

COMPANY MANUAL

PREPARATION FOR VISAGINAS NPP PROJECT

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Glossary

bn	billion
EUR	Euro currency
IAEA	The International Atomic Energy Agency
INPP	The existing Ignalina Nuclear Power Plant
Investor	Strategic investor into the Visaginas Nuclear Power Plant
k or ths	in thousand
NNPP	New Nuclear Power Plant
NPP	Nuclear Power Plant
Project Manager	Entity selected to manage the VNPP construction and/or operation
Region	Lithuania, Latvia and Estonia
VAE	Visagino atominė elektrinė UAB
VATESI	State Nuclear Power Safety Inspectorate of Lithuania
VDI	State Labour Inspectorate of Lithuania
Vendor	The chosen supplier of the nuclear reactor
VNPP	The envisaged Visaginas Nuclear Power Plant
Potential Supplier	A potential supplier to the VNPP project being an entity registered in the territory of Lithuania and/or the Region who is aware of the VNPP process and the requirements therein.
Qualified Supplier	A Potential Supplier who has been qualified by the Strategic Investor and the relevant Lithuanian authorities such as VATESI to participate in the supply chain of the VNPP project
Contracted Supplier	A Qualified Supplier who has signed a supply / cooperation contract with the Strategic Investor and/or another Contracted Supplier and has become part of the VNPP supply chain.
Standard quality	Standard quality products and services common to large infrastructure projects
Supplemental quality	Project parts important to construction/operation, however not nuclear safety related
Safety related	Nuclear safety related project parts requiring special standards
Vendor	Company supplying nuclear power plant technology for NPP (not yet selected)

1 Visaginas NPP project

1.1 Current status

Visagino atominė elektrinė UAB (VAE) is in process of selecting a Strategic Investor to VNPP. Once the Strategic Investor is selected, the technology will be determined and Project Manager selected. In parallel, a number of other preparation works related to the project are taking place.

In 2010 VAE together with Deloitte Lietuva performed an initial assessment of regional supply chain capabilities (Lithuania, Latvia and Estonia) to supply goods and services to the Visaginas NPP construction project. The performed analysis showed that the Baltic Regional Supply Chain could potentially supply up to 30% of VNPP project demand. In monetary terms this transforms to a range of EUR 0.9 - 1.5bn depending on the project scale.

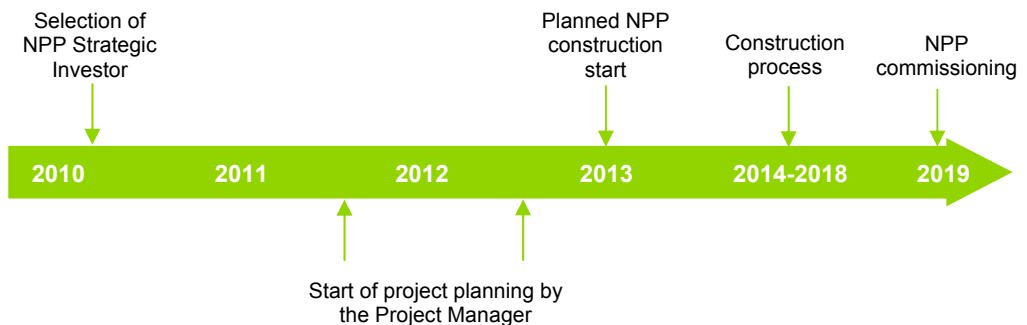
Initial Visaginas NPP Project assumptions according to VAE:

Area	Assumption
Number and type of reactors	One NPP with one unit
Reactor design	International III / III+ generation reactor design: - Water cooled - Thermal-neutron reactor
Preparation stage	2011 / 2012
Construction start	2013 / 2014
Project value	EUR 3 – 5 bn (referred to as Budget Low and High)
Location	Next to the current Ignalina NPP

NPP projects are complex and their successful execution largely depends on Project Manager's ability to control the process throughout the construction cycle which takes at least 5-7 years including preparation.

1.2 Envisaged timeline

Visaginas NPP Project timeline, based on current status and VAE project plan, is the following:



2 Demand for goods and services in Visaginas NPP project

2.1 NPP project supply scale

2.1.1 Overview

Throughout the project a large number of smaller sub-projects will take place, a number of which will provide opportunities for Lithuanian and/or Regional businesses. The pro-forma NNPP project investment allocation by key project areas is as follows:

Project area	budget, in %	Budget High* in EUR m	Region's capacity, in %	Region's share, in EUR m
Design and licensing	22%	1,100	25%	275
Nuclear Steam Supply System	28%	1,400	0%	0
Civil construction	20%	1,000	70%	700
Turbine & Mechanical	13%	650	35%	227
I&C	6%	300	35%	105
Other	11%	550	35%	193
Total	100%	5,000	30%	1,500

Note*: for pro-forma purposes the upper level of the envisaged construction cost range of EUR 5bn was used

Based on the Regional supply chain analysis construction, assembly, installation and related works will be the key areas for the Lithuanian and/or Regional businesses to compete for. The supply of components for the nuclear specific parts of the NPP requires being a part of the Global supply chain and investing significant time in advance to become qualified and certified. This is certainly feasible for companies with high quality product and capacity to deliver on larger scale.

Based on analysis of vendor supplied information on several technologies, the VNPP project will require substantial volumes of construction materials and components. Estimated maximum values of NPP construction components and inputs are presented in the following table.

Item	Unit	Max Value Range
High quality / reinforced concrete	m3	420,000+
Steel	tonnes	70,000+
Wiring	km	2,500
Piping	km	210
Valves	units	36,000+
Pumps	units	870
I&C tubing	km	226
Workers on site	number	5,000+
Man-hours worked	millions	10+

2.1.2 Potential for local suppliers

The Project Manager will have to procure a substantial part of products and services in open tenders, which will intensify the competitive pressure for local companies. Specialised and Safety-related products will be mostly procured from the Technology providers approved Global supply chain, the most of Supplemental quality and all Standard quality products and services will be openly tendered.

Taking this into account, local supply chain companies planning to participate in the NPP project must plan in advance, prepare and be ready to compete once the tenders are issued. Depending on the VNPP project timescale certain tenders may have relatively short response timing.

The Project Manager will have a vested interest to source the most effective and efficient services and the local supply chain seems to be a natural choice, however the complexity of the project will require any participating party to adhere to number of prequalification requirement, which can eliminate companies from the race, if they do not possess the needed prerequisites. In addition, local regulating bodies like VATESI have local requirements for the companies participating in NPP construction process, which will also shape the minimal requirements for the supply chain (detailed in Section 4.1).

The key components of a nuclear plant are divided into four main areas:

- Nuclear Island
- Turbine Island
- Balance of Plant
- Site Development and Construction

The specifics of the each project area dictate the requirements for suppliers of components, materials and services. Nuclear Island and nuclear related components pose the most rigorous requirements.

Nuclear Manufacturing Standards and Quality Assurance Requirements

Many components of a nuclear plant, particularly those critical to reactor safety, are subject to specific manufacturing standards. These standards ensure that the structures, systems, components and controls of a facility can be relied on to remain functional and follow design basis under rigorous conditions.

Components subject to these standards are often referred to as “nuclear-grade” or “safety-related” components. Facilities that manufacture them must have Quality Assurance (QA) programs in place to ensure that the standards are met (detailed in Section 4.2).

All products supplier and services rendered in a NPP project fall within one of three key categories, commonly used by the technology vendors:

Safety-related products

The manufacture of these components requires a Quality Assurance program. Alternately, vendors could work under the QA program of the prime vendor, utility or purchaser, however all vendors will ensure that subcontractor meets and adheres to these requirements before granting specific order.

Supplemental quality products

The purchaser of these products and services will typically set the specific quality requirements that must be met for each component. In addition, the minimum quality requirements will be shaped by local regulations and requirements (e.g. VATESI).

Standard quality products

All other products are typically considered standard quality products. Purchasers for these products will usually set specific expectations or requirements that must be met (similar to other large infrastructure projects). As for Supplemental quality, the local regulations and requirements will need to be adhered to.

The Vendor and technology for the VNPP has not yet been selected and this can affect the equipment and services required from the local supply chain as some designs involve mainly site-based civil works whereas other designs involved modular construction at factories and only erection at site. On this basis the provided information has to be regarded as preliminary, however **the minimum requirements will apply regardless of the technology chosen.**

This manual briefly covers the key areas and requirements for local companies willing to participate in the new NPP construction project:

	Standard quality	Supplemental quality	Safety related	Ref.
Products / Services	Basic products and services	Non safety related products/services important for construction and/or operation	Nuclear related components	2.1.2
Supplier's selection approach	Open tender / Quick approach	Open tender / Proactive / Standard approach	Standard approach	3.1
Requirements	ISO standards, VATESI & RSC requirements	ISO standards, VATESI & RSC requirements	ISO standards, VATESI & RSC requirements, ASME standard, RCC-M code, IEEE standards	4.1 & 4.2
Local company potential	High	Medium/High	Low	

Note: please refer to glossary for specific terms

2.2 Local supply chain

Based on the performed study the regional supply chain is well positioned to deliver conventional construction capacities required for VNPP construction. A substantial part of the engineering and construction work on a new nuclear power plant is not directly nuclear related, but is similar to work being carried out by many companies on other large infrastructure projects throughout the Region.

The skills required for a nuclear new build project are common to all large multi disciplinary infrastructure projects, however certain specific nuclear skills will be required in the areas of safety and licensing, which is a specialist area covering safety analysis and safety case preparation.

The critical area for successful nuclear power station delivery and operation is Quality Management. Independent quality inspection is required for safety critical items to ensure that they have been manufactured to the defined standards and that there is a clear auditable trail of all components. The local supply chain will be at a disadvantage, as certain internationally recognised accreditations and licensing will be required by the Vendor / Project Manager.

Specific skills and resources required for NPP can be sourced in advance by local and Regional companies, which still do have sufficient timeframe to make investments in facilities, recruiting and training staff for VNPP project. These additional resources could be put in place within the period for project development, planning and licensing (2-3 years).

2.2.1 Localisation assumptions

Based on initial assessment of the potential technology vendors' view, the expectation for the local supply chain is to be the most competitive in the following key areas:

- Balance of Plant;
- Site Development;
- Activities related to erection (both mechanical and electrical);
- Activities related to the civil work.

The extent of the localization will largely depend on the ability of local companies to meet the requirements and scale required for efficient participation. Detailed list of NPP project components and supply opportunities by key areas and quality grading is presented in Appendix 1.

2.2.2 Capacity requirements

The overall NPP construction project may be split into up to 150 contract packages separately tendered in the market. Companies granted with a specific package will usually have right to further subcontract part of the work, provided that they can ensure the same high quality standards and delivery terms. This expands the supply chain into a vast number of smaller projects which will have to be absorbed by both local supply chain and international competitors.

The NPP supply chain from top to bottom will have to adhere to the minimum quality requirements stipulated by legislation, technology vendor and Project Manager. This means, that the quality assurance requirements (discussed in detail in Sections 3 and 4) will be applicable not only to lead providers, but also to smaller subcontractors willing to participate in the process.

2.2.3 Human resources

The NPP construction project will require substantial volumes of professional, skilled and non-skilled labour force. The need for labour will not be linear and the number of people involved will vary depending on the construction stage. The process intensiveness will depend on the technology chosen and work plan developed by Project Manager. The potential volume of NPP project workforce required at peak is presented below.

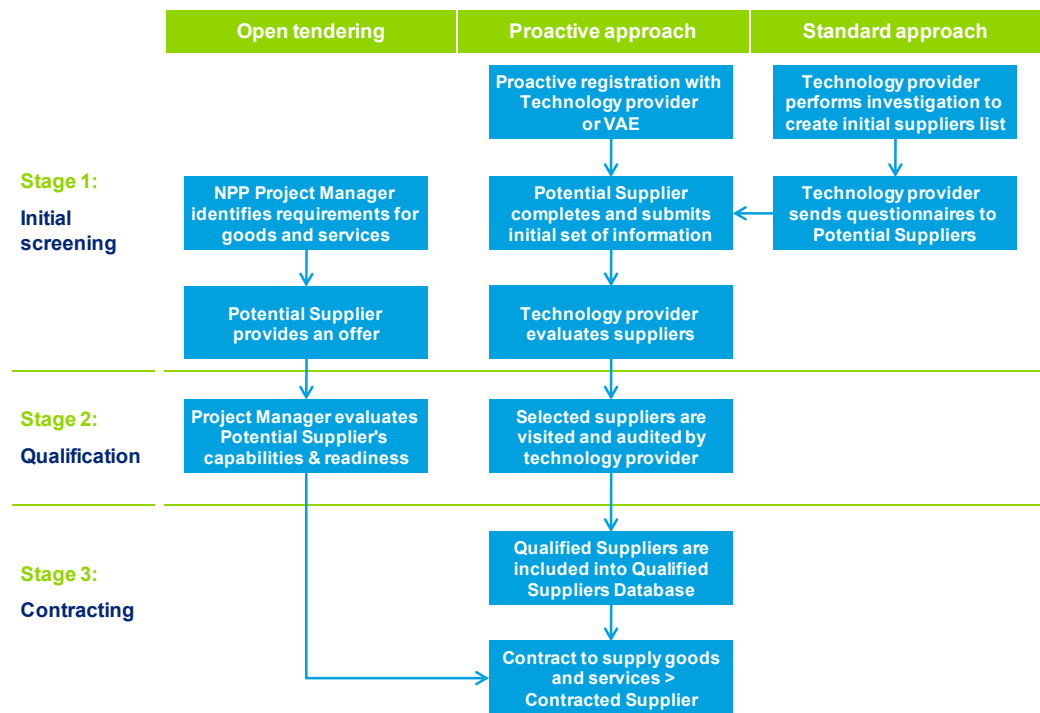
Job categories	# of people	% of workforce	# of local people	Localisation ratio
Management / Supervision	900	18%	300	33%
Skilled / Semi-skilled	3,300	66%	2200	67%
Non Skilled	800	16%	800	100%
Total	5,000	100%	3,300	66%

The above breakdown and percentages are based on the various vendor experiences on other similar projects. The key additional factors that may influence material changes are experience of the sub-contractors as well as the existence of qualified local suppliers.

3 New NPP supplier selection process

3.1 Involvement process overview

Each Potential Supplier will undergo a certain process in order to qualify to provide goods and services in NPP construction project, will have to satisfy the prerequisite requirements and be approved by Project Manager. There are several potential scenarios of the selection process. It can be either passive participation in tenders, or advance preparation to become Qualified Supplier for a given technology provider. The process scenario outline is presented below.



The main difference between Open tendering and Proactive/Standard approaches is the scope of products and services for which local suppliers may realistically compete. In general, open tendering is used by NPP Project Manager to effectively purchase Supplemental and Standard quality products and services for NPP construction, therefore the selection process is shorter. Proactive/ Standard approaches are used by the Technology provider to select companies which are able to supply more sophisticated products and become a Qualified Supplier – part of the approved / global supply chain.

If the more sophisticated or value added products and services will be procured via open tenders, the qualification requirements may be impossible to fulfil ad-hoc and only the fully qualifying entities (including preselected Qualified Suppliers) will compete for contracts.

More details about each stage in Potential Supplier's approval process are provided below.

Stage 1

Purpose of the Initial screening in under approach is to gather basic information about Potential Suppliers and/or potentially interesting companies (in case technology provider proactively screens for suppliers).

During Open tender approach Project Manager announces request for tender in public or contacts suppliers directly. More actions of suppliers are required in both Proactive and Standard approaches. Except for the first stage, where either a supplier registers via internet or the Technology provider starts investigation, the following steps in Proactive and Standard approaches are the same.

Information usually requested from Potential Suppliers in the Initial screening is basic:

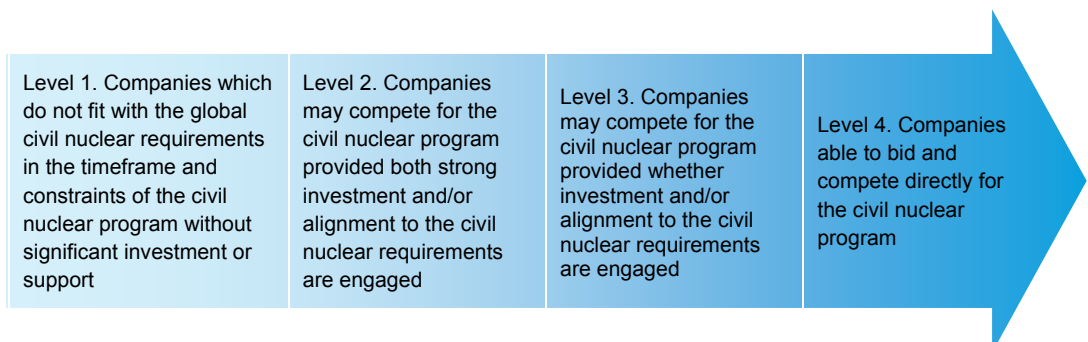
1. General information: company name, legal status, registration number, incorporation date, address, contact persons and etc.
2. Human resource data: total number of employees, employees' breakdown by functions, employee qualifications, accident statistics etc.
3. Financial & commercial data: historical data on turnover, net income, shareholder's equity, main fields of activities and % turnover of each of them.
4. Technical data: certifications held (ISO 9001 – 2000, ISO 14001) and standards applied (RCC–M, ASME, IEEE).
5. Fields of activities/specialisation (recent major projects/references).

The information from the Potential Supplier's information questionnaire is used to perform a first scoring and to pre-select companies.

Stage 2

During second stage Project Manager/Technology provider evaluates Potential Supplier's ability to align with requirements, including technical, Quality Assurance qualifications, manufacturing capacities/capabilities, credentials and commercial elements (requirements for potential suppliers are described in Section 4). Both environmental and safety issues are taken into account.

Most Technology providers (usually not applicable to open tendering process) have developed evaluation schemes, which group initially screened companies into specific categories according to their readiness and suitability for a specific task. Each company is assessed against comprehensive indicators that imply their state of readiness to support civil nuclear new build: ability to align on civil nuclear requirements and ability to provide product range aligned on civil nuclear products portfolio. According to the indicators, suppliers are grouped to specific levels characterising their readiness. The logic of the levels can be illustrated below.



Result of the survey allows Technology provider sort out and rank Potential Suppliers. Generally only Potential Suppliers falling within Levels 3 and 4 are allowed to proceed in the selection process (in limited cases companies from Level 2 may be invited, given they have high potential and/or interesting product). Companies falling into Level 2 and 3 usually receive a list of areas falling behind the set requirements. The survey assessment allows determining the strengths and weaknesses of the Potential Supplier and the set up of action plan and follow-up to reach the expected levels for being qualified. As necessary, product or process qualification tests may be handled.

During this phase, detailed technical assessment is performed, which allows to confirm that Potential Supplier is both technically and cost competitive become Qualified Supplier and/or to participate in global supply chain.

Stage 3

In case, the previous steps are completed successfully, depending on the approach used, Potential Supplier is either contracted (i.e. Contracted Supplier) or included into Qualified Suppliers' list.

Potential Suppliers, which are on Qualified Suppliers' list, can be awarded a purchase order or a contract to provide goods and/or services in NPP projects, which are implemented globally. The revisiting and revaluation of companies on of the approved list of Qualified Suppliers is done periodically (e.g. 2-3 year basis).

Depending on the quality requirements of the products and/or services which will be provided by Qualified Suppliers included in Suppliers Database, they are classified into three main categories:

Quality grading	Component status
Safety related products	Nuclear related components. Nuclear Island is the primary location for such components.
Supplemental quality products	Products and services non safety related but important for construction and/or operation. These components are required throughout the Nuclear Island, Turbine Island and Site.
Standard quality products	Other products and services. The Turbine Island and Site will generally require standard quality products.

The requirements for Potential Suppliers discussed further are based on this classification of quality grading for products and services.

3.2 Process comparison

Potential Supplier can choose as a matter of their business decision, one of many different possible approaches – be active or passive during selection process. The summary of key advantages and disadvantages in every stage of each approach are described below.

		Open tendering	Proactive approach	Standard approach
Stage 1	Pros:	– Potential Supplier is not required to take any actions until Project Manager announces tenders	– Interested company can start Potential Supplier's selection process itself – If Potential Supplier does not meet the requirements, there is possibility to improve and reach expected levels of qualifications – Potential Supplier is able to use EU funds for improvement or attend necessary trainings	– Technology provider contacts potentially interesting companies, which are seen as having potential – If a Potential Supplier does not meet the requirements, there is possibility to improve and reach expected levels of qualifications
	Cons:	– If a Potential Supplier does not meet the tender requirements, there is no time for improvement	– The process does not automatically guarantee successful completion	– There are fewer possibilities for smaller/less known companies to be contacted by technology provider
Stage 2	Pros:	– Requirements for Potential Suppliers may be lower	– Possibility to supply more sophisticated products/services	– Possibility to supply more sophisticated products/services
	Cons:	– Possibility to supply only Supplemental/Standard quality products/services	– Requirements for Potential Suppliers may be higher	– Requirements for Potential Suppliers will be higher
Stage 3	Pros:	– Simple and quick Potential Supplier's selection process	– Listing in Suppliers Database – Qualified Supplier becomes a part of global supply chain and is able to provide goods/ services for global NPP projects	– Listing in Suppliers Database – Qualified Supplier becomes a part of global supply chain and is able to provide goods/ services for global NPP projects
	Cons:	– Potential and Qualified Suppliers are not included in the Suppliers Database	– Time, investment and commitment is required to access the global supply chain	– Time, investment and commitment is required to access the global supply chain – Full process of becoming Qualified Supplier for global supply chain may take 2 years to complete

The above comparison on high-level and cannot take into account each and every potential aspect of the process, however it clearly indicates, that in order to access the more sophisticated project orders, advance investment is required.

4 Qualification requirements for Potential Suppliers

The qualification requirements for potential NPP suppliers can be generally grouped into two broad categories: Base and Advanced. The Base category covers prerequisite requirements which will be expected virtually from any Potential Supplier willing to participate in the NPP construction process. The Advanced requirements relate to supply of more advanced products and services requiring specific industry standards.

4.1 Base requirements

Any supplier in order to supply NPP with products or services will have to adhere to the specific prerequisite requirements stipulated by Technology provider, Project Manager and local supervisory bodies, which will be applicable to the supply object. The requirements for Potential Suppliers fall within four essential groups:

Requirement	Description
Quality	Fundamental requirement of quality governing codes and standards, continuous improvement, certified/qualified per technical specifications
Safety	Fundamental safety requirements, adherence to safety governing codes and standards
Cost	Competitive pricing, suppliers are encouraged to identify potential cost savings
Commercial	Delivery on time and on budget, financial viability of supplier, terms and conditions

4.1.1 Quality management

The following quality management standards will be prerequisite for VNPP Potential Suppliers regardless of the technology chosen.

4.1.1.1 ISO

All leading NPP Technology providers require suppliers to possess ISO certification.

ISO – International Organization for Standardization is the world largest standards developing organization. ISO has published more than 18 000 International Standards, ranging from standards for activities such as agriculture and construction, through mechanical engineering, to medical devices, to the newest information technology developments.

The following two standards are applicable for potential NPP suppliers:

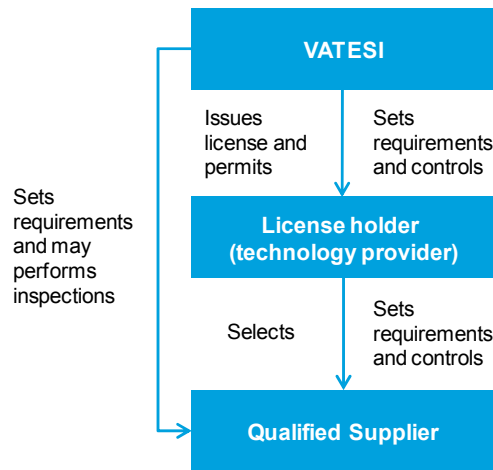
- **ISO 9001 - 2008** specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide product that meets customer and applicable regulatory requirements, including processes for continual improvement of the system and the assurance of conformity to customer and applicable regulatory requirements.
- **ISO 14001** (may be required for certain NPP project areas) specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. ISO

14001:2004 is applicable to any organization that wishes to establish, implement, maintain and improve an environmental management system.

For more information please visit ISO official website www.iso.org.

4.1.1.2 VATESI

VATESI – State Nuclear Power Safety Inspectorate the main regulatory and supervision institution of nuclear safety in Lithuania, which sets safety requirements, controls whether they are complied with, issues licences and permits, performs safety assessments and other functions.



VATESI has established new set of requirements - “Requirements for management system”, as a part of “Nuclear safety requirements” (Branduolinės saugos reikalavimai BSR-1.4.1-2010 „Vadybos sistemos reikalavimai“), which will be effective from 1 January 2011. These requirements are designated for organizations which are licensed to operate in the nuclear field (i.e. technology providers in NPP project). They also describe quality requirements for suppliers, e.g., suppliers management system must comply with ISO 9001 – 2008 requirements.

The overall set of requirements for management system is very detailed and for many companies it will take time to prepare, document respective processes and other required areas.

The VATESI set of requirements will be obligatory to Project Manager and will filter down throughout the supply chain.

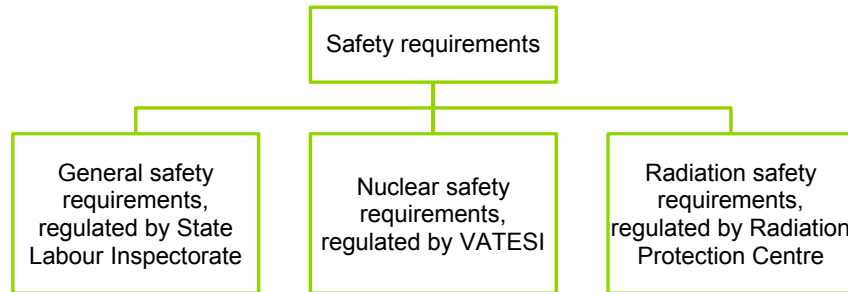
All related legislation and documentation is provided in VATESI website www.vatesi.lt.

4.1.1.3 Subcontractor quality management

VATESI “Requirements for management system” indicates that every supplier has to inform what subcontractors will be used and what will be their role in the project. The supplier has to ensure that the quality assurance requirements are applicable throughout the supply chain, which forces subcontractors to adhere to same minimal requirements.

4.1.2 Safety at work

Safety is the second group of key criteria, which will not be compromised in NPP project. Safety requirements can be divided into general safety, nuclear safety and radiation safety:



4.1.2.1 General safety

Every supplier is required to have a valid and adhered to health and safety policy procedures. The goal of health and safety policy is to foster a safe work environment and prevent risks to health. General safety requirements are regulated by State Labour Inspectorate of the Republic of Lithuania (VDI), which performs prevention of violations of standard acts regulating occupational safety and health, labour relations as well as the prevention of accidents at work and occupational diseases in enterprises.

For more information please visit VATESI and VDI websites www.vatesi.lt, www.vdi.lt.

4.1.2.2 Nuclear safety

Nuclear safety requirements are regulated and enforced by VATESI, which is also responsible for controlling whether they are complied with.

VATESI issues licences for organizations which are responsible for design, construction and management of NPP. As suppliers are subcontractors of license holder, there is no such requirement for a supplier to have a license in order to supply goods and/or services in NPP. However, supplier has to comply with general subcontractor requirements. For example, according to the rules of VATESI, every supplier's employee, who works in nuclear object area, has to undergo relevant training and be familiar with nuclear safety requirements.

All related legislation and documentation is provided in VATESI website www.vatesi.lt.

4.1.2.3 Radiation safety

Radiation safety requirements are regulated by Radiation Protection Centre (RSC). RSC is the Government authority supervising and controlling radiation protection activities, assessing and expertising public exposure and coordinating activities in radiation protection area.

Everyone who uses and works with ionizing radiation sources has to be trained of radiation protection, and to hold certificate of radiation protection. RSC issues Certificate of Radiation Protection to individuals who had compulsory training of radiation protection and passed the examination.

RSC coordinates, organizes and implements training courses for employees of organizations, private companies responsible for radiation protection and dealing with sources of ionizing radiation, and other specialists regarding radiation protection and preparedness for radiological emergency.

For more information please visit RSC official website www.rsc.lt.

4.1.2.4 Insurance

Each supplier should expect to be required to have the basic forms of insurance, such as civil liability insurance, employee/accident insurance, product insurance corresponding to the value range of supplied products and/or services.

4.2 Advanced certifications

Depending on the nuclear plant design and technology chosen for Visaginas NPP, its construction activities shall be in line with the specific standard. This means that local companies intending to provide components or related specialised services will need to be qualified according to a specific standard (these requirements are mainly related to the Nuclear Steam Supply System / Safety related equipment).

The two most commonly used internationally are the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (often referred to as ASME III code) and the RCC-M code of the French nuclear industry, as well as those developed by IEEE.

Please note that these standards apply to suppliers of components, parts and systems falling within Safety grade related products and will not be applicable to lower grade product suppliers.

4.2.1 ASME standards

ASME – American Society of Mechanical Engineers is a not-for-profit professional organization that issues codes and standards, publications, conferences and professional development programs to provide a foundation for advancing technical knowledge and a safer world.

Nuclear Component Certification Program (N-Type Code Symbol Stamps) is the standard for quality assurance of construction materials, design, operation, inspection, and continuing maintenance of nuclear facilities. The ASME N-Type Code Symbol Stamp is used to indicate that items stamped comply with the quality assurance requirements.

ASME, by the use of survey teams, reviews the implementation of the suppliers' quality assurance program. Any findings are discussed between the team and the supplier, and a report is submitted to the ASME Committee, which either authorizes the issuance of the certificate(s) of Authorization or requests additional action by the supplier.

The cost of survey team visit to Potential Supplier could range from \$40,000 to \$85,000, depending on the state of the quality assurance system in operation by the Potential Supplier. Supplier is also required to pay annual certificate fees and other dues.

For more information please visit ASME official website www.asme.org.

4.2.2 RCC-M code

RCC-M code is a set of design and construction rules for mechanical components of nuclear islands and primarily applies to safety class components. The code is published by AFCEN, French Association for the rules governing the Design, Construction and Operating Supervision of the Equipment Items for Electro Nuclear Boilers. RCC-M code concentrates on one type of plant, i.e. the PWR (pressurised water reactor).

Training in RCC-M requirements is provided by AFCEN, based in Paris, France. The extent of training can be for 1 day in Paris or up to 2 weeks at the applicant's site. The training gives a comprehensive overview of requirements. The Potential Suppliers aiming to get certified must undergo rigorous audit and inspection by AFCEN.

For more information please visit AFCEN official website www.afcen.com.

4.2.3 IEC standards

IEC – International Electrotechnical Commission a global organization that prepares and publishes International Standards for all electrical, electronic and related technologies. IEC standards provide industry and users with the framework for economies of design, greater product and service quality, more inter-operability, and better production and delivery efficiency. Using IEC standards for certification at the national level ensures that a certified product has been manufactured and type-tested to well established international standards. The end user can be sure that the product meets minimum (usually high) quality standards, and need not be concerned with further testing or evaluation of the product.

For more information please visit IEC official website www.iec.ch.

4.2.4 IEEE standards

IEEE – Institute of Electrical and Electronics Engineers is a global professional association dedicated to advancing technological innovation. IEEE develops international standards that underpin many of today's telecommunications, information technology and power generation products and services. IEEE has more than 395,000 members in more than 160 countries.

For more information please visit IEEE official website www.ieee.org.

4.3 Summary of requirements

The following table summarises key base and advanced requirements for supply chain companies in NPP construction project.

Requirement	Standard quality products	Supplemental quality products	Safety related products
ISO 9001 - 2008	x	x	x
ISO 14001		(x)	x
VATESI requirements	x	x	x
RSC requirements	x	x	x
IEC standards		x	x
IEEE standards		x	x
ASME standard			x
RCC-M code			x

The full set for specific safety related and product licensing requirements may be adjusted / expanded depending on the NPP technology chosen.

Appendix 1: Supply Chain Map

The map arranges the components of a nuclear plant into four main groups: Nuclear Island, Turbine Island, Balance of Plant, and Site Development and Construction. These groups are then further broken down by system. From there, the groups are divided into components and subcomponents. Components whose manufacturing requires a Quality Assurance program are marked with a footnote:

- Safety-related products are marked with – * (one asterisk).
- Supplemental quality products are marked with – ** (two asterisks).
- Standard quality products are not marked with an asterisk.

Nuclear Island				
Primary Containment				
Containment Structure	Liner*	Doors and Hatches*	Penetrations*	Tendons*
Containment Interior	Reactor Cavity* Pool Liners* Fuel Pool Cavity*	Fuel Pool Gates* Interior Walls* Shielding*	Neutron Absorbers Stairs	Elevators Leaded Windows
Cranes and Hoists	Polar Crane** Jib Cranes	Monorail Hoists	Mobile Systems	Crane Safety Systems*
Refuelling Equipment	Fuel Transfer Equipment*	Fuel Inspection Equipment	Refuelling Tools	
Commodities and Consumables	Adhesives* Anchor bolts* Bolts* Clips* Coatings* Columns* Concrete* Dunnage Embeds* Fasteners*	Form Work Girders* Gratings* Grout* Insulated Concrete Panels* Insulated Metal Panels* Ladders Misc Steel* Nuts*	Paint* Plate* Platforms* Ply Form Lumber Precast Concrete Panels* Precast Precast Concrete Installation Rebar* Shoring	Siding Silicone* Stairs Structural Bolts* Structural Precast Concrete, Purchase* Structural steel* Wide-flange Beams*
Primary Support Systems				
Make-up and Purification	Ion Exchanger	Resin		
Heating and Ventilation	Ductwork* Dehumidifiers* Dampers* Heating Units* HEPA Filters*	Chillers* Compressors* Controllers*	Fans* Blowers* Louvers*	Filters* Evaporative Coolers* Expansion Joints*
Rad Monitoring	Airborne Particulate*	Inert Gas	Liquids Processing	
Radwaste Processing	Off-Gas	Resin Processing	Ion Exchange Systems	Compactors
Radiochemical Lab	Monitoring Equipment Sampling Equipment	Analysis Equipment Sampling Sinks	Fume Hoods Sample Changers	Titration Systems Counting Systems
Fire Protection	Fire Barriers* Smoke Detectors* Temperature	Detectors* Fire Rated Structures*	Fire Water System* Fire Alarm Panel* CO2 & Halon Fire	Suppression Systems*
Instrument Air	Compressors*	Air Dryers*	Receivers*	Pressure Regulators*
Lighting	Normal Lighting	Emergency Lighting**		
Reactor Coolant Systems				
Reactor Vessel and Internals	Reactor Vessel Head*	Reactor Pressure Vessel*	Nozzles*	Internals*
Fuel				
Reactivity Control	Control Rods*	Control Rod Drives*	Boron Control Systems*	Emergency Shutdown Systems*
Steam Generator	Channel Heads* Transition Cones Wrapper Shell*	Barrels AVBs Tubing*	Tube Sheet* Feed Ring Primary Separators*	Secondary Separators* Nozzles* Manways*
Pressurizer	Pressure Vessel*	Heaters*		
Reactor Coolant Pump	Reactor Coolant Casing*	Reactor Coolant Motor*	Impeller	Pump Seals*
Pressure Relief Valves / Safety Valves*				
Health Physics Equipment and Supplies	Anti-contamination Clothing Respiratory Protection	Personal Dosimetry Area Rad Monitors	Portable Radiation Survey Instruments	Personal Communications Devices
Electrical Equipment				
AC Power	Power Supplies	Transformers	Uninterruptable Power Suppliers	
Switchgear	Instruments and Meters* Load Centres* Circuit Breakers*	Motor Control Centres* Starters*	Contactors* Electrical Interlocks and Controls*	Racking Devices Grounding Devices
Cable and Raceways	High Voltage Cable* Medium Voltage Cable*	Low Voltage Cable* Cable Tray Covers*	Supports* Conduit*	Radiation Resistant Insulation*
Emergency Diesel Generator				

DC Power	Batteries*	Battery Chargers*	Inverters*	
Subcomponents, Commodities and Consumables	Bus Duct* Coil* Conduit* Connectors* Disconnects/Reclosures*	Electrical Switches* Feedthroughs* Fuses* Greases* Junction Boxes*	Plugs* Programmable Logic Controllers* Receptacles Solenoids*	Splices*Terminal Boards* Unistrut* Wiring*

Mechanical Equipment

Class 1, 2, 3 Piping	Piping Assemblies*	Snubbers*	Supports*	
Pumps	Centrifugal* Positive Displacement* Diaphragm*	Rotary* Vacuum*	Air Operated* Hydraulic*	Slurry* Reciprocating*
Valves	Containment Isolation* Motor-operated* Air-operated*	Hydraulic Operated* Solenoid-operated* Manual* Check*	Stop-check* Gate* Water Relief* Steam Relief*	Control* Globe* Throttle* Pressure Seal*
Valve Operators	Motor-operators* Air-operators*	Hydraulic-operators* Solenoid-operators*	Manual*	Explosive Squib-operated*
Tanks	Rupture Disks*	Manways*	Gaskets*	
Sumps and Drains	Equipment Drains	Floor Drains	Drain Cover Plates	Leak Detectors*
Subcomponents, Commodities and Consumables	Bar Stock* Bearings* Belts* Brackets* Couplings* Elbow* Fasteners (Bolts, Nuts, Quick Throws, Studs, Washers)* Filters* Flanges, Pipe* Flanges, Pressure Vessel*	Forgings* Insulation, Mirror* Insulation, Piping* Limit Switch* Low Alloy Steel* Lubricants* Mechanical Switches* Metal Bellows* Orifices* O-rings* Packing Materials* Packings*	Piping Materials* Piping Wall Sleeves* Pulsation Dampeners* Pump, Air Operated* Pump, Centrifugal* Pump, Diaphragm* Pump, Hydraulic* Pump, Positive Displacement* Pump, Reciprocating* Pump, Rotary* Pump, Slurry*	Pump, Vacuum* Refractory Materials* Retaining Rings* Rupture Disks* Seals* Seamless Carbon Steel* Springs* Stainless Steel* Tags and Labels* Unions* Venturis*

Instrumentation & Controls Equipment

Process Computer Simulator	Computer* Computers Control Stations	Control Stations* Mockup Facility	Data Point Feeds* Control Panels	Display Software* Alarm Panels
Process Instrument Detectors	Control Rod Position* Low Range Neutron Power* Intermediate Range Power* Reactor Power	Range Power* Reactivity*Fluid Level* Pressure* Temperature* Seismic Activity*	Vibration*Fire Detection* Fluid Flow* Mass Flow* Chemicals/Gas* Contamination	Radiation Meteorological Differential Pressure* Valve Position* Reactor Period*
Monitors, Controls and Alarms	Meter Indicators* Recorders*	Transmitters* Annunciator Panels*	Protective Functions* Alarms*	Safety Parameter Display System*
Tubing and Wiring	Tubing* / Wiring*	Terminal Blocks*	Connectors*	Splices*
Isolation Valves and Fittings				
Communications Systems	Telephone	Announcing	Alarms/Sirens	Voice Communications
Subcomponents, Commodities and Consumables	Amplifiers* Analyzers* Cable Ties* Condensing Pots* Counters* Fiber Optic Cable*	Fiber Optic Devices* Fittings* Micro Switches* Pre-amplifiers* Programmable Logic Controllers* Rate Meters*	Rectifiers* Reed Switches* Relays* Resistance Temperature Detectors* Scalars*	Semiconductor Devices* Signal Generators* Surge Suppression Devices* Thermocouples* Thermo Wells*

Turbine Island

Turbine Island Structural

Structural Components	Turbine Building Structure Penetrations	Doors and Hatches Shielding	Secondary Containment Structure	Electrical Feedthroughs
Turbine Building Interior	Interior Walls	Shielding	Stairs	Elevators
Cranes and Hoists	Turbine Building Bridge Crane	TB Secondary Bridge Crane	Monorail Hoists Mobile Systems	Crane Safety Systems
Miscellaneous Building Materials	Adhesives Anchor Bolts Bolts Clips Coatings Columns Concrete Dunnage Embeds Fasteners	Form Work Girders Gratings Grout Insulated Concrete Panels Insulated Metal Panels Ladders Misc Steel Nuts	Paint Plate Platforms Ply Form Lumber Precast Concrete Panels Precast Concrete, Installation Precast Concrete, Purchase Rebar	Shoring Siding Silicone Stairs Structural Bolts Structural Precast Structural Precast Concrete, Purchase* Structural Steel Wide-flange Beams

Secondary Support Systems

Heating and Ventilation	Ductwork Dehumidifiers Dampers Heating Units	HEPA Filters Chillers Compressors Controllers	Fans Blowers Louvers	Filters Evaporative Coolers Expansion Joints
Rad Monitoring	Airborne Particulate	Inert Gas	Liquids Processing	
Radwaste Processing	Off-gas Resin Processing	Ion Exchange Systems Compactors	Standby Gas Treatment	Main Stack Discharge

Radiochemical Lab	Monitoring Equipment	Sampling Equipment Analysis Equipment	Sampling Sinks Fume Hoods	Sample Changers Titration Systems
Fire Protection	Fire Barriers** Smoke Detectors**	Temperature Detectors** Fire Water System**	Fire Rated Structures** Fire Alarm Panel**	CO2 & Halon Fire Suppression Systems**
Oil Mitigation and Recovery System	Oil Separators	Oil Interceptors		
General Area Lighting	Normal Lighting	Emergency Lighting**		
Secondary Steam Cycle				
Main Turbine	Main Steam Piping Reflective Metal Insulation Turbine Bypass	Valves (Steam Dump) Control Valves Exciter Cabinet High Pressure Rotors	Low Pressure Rotors Shaft Journal Bearings Lub Oil System	Turbine Gland and Shaft Seals Shaft Thrust Bearing
Main Generator	Stator Rotor	Isophase Bus Duct Isophase Cooling	Stator Water Cooling Electrical Output	Main Transformer
Main Condenser	Condenser Tubing Air Ejectors Exhaust Boot	Vacuum Breaker Valves Condensate Pumps	Condensate Booster Pumps Hotwell Level Control	Condensate Polishing Filters
Moisture Separator-Reheater	Safety/Relief Valves			
Feedwater Heaters				
Feed Pumps	Main Feed Pump	Start-up/Shutdown Feedwater Pump		
Feedwater Regulating Valves				
Feedwater Control System	Automatic Recirc Valves			
Health Physics Equipment and Supplies	Anti-contamination Clothing Portable Radiation	Survey Instruments Area Rad Monitors	Personal Dosimetry Respiratory Protection	Personal Communications Devices
Electrical Equipment				
Class 1E Electrical System	Engineered Equipment	AC Power	Power Supplies	Transformers
Switchgear	Instruments and Meters Circuit Breakers Motor Control Centres Starters	Contactors Electrical Interlocks and Controls Load Centres	Racking Devices Grounding Devices Fast Transfer Devices	Automatic Bus Transfer Devices AC Ground Detection System
Cable and Raceways	Medium Voltage Cable	Low Voltage Cable High Voltage Cable	Cable Tray Covers Supports	Conduit Insulation
Uninterruptable Power Suppliers	DC Power	Batteries / chargers	Inverters	DC Ground Detection System
Subcomponents, Commodities and Consumables	Bus Duct Coil Conduit Connectors Disconnects/Reclosures	Electrical Switches Feedthroughs Fuses Greases Junction Boxes	Plugs Programmable Logic Controllers Receptacles Solenoids	Splices Terminal Boards Unistrut Wiring
Mechanical Equipment				
Class 1, 2, 3 Piping	Piping Assemblies*	Snubbers*	Supports*	
Pumps	Heater Drain Sump Pumps Chilled Water Transfer	Pumps Booster Feedwater	Pump Pkg Make-up Pumps	Sample Pumps Rotary Gear Pump
Vertical Heat Exchangers	Horizontal Heat Exchangers			
Valves	Air-operated Automatic Recirc Auxiliary Relief Ball Butterfly Containment Isolation Valves*	Control Explosive Charges Extraction Steam Non- return Globe Hydraulic-operated	Manual Motor-operated Gate NFPA Code Valves Plug Pressure Regulating Globe	Pressure Seal Solenoid-operated Steam Relief Stop-check Three-way Throttle
Valve Operators	Motor-operators Air-operators	Hydraulic-operators	Solenoid-operators	Manual
Tanks	Rupture Disks	Manways	Gaskets	
Sumps and Drains	Equipment Drains	Floor Drains	Drain Cover Plates	Leak Detectors
Subcomponents, Commodities and Consumables	Bar Stock Bearings Belts Brackets Couplings Elbow Fasteners (Bolts, Nuts, Quick Throws, Studs, Washers) Filters Flanges, Pipe Flanges, Pressure Vessel	Forgings Insulation, Mirror Insulation, Piping Limit Switch Low Alloy Steel Lubricants Mechanical Switches Metal Bellows Orifices O-rings Packing Materials Packings	Piping Materials Piping Wall Sleeves Pulsation Dampeners Pump, Air Operated Pump, Centrifugal Pump, Diaphragm Pump, Hydraulic Pump, Positive Displacement Pump, Reciprocating Pump, Rotary Pump, Slurry	Refractory Materials Retaining Rings Rupture Disks Seals Seamless Carbon Steel Springs Stainless Steel Tags and Labels Unions Venturis Pump, Vacuum
Instrumentation & Controls Equipment				
Local Control Stations	Local Alarm Panels			
Process Instrument Detectors	Fluid Level Pressure Temperature Seismic Activity	Vibration Fire Detection Fluid Flow Mass Flow	Chemicals/Gas Contamination Radiation Meteorological	Differential Pressure Valve Position Strain Gages
Monitors, Controls and Alarms	Meter Indicators Recorders	Transmitters Annunciator Panels	Protective Functions Alarms	Safety Parameter Display System
Tubing and Wiring	Tubing & Wiring	Terminal Blocks	Connectors	Splices

Instrument Isolation Valves & Fittings				
Communications Systems	Telephone Alarms/Sirens	Announcing	Process Alarms	Voice Communications
Control Room Instrument Panels				
Subcomponents, Commodities and Consumables	Amplifiers Analyzers Cable Ties Condensing Pots Counters Fiber Optic Cable Fiber Optic Devices	Fittings Micro Switches Pre-amplifiers Programmable Logic Controllers Rate Meters Rectifiers	Reed Switches Relays Resistance Temperature Detectors Scalars Semiconductor Devices	Signal Generators Surge Suppression Devices Thermocouples Thermowells Transducers Tubing

Balance of Plant

BOP Island Structural

Structural Components	Circ Water Intake & Discharge Structure	Penetrations Doors and Hatches Shielding	Secondary Containment Structure	Electrical Feedthroughs
Misc Building Interior	Interior Walls	Shielding	Stairs	Elevators
Intake Canal Earthwork	Discharge Canal Earthwork			
Cranes and Hoists	Bridge Cranes	Secondary Bridge Crane	Monorail Hoists Mobile Systems	Crane Safety Systems
Switchyard Structural	Roads Pads High Voltage Towers	Control Houses Paint (Electrical Spec)	Substation Security Fencing	Substation Security Alarms
Concrete Ductwork	Underground Piping	Cathodic Protection System		
Auxiliary Boiler Building	Steam Heating Units			
Emergency Diesel Generator Structure				
Emergency Planning Structures	Technical Support Center** Emergency Off-site Facility	Emergency Communications Networks**	Emergency Planning Siren Towers	Emergency Planning Sirens
Heat Tracing	Freeze Protection	Prefabricated Buildings		
Subcomponents, Commodities and Consumables	Adhesives Bolts / Anchor Bolts Clips Coatings Columns Concrete Dunnage Embeds Fasteners FormWork	Girders Gratings Grout Insulated Concrete Panels Insulated Metal Panels Ladders Misc Steel Nuts Paint	Plate Platforms Ply Form Lumber Precast Concrete Panels Precast Concrete, Purchase Precast Concrete, Installation Rebar Shoring	Siding Silicone Stairs Structural Bolts Structural Precast Concrete, Purchase Structural Precast Concrete, Purchase* Structural Steel Wide-flange Beams

BOP Support Systems

Heating and Ventilation	Blowers Chillers Compressors Controllers	Dampers Dehumidifiers Ductwork Evaporative Coolers	Expansion Joints Fans Filters Heating Units	HEPA Filters Louvers Plenums
Fire Protection	Fire Barriers** Smoke Detectors** Temperature Detectors**	Fire Rated Structures** Smoke Detectors** Fire Water System**	Fire Rated Structures** Fire Water Pump (Diesel)**	Fire Water Pump (Centrifugal)**
Switch Yard (Substation) Circuit Breakers	Air Circuit Breakers	Oil Circuit Breakers		
High Voltage Insulators	High Voltage Disconnect Switches		Ground Switches	
Transformers	Large Current	Potential Step-Up 230 KVA	Step-Up 345 KVA Step-Up 500 KVA	Auxiliary Transformers (Unit, Station, Reserve)*
Control Panels	SCADA Controls System	Local Control System		
Communications Systems	Switchyard Security Fencing	Switchyard Security Alarms	High Voltage Fuses Lightning Arrestors	Sudden Pressure Relays
Physical Security System	Structural Road and Gate Monitoring and Alarm Systems Barriers	Security Control Structures Alternate Security Control Structure	Security Staff Armed Guard Force Equipment	Electronic Detection Systems Fencing
Water Treatment System				
Oil Mitigation and Recovery System	Oil Separators	Oil Interceptors		
General Area Lighting	Normal Lighting	Emergency Lighting**		

Mechanical Equipment

Safety-Related Piping Pumps	Piping Assemblies* General Purpose Pump (Water)	Snubbers* Sump Pumps Chilled Water Transfer Pumps	Pipe Supports* Jockey Pumps Make-up Pumps Sample Pumps	Rotary Gear Pump Vertical Make-up Pumps
Non-Safety-Related Pumps				
Non-Safety-Related Piping	Piping Assemblies	Snubbers	Pipe Supports	
Vertical Heat Exchangers	Horizontal Heat Exchangers			
Valves	Air-operated Auxiliary Relief	Extraction Steam Non-return	Manually Operated Gate Motor-operated Gate	Pressure Seal Solenoid-Operated

	Ball Butterfly Check Containment Isolation Valves*	Control Globe Hydraulic Operated Manual	NFPA Code Valves** Plug Pressure Regulating Globe	Steam relief Stop-check Three-way Throttle Vacuum Breaker Valves
Valve Operators	Motor-operators	Hydraulic-operators	Solenoid-operators	Air-operators
Tanks	Rupture Disks	Man ways	Gaskets	
Compressed Gas Storage and Transfer				
Sumps and Drains	Equipment Drains	Floor Drains	Drain Cover Plates	Leak Detectors
Subcomponents, Commodities and Consumables	Bar Stock Bearings Belts Brackets Couplings Elbow Fasteners (Bolts, Nuts, Quick Throws, Studs, Washers) Filters Flanges, Pipe Flanges, Pressure Vessel	Forgings Insulation, Mirror Insulation, Piping Limit Switch Low Alloy Steel Lubricants Mechanical Switches Metal Bellows Orifices O-rings Packing Materials Packings	Piping Materials Piping Wall Sleeves Pulsation Dampeners Pump, Air Operated Pump, Centrifugal Pump, Diaphragm Pump, Hydraulic Pump, Positive Displacement Pump, Reciprocating Pump, Rotary Pump, Slurry	Pump, Vacuum Refractory Materials Retaining Rings Rupture Disks Seals Seamless Carbon Steel Springs Stainless Steel Tags and Labels Unions Venturis
Circulating Water Cycle				
Ultimate Heat Sink				
Travelling Screens	Motors	Controls		
Trash Rakes	Motors	Controls		
Circ Water System	Circ Water Pumps Strainers	Butterfly Valves	Other Circ Water Valves	Circ Water Piping
Service Water System	Service Water Pumps	Heat Exchangers	Coolers	
High Pressure Service Water	High Pressure Service Water Pumps*	Heat Exchangers*		
Emergency Service Water	Emergency Service Water Pumps*	Heat Exchangers*		
Tanks	Condensate Storage Tank	Refuelling Water Storage Tank*	Diesel Fuel Oil Storage Tank*	Emergency Service Water Reservoir/ Tank*
Cooling Towers	Bulk Concrete**	Cooling Tower Fill Material**	Spray Pond	Spray Nozzles
Discharge Canal	Canal Discharge Gate Monitors			
Environmental Monitoring System	Analysis Analyzers Counters Data Loggers	Detectors Filters Indicators Meteorological Equipment	Meters Pumps Radiation Monitors Sampling Systems	Seismic Monitoring Separators Skimmers Transducers
Control and Service Air	Accumulators Compressors	Air Dryers Receivers	Pressure Regulators Filters	Flex Hose
Electrical Equipment				
Engineered Equipment	AC Power	Power Supplies	Transformers	
Switchgear	Instruments and Meters Circuit Breakers Motor Control Centres Starters	Contactors Electrical Interlocks and Controls Load Centres	Racking Devices Grounding Devices Fast Transfer Devices	Automatic Bus Transfer Devices AC Ground Detection System
Cable and Raceways	High Voltage Cable Medium Voltage Cable	Low Voltage Cable Cable Tray Covers	Supports Conduit	Insulation
Uninterruptable Power Suppliers	DC Power	Batteries Battery Chargers	Inverters	DC Ground Detection System
Outdoor Lighting	Normal Lighting	Emergency Lighting**	Indoor Lighting	
Subcomponents, Commodities and Consumables	Bus Duct Coil Conduit Connectors Disconnects/Reclosures	Electrical Switches Feedthroughs Fuses Greases Junction Boxes	Plugs Programmable Logic Controllers Receptacles Solenoids	Splices Terminal Boards Unistrut Wiring
Instrumentation & Controls Equipment				
Local Control Stations				
Local Alarm Panels				
Process Instrument Detectors	Fluid Level Pressure Temperature Seismic Activity	Vibration Fire Detection Fluid Flow Mass Flow	Chemicals/Gas Contamination Radiation Meteorological	Differential Pressure Valve Position Strain Gages
Monitors, Controls and Alarms	Meter Indicators Recorders	Transmitters Annunciator Panels	Protective Functions Alarms	Safety Parameter Display System
Tubing and Wiring	Tubing & Wiring	Terminal Blocks	Connectors	Splices
Instrument Isolation Valves & Fittings				
Communications Systems	Telephone Alarms/Sirens	Announcing	Process Alarms	Voice Communications
Control Room Instrument Panels				
Subcomponents, Commodities and Consumables	Amplifiers Analyzers Cable Ties	Fittings Micro Switches Pre-amplifiers	Reed Switches Relays Resistance Temperature	Signal Generators Surge Suppression Devices

Consumables	Condensing Pots Counters Fiber Optic Cable Fiber Optic Devices	Programmable Logic Controllers Rate Meters Rectifiers	Detectors Scalars Semiconductor Devices	Thermocouples Thermowells Transducers Tubing
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Site Development & Construction

Site Preparation & Structures

Transportation Infrastructure	Railway Road - Ballast Road - Base Course	Road - Top Surface Parking Areas Waterway	Marine work Barges	Barge Slips Airports
Construction Equipment Concrete Batch Plants	Batch Plant-Concrete*1	Batch Plant-Concrete	Concrete Works*1	Concrete Works
Blowers	Portland Cement Concrete*	Portland Cement Concrete		
Portable Tanks and Pumps	Material Testing Services for Concrete and Earthwork*	Material Testing Services for Concrete and Earthwork		
Earthwork Infrastructure	Slope Protection and Stabilization Pond and Reservoir Construction Furnishing Water Wells	Security Fencing and Installing Temporary Fencing Earthwork, Grading and Structural Backfill*	Excavation, Backfill and Compaction Of Trenches/Pipe and Elec. Duct* Grading and Site Prep Piles and Caissons*	Piers, Drilled* Intake Structure and Tunnel Concrete and Earthwork* Concrete and Earthwork
Construction Facilities	Armed Guard Force Facility Construction Buildings Fabrications Shop	First Aid Building Materials Assembly Areas	Materials Lay Down Areas Prefabricated Buildings Testing Shop	Trailers Warehouses Welding Shop

Construction Equipment & Supplies

Concrete Batch Plants	Batch Plant-Concrete*1	Batch Plant-Concrete		
Concrete Works	Concrete Works*1 Concrete Works	Portland Cement Concrete* Portland Cement Concrete	Material Testing Services for Concrete and Earthwork*	Material Testing Services for Concrete and Earthwork
Safety Items	Fire Watch Staff Fire Detection**2	Fire Alarms**2 Fire Barriers**2	Fire Extinguishers	Fire Rated Structures**2
Consumables	Welding Gas Supplies	Welding Rods*	Cleaning Agents	
Site Logistics	Emergency Electricity Supply	Fuels Internet Lubricants	Normal Electricity Supply Portable Electric Generators	Telephone Water Supply Sanitation Services
Temporary Ventilation Equipment	Portable Ventilation Hoses Portable Tanks and Pumps	Blowers Scaffolding	Tools	

Construction Materials

	Adhesives Anchor bolts Bolts Clips Coatings Columns Concrete Dunnage Embeds Fasteners	Form Work Girders Gratings Grout Insulated Concrete Panels Insulated Metal Panels Ladders Misc Steel Nuts Paint	Plate Platforms Ply Form Lumber Precast Concrete Panels Precast Concrete, Purchase Precast Concrete, Installation Rebar Shoring	Siding Silicone Stairs Structural Bolts Structural Precast Concrete, Purchase* Structural Steel Wide-flange Beams Structural Precast
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Construction Support Services

Geotech Services	Bathymetry / Hydrographic Survey*	Surveying Dewatering/Monitoring	Seismic Data Collection and Analysis*	Technical Specification for Sheet Piling (Provide and Install)
Quality Assurance	Quality Assurance*	Nondestructive Examination (NDE)*		
Rigging and Heavy Hauling Freight Services	Ocean Freight Services	Air Freight Services	Inland Freight Services	
Agents	Agents, Freight Forwarding Agents, Export Packing	Agents, Customs	Clearance	Agents, Port Handling
Leased Equipment	Scaffolding (Leased/Job Owned)	Shoring, Furnish (Leased/Job Owned)		
Transportation/Logistics Services	Freight Services Ocean Freight Services Air Freight Services	Inland Freight Services Agents, Freight Forwarding	Agents, Export Packing Agents, Customs	Clearance Agents, Port Handling
Temp Labour, Staff Augmentation and Engineering	Background Investigation, Screening	Configuration Management*	Drug Screening	Materials Testing Services*
Other	Records Management* Rodent & Insect Control	Security Service	Janitorial Service	Temporary Food Services Training*

