperation with the Spanish Government and the ITER Organization, would establish an international school. This would lead to an International Baccalaureate. This school would be based on the European school model. The method for funding this option is not yet known.

There are 11,000 students in 31 existing international schools in Catalonia, mainly in the Barcelona area. These include schools from the UK, US, France, Germany, Switzerland, Italy and Japan. They are privately funded and the annual fees are in the range of 2,000 – 6,000€. One of the schools is a French school in the Tarragona area. Although at present there is no specific Russian schooling available, there is experience in integrating Russian children in the public school system in the Tarragona area.

Information was provided on the process of integrating foreign students into the Spanish School system including language training and cultural education.

Schools in Spain recognize qualifications gained in other countries and there are a range of equivalencies identified.

<u>3) Hospitals and Clinics</u>

The Spanish health care system, including medical and dental services, is funded from general government revenues. It is free for residents of Spain, and ITER families will be considered to be residents.

The ratio of doctors to people in the Catalonia region is 1/217. Many doctors are able to communicate in English and there is a translation service available for many languages. Hospitals in the Region regularly provide foreign nationals with a full range of treatments, particularly because of the large international tourist population.

There is an established network of hospital care in the Tarragona region with three levels:

1. Facilities for primary care, for example at L'Hospitalet de l'Infant, Cambrils and Salou,
2. Facilities for more specialized care, for example in Reus and Tarragona, and
3. Facilities for very specialized care, for example in Barcelona.

A common electronic system of patient records facilitates expedient sharing of information across these three levels.

In the case of emergencies, a specialized care centre can be reached within 30 minutes and many primary care centres are closer.
A helicopter service is also available in the event of critical conditions.

<u>4) International Cultural Environment in Neighboring Cities</u>

The Vandellos site is located in Catalonia region with a surface area of 31,895 km^2 and a total population of 6.1 million. Approximately 280,000 or 5 % are foreign residents. In addition, each year more than 20 million people visit the region. The towns close to the site are Cambrils, Salou, and L'Hospitalet de l'Infant. The nearest cities are Reus, which is ~37 km away and has a population of 95,000 and Tarragona, which is ~46 km away and has a population of about 115,000. The city of Barcelona is approximately ~134 km away and is the second largest city in Spain with a population of approximately 1.5

million.

Dependents of ITER staff will automatically receive a resident card, which will allow them to apply for a job.

The Catalonia region is well known for the variety of lifestyle options it offers. It has a mild climate and provides a safe and secure environment for families.

The cost of living in Spain is below the average for Europe, but is increasing at a higher rate.

In the Barcelona area, there are places of worship for many faiths and in the Tarragona area there are places of worship for the Anglican, Catholic and Muslim faiths.

There are a variety of cultural attractions throughout the Catalonia region including theme parks, museums, festivals, performing arts and concerts. There are also a variety of sports and recreational activities accessible to the public throughout the year.

The Governments of Catalonia and Spain will establish an organization (a welcome centre) to provide information, guidance and assistance to ITER families for their relocation and daily life. Administrative services will be provided in a variety of languages.

3.0 LICENSING ASPECTS

Roadmap toward a License including construction, operation, decommissioning

JASS Criteria

1) Regulatory framework
2) Safety design approach /guideline
3) Steps of licensing procedures
4) Road map
5) Design standard, QA etc.
6) Restrictions on long lead procurement, site preparation, and financing activities
7) Proponent's commentary on obtaining a nuclear construction, operation, and decommissioning license.

(1) Regulatory framework

In Spain the Ministry of Economy (MINECO) enforces laws and regulations, and is responsible for the issue of permits for nuclear and radioactive installations following a mandatory and binding report by the Nuclear Safety Council (CSN). The CSN is the sole body in Spain with competency in the control and surveillance of the nuclear and radioactive installations to guarantee their safe operation.

The Spanish legal system provides for the control and use of nuclear and radioactive materials and technology through national and international norms and technical instructions and guides issued by the CSN:

- national norms consist of laws, regulations and ministry instructions.
- international norms are those from the European Union, particularly the directives from EURATOM, and standards and guidelines related to conventions (e.g. the Convention on Nuclear Safety), to which Spain is a Party.
- CSN technical instructions, circular and guides related to nuclear and radioactive installations.

The licensing of ITER in Spain will use an approach based on the existing legal framework for nuclear installations. This must be appropriately adapted to effectively control the safety aspects specific to ITER in all of its phases. Furthermore, ITER will be subject to an Environmental Impact Statement, because the amount of thermal power transferred to the environment by the experiment is above the exempt level of 300 MW provided by law. In addition, since ITER is a unique international project, the safety approach to be followed by CSN in the evaluation of the ITER project will be based on the IAEA Safety Standards in all aspects that are not covered by the current Spanish regulations.

In Spain ITER will be classified as Nuclear Radioactive Installation.

(2) Safety design approach/guideline

The CSN has confirmed that the ITER licensing will follow a multi-step process to get authorisations or permits of site, construction, operation, modification, decommissioning and declaration of closure and will take into account the special characteristics of the ITER project and facility.

CIEMAT can initiate the formal licensing of ITER acting as a proxy of the Organization and request the CSN to start the review and assessment of the ITER safety design approach. However the licence can only be given to the ITER Organization.

It is envisaged that the evaluation of the ITER design, including external events, should pursue a logical sequence that may be composed of the following steps:

- Definition of basic safety objectives, based on the defence in depth deterministic approach, but using probabilistic targets for radiological doses to public, operators and environment;
- Derivation of safety requirements for the facility;

- Safety classification of structures, systems and components, with reference to unmitigated release and in relation to the radiological hazard of the facility;
- Application of a conservative design;
- Deterministic application of the defence in depth concept with definition of number and quality of safety levels, as well as the ALARA principle in relation to the radiological hazards of the facility;
- Development where applicable and practicable of a probabilistic study;
- Development of radiological dispersion analysis as a final check of the design.

This proposed sequence is in line with international practices in many countries, where a simplified probabilistic approach is kept in the background of the application of a deterministic design.

(3) Steps of licensing procedures and
(4) Road map

ITER licensing will follow a multi-step process, in accordance with the Regulations on Nuclear and Radioactive Installations (RINR) which including a) a Site Permit, b) a Construction Permit, c) an Operation Permit. Likewise, the decommissioning of ITER at the end of the plant operation will require a dismantling Permit and Closure statement.

These authorizations jointly with the procedures of public information are under the competencies of the Ministry of Economy (MINECO).

In addition, the ITER facility will require an Environmental Impact Assessment subject to procedures of public information, which should finally lead to the issuance of a positive Environmental Impact Statement (EIS) by the Ministry of the Environment (MMA). The attainment of the Site Permit is subject to the successful completion of the EIS.

Each one of the steps to be undertaken in the licensing process has a well-established set of procedures and well-defined definition of the mandatory documentation content.

The ITER licensing schedule accepted by the CSN respects the anticipated general technical schedule of the project including important milestones and deadlines such as the start up of the construction (2005). The issue of Site and Construction Permit will require ~18 months after the full required documentation is submitted.

(5) Design Standards and QA

For the tokamak, the CSN will not impose to the project any Spanish design code. The use by the ITER Organization of well-established foreign codes and standards, such as ASME or KTA, will be acceptable from a regulatory standpoint. The justification for the choice of appropriateness of the code should be provided. Concerning conventional civil and electrical works Spanish regulations will apply.

Regarding QA, the CSN has issued several guides including recommendations on the standards on which the QA programs should be based. These guides consider acceptable the Spanish industry standard applicable to the nuclear sector (UNE 73-41), which is based on the 18 criteria of Appendix B to the Part 50 to Title 10 of the US CFR.

In Spain it is accepted to use internationally recognised QA standards such as IAEA (SS No. 50-C/SG-Q), ISO 9001, or equivalent.

(6) Restrictions, site preparation, and financing activities

The procurement of long lead items may be started before the construction permit is issued, and after specific authorization by the CSN. Infrastructure civil works can begin after the Site Permit is issued.

(7) Proponent's commentary on obtaining a nuclear construction, operation, and decommissioning license

Following the schedule presented, during the second half of the present year 2002 the CIEMAT has launched the licensing–related tasks defined within the EISS-Vandellos project framework. On one hand, the purpose of these tasks is to initiate the preparation of the documentation to be submitted in support of the Environmental Impact Statement, Site Permit and Construction Permit and, on the other hand, to analyse in detail critical aspects on ITER design (mainly related to Safety) in the framework of the Spanish legislation requirements. These studies will also help in the preparation of the Preliminary Safety Study (a kind of PSAR) required for the award of the Construction Permit.

As of 15 November 2002, the EISS-Vandellos project has completed a number of tasks relating to the implementation of the above-mentioned schedule. Thus, drafts of the Preliminary Report or "Memoria Resumen" and the anticipated format of the Preliminary Safety Study or PSAR are already available, and other documents are well advanced in their preparation.

4.0 HOST SUPPORT

4.1 SITE SUPPORT

JASS Criteria

1) Special conditions of the site offer
2) Public /community support
3) Securities (fire services, police)
4) Responsibilities of the host in water supply, electricity supply, and maintenance of the road.
5) Required/recommended relation with local governments and communities
6) Use of existing facilities e.g. libraries, cafeteria, etc.

The Spanish Government has delegated authority to CIEMAT to act as the interface between the Spanish authorities and the ITER Organization.

Special conditions of the site offer

The Government of Spain will make available 70 ha of land free of rent to the Organization for the duration of the ITER project.

Public/community support

The Minister of Science and Technology has publicly stated the strong support of the Spanish Government for the proposal of Vandellos as a European site for hosting ITER. The Governments of Catalonia and the local municipalities have given their full support for hosting ITER.

The Presidents' Assembly of the Social Council for the Spanish universities has expressed its full support for research in fusion and hosting ITER in Spain.

Research studies have been conducted among the residents in the area and the results show strong support for hosting ITER in their community. The research also shows that people support development of fusion as an energy source, want to be informed about the project and want to be involved in the developments that may affect their community.

Security
See also Section 2. The Asco-Vandellos Nuclear Association, operator of the three neighbouring nuclear facilities, has offered to extend its emergency response, medical and radiological services to ITER. The actual costs to bring the services to the required level and the cost for their use would be charged pro rata to the different users. There is also a network of public emergency services, available by dialling 112. It has a multilingual capability including Catalan, Spanish, English, French, German, Italian and Portuguese. A new regional centre will co-ordinate the overall emergency response including police, fire and nuclear expertise.

Responsibilities of the host in water supply, electricity supply and maintenance of the road
The site requirements and site design assumptions for services and road access, both up to the site boundary and to the point of connection to the ITER generic facilities, will be met as part of the host obligations under the Agreement. This same arrangement would apply to the treatment and disposal of effluents.

Required/recommended relations with local governments and communities
CIEMAT will establish a liaison committee. The appropriate organization/structure is under discussion.

Use of existing facilities
There is a proposal to provide office accommodation for up to 100 persons during ITER's initial construction phase, and a cafeteria. The office services would be provided free of charge and the

cafeteria services would be on a contract basis. The ITER project could take advantage of the Virtual Library Collective Catalogue of the Universities of Catalonia. This service would be free of charge to ITER.

Access to CESCA and CIEMAT computing facilities would be available by high-speed link. Arrangements for access and payment would have to be made with the service provider.

5.0 FINANCIAL ASPECTS

5.1 OPERATIONAL COSTS

JASS Criteria

1) If a Party wishes, it could include in its proposal operating costs as an element to take into consideration for JASS. The operational costs should be analysed for the Site, considering the main categories of operating costs from the FDR. The same methodology of cost estimate as used for FDR should be used if possible.

The average annual wage for support staff, in the Tarragona region, is around 25 k€/year.

The cost of electricity was reported to be about 28M€ /a, based on FDR consumption and a unit cost of 0.043 € /kWh (including commodity and transmission charges). The proponent indicated that there are no other charges.

5.2 DECOMMISSIONING COSTS

JASS Criteria

1) Classification of the radioactive waste
2) ITER Waste management strategy
3) Dismantling strategy
4) Decommissioning costs (as listed in Section 1.1 G - Regulations and Decommissioning)

According to the current Spanish legal framework, and to the short/medium-term forecasts available, the following categories of wastes may be defined:

- Very low level wastes (VLLW)
- Low/Intermediate Waste, acceptable for the surface disposal option currently existing in Spain at El Cabril Waste Disposal Facility (LILW).
- Intermediate level waste, not acceptable for the El Cabril Waste Disposal Facility (ILW).
- High level waste, not acceptable for surface disposal (not applicable in ITER)

The same methodology discussed in the FDR has been adopted for the Vandellos specific cost study on decommissioning. After deactivation, the decay and decommissioning costs have been estimated as follows:

- 331 M€-2000 for dismantling including 67 M€ for the 25 years dormancy period and the inclusion of the dismantling operations not foreseen by IT such as the demolition of all buildings.
- 282 M€-2000 for the decommissioning waste, composed by 167 M€ for LILW, 110 M€ for ILW and 5 M€ for VLLW.
- 40 M€-2000 for the operational waste

6.0 PRIVILEGES AND IMMUNITIES

JASS Criteria

1) In presenting siting offers the interested Parties should indicate as part of their documentation, how they envisage to meet the project's likely needs in their specific circumstances.

The December 12, 2002 presentation by CIEMAT summarized the Spanish experience on Privileges and Immunities regarding international organizations.

The essential elements of the Privileges and Immunities are intended to be common to all Participants. These elements are being addressed in the Negotiations and they will be described in the Agreement itself.

The establishment of the JASS process did not include a review of Privileges and Immunities. It has been subsequently agreed that when questions with respect to these matters are raised during the JASS process, answers could be provided.