

Activitati de retehnologizare parte nucleara (NSP) si parte clasica (BOP) in scopul Proiectului retehnologizare U1

Refurbishment activities for NSP and BOP						
No Crt.	Index #	BSI	Descriere/ Description	Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
1.	1	21000	Reactor Building Containment Structure - Instrumented Monitoring Program (IMP) - install new instrumentation	An effective Instrumented Monitoring Program (IMP) for evaluating integrity of containment prestressing system of Cernavoda 1 Reactor Building (RB) Containment Structure (CS) necessitates the installation of various new instruments in addition to those installed during construction of the unit. These new instruments are intended to enhance and complement the existing system.		
2.	2	21000	Reactor Building Containment Structure - Perform repairs of the containment liner on the upper dome area	All the internal exposed surfaces of the containment/ internal structure are covered/ protected with nonmetallic liner systems that have various roles: enhancing leak-tightness, accommodating maintenance and ease of decontamination. Based on the observations, condition of the liner in some areas of the Reactor Building Containment Structure (CS) including the underside of the upper dome is poor. Signs of degradation such as peeling of the liner and discoloration have been observed. To ensure that containment liner will be able to support Long Term Operation (LTO), repairs to restore the integrity of the liner system on the upper dome should be performed.		
3.	3	21000	Reactor Building Containment Structure - Implement testing of the spare gland components	The existing Electrical containment penetrations (ECP) assembly has 40 years specified service life. Testing and inspection of the condition of the spare Electrical containment penetrations (ECP) assembly components (spare gland components which has been exposed to the thermal and radiation effects for the service life of the plant) will provide information for the aging effects on the internal components, such as the epoxy casting, the splices and the fastener components. Embedded containment penetration (ECP) gland assembly from group 1 or group 2 containment penetrations will be removed and shipped to the testing lab at Canada. An embedded containment penetration (ECP) assembly will be installed to the location from where the ECP will be removed for testing.		
4.	4	21000	Reactor Building Containment Structure - Perform detailed condition survey of the areas of Fuel Transfer Structure supplemented by Non-Destructive Tests (NDT) methods as applicable	Based on the Reactor Building (RB) System Condition Assessment report, repairs for Reactor Building (RB) Containment Structure and Fuel Transfer Structure (FTS, Room 001) are required to improve containment leak tightness and integrity. Non-Destructive Tests (NDTs) of the areas where degradation is suspected as well as the areas that are notorious for leakage should be performed at the beginning of the refurbishment outage so that the appropriate materials and methods are selected for repairs to be implemented.		
5.	5	21000	Based on results of the survey of Fuel Transfer Structure (FTS, Room 001) develop and implement necessary repairs	There is a concern related to degradation of fiberglass reinforced epoxy liner inside R001 since the air leakage into R001 was identified during RBILRT. Repairs are regularly performed before and after every LRT; however, they don't seem to be effective, as the areas where leaks are found don't change from test to test. It is important to do repairs properly to limit the leakage. The originally applied liner material (Amercoat 90) is no longer available, thus alternative liner system should be used for repairs. Materials specified for repairs should be qualified to be used in the ambient conditions that the repaired structure is exposed to, it should also be compatible with the substrate. The repair of the Fuel Transfer Structure (FTS, Room 001) will be performed, updating procedures for repairs of R/B concrete is required. Injections of flexible materials and application of the coatings to be performed during refurbishment outage to enhance containment integrity and leak tightness.		
6.	6	21000	Reactor Building Containment Structure - Implement necessary repairs to concrete and replace joint sealants	From review of RBILRT reports, it appears that the same areas are prone to leakage during the test including areas around some Airlocks' Embedded Parts (EPs), joints, bottom of the perimeter wall, etc. Considering results of condition survey and NDT as well as various repair methods epoxy injections, injections of expandable materials and application of coatings, repair should be performed following the newly developed procedures.		
7.	12	24900	Service Building Structures - Relining of the Spent Fuel Bay (SFB) walls.	The NORMAC liner on the interior surface of SFBs is severely degraded and the physical condition of the underlying fiberglass reinforced epoxy liner system (where available) is unknown at this time. Furthermore, there is no fiberglass reinforced epoxy liner system on the walls of S 124 and S 126. The degradation of the liner system may be potentially detrimental to the performance of the SFBs. The relining of the SFBs will be performed by applying BIO-DUR 560 underwater epoxy coating. It is recommended that prior to application of the BIO-DUR 560, the repairs are to be performed. BIO-DUR 560 epoxy coating has been previously qualified for underwater application in the SFBs' environment over various substrates including Amercoat 90 epoxy coating. This design change will enhance leak tightness of the SFBs and will protect the concrete structure.		
8.	13	21900	Reactor Building Containment Structure - Spent Fuel Transfer Bay (SFTB) - Liner repair in R-001	The Spent Fuel Transfer Bay (SFTB) structure which is also called as R-001 is located inside the Reactor Building (RB). The SFTB is a reinforced concrete structure with the interior surfaces protected by a fibreglass reinforced epoxy liner system. The SFTB structure forms a part of containment boundary. The option is to apply BIO-DUR 560 manufactured by Thin Film Technology Inc. (TFT). It is recommended that prior to application of the BIO-DUR 560, the repairs are to be performed, if there are any damages on the existing fibreglass weave cloth, concrete, and joint sealant, in accordance with the procedures for repairs which are to be developed during detailed design phase.		
9.	16	31714	Start-up Instrumentation- Redesign of reactor start-up unit to permit independent moving of each of the three in-core SUI detectors	The reactor start-up units are one assembly of three BF3 (boron-trifluoride) counters which is raised and lowered in the core via a single guide tube. The existing design does not provide for independent movement of the BF3 (boron-trifluoride) counters within the assembly. Having the capability for independent movement of the BF3 (boron-trifluoride) counters is useful, since BF3 (boron-trifluoride) counters can continue to provide a signal as one is being moved. This change involves redesign of the start-up unit to enable independent movement of BF3 (boron-trifluoride) counters. This design change is to divide the guide tube for the BF3 (boron-trifluoride) counters into three compartments so the counters can be moved independently by their electrical cables.		

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10.	17	32000	Moderator and Auxiliary Systems - Moderator Purification System- Replace the Colmonoy and Deloro manual valves on moderator system	The valves with disc and seat made with Colmonoy and Deloro are susceptible to leak if they are working in high concentration of acid. The valves seats are integrated in the valves body and they can't be replaced. The valves will be to replace with new models/ design without Deloro and Colmonoy. This design modification involves the replacement of the existing manual valves in the moderator purification system (1-3221-V1, V2, V3, V4, V18, V12, V13, V14, V15, V16) and moderator D2O collection system (1-3251-V6, V7) with new models/ design that do use Deloro or Colmonoy hardfacing materials. This is consistent with a COG study which recommended to avoid using Colmonoy, Deloro and AISI Type 410 SS (UNS S41000) for hardfacing sealing surfaces in valves in future applications within the moderator and moderator auxiliary systems. Furthermore, feedback from the manufacturer Thompson Valves Ltd. recommended to replace the affected valves with new valves that do not contain Colmonoy or Deloro as the best solution as done at Bruce Power and Qinshan. The valve trim materials and valve models to be used will be confirmed during the detailed design phase.		
11.	18	32000/ 34340	Moderator make-up system (Containment Heat Removal system)	<i>The Moderator Make-Up System (MMS) (BSI 34340) will be a new system to be implemented at Cernavoda Nuclear Power Plant Unit 1 to mitigate postulated severe accidents. The MMS is designed to remove decay heat from the core by replenishing the moderator inventory or calandria vault from the dousing tank.</i>	Yes	
12.	22	32110	Main Moderator System - Moderator EQ class	Main Moderator System components must to remain functional in the harsh environmental conditions in the Reactor Building in the event of a Loss of Coolant Accident (LOCA) followed by a Loss of Emergency Core Cooling (LOECC), including after a Loss of Class IV (LOCL IV) power. Therefore, active components which are required to provide a heat sink would have to be qualified to the most recent Environmental Qualification (EQ) standards, CSA N290.13-18 "Environmental qualification of equipment for nuclear power plants" and CSA N290.16-16 "Requirements for beyond design basis accidents". These is referred to Main moderator system equipment, such as valves, pumps, heat exchangers as well as instrumentation which are located inside the Reactor Building that are required to function after a LOCA + LOECC. Packing rings replacement is required for the Moderator System Pump and HX isolation valves 1-3211-V1, V2, V5, V6, V7, V8, V9, V10.		
13.	23	32110/ 73140	Main Moderator System - Containment Isolation Enhancements for Main Moderator System	The main moderator system (BSI 32110) is located in the reactor building (R/B) and is considered open to the containment atmosphere under some scenarios. The main moderator system connects to the D2O supply system (BSI 38110) located in the service building (S/B). The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A in order to comply standardss and regulatory requirements. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements per CSA N285.0-17.		
14.	27	32210/ 73140	Moderator and Auxiliary Systems - Moderator Purification System - Containment Isolation Enhancement to Moderator Purification System	This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The moderator purification system (BSI 32210) is located in the Service Building (S/B) and is directly connected to the main moderator system (BSI 32110) which is located in the Reactor Building (R/B). Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
15.	28	32310/ 73140	Moderator and Auxiliary Systems - Moderator Cover Gas - Containment Isolation Enhancements for Moderator Cover Gas System	This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. This system is located in the Reactor Building (R/B) and is considered open to the containment atmosphere for in-core pressure tube failure and any other events involving the breaking of the rupture disks in the relief ducts of the calandria. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements		
16.	29	32510/ 73140	Moderator and Auxiliary Systems - Moderator Heavy Water Collection System - Containment Isolation Enhancements for Moderator Heavy Water Collection System	This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The moderator D2O collection system is located in the reactor building (R/B) and is considered open to the containment atmosphere (BSI 32510). It connects directly to the moderator D2O clean-up system (BSI 38410) in the service building (S/B). Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
17.	31	33100	Primary Heat Transport System (PHT) - Replace the carbon steel SG primary side separators with those made of materials resistant to FAC	The PHTS (BSI 33100) is equipped with four SGs (3311-BO01 and BO04), to transfer the reactor heat to the light water feedwater and generator steam for power production. It is neccessary to replace the actual degraded separators with those made of stainless steel or other FAC resistant materials to prevent similar degradation seen by the current separators. The OEM -BWXT will be involved in solution development and implementation.		
18.	39	33320	Primary Heat Transport and Auxiliary Systems - Improve the control circuits for Liquid Relief Valve (LRV) pressure control valves, to help prevent unplanned opening of Liquid Relief Valves (LRVs)	This design change is to improve the control circuits for the LRV (Liquid Relief Valve) pressure control valve to help prevent their unplanned opening. This design change addresses wiring changes that improve the separation and grouping of the control/ monitoring circuits of the Liquid Relief Valves (LRVs). This is achieved by using channelized, separately fused power supplies to feed the Liquid Relief Valve (LRV) monitoring circuit and the Liquid Relief Valve (LRV) control circuit such that each channel is fully independent of the other two channels and is fail safe. The channel 'E' LED on MCR panel (66110-PL-4) will more accurately indicate the status of the channel 'E' control circuit for the Liquid Relief Valve (LRV). In addition, the computer alarm for channel 'E' trip status will be more accurately reported.		

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19.	42	33360/ 73140	Primary Heat Transport and Auxiliary Systems - HT Deuteration and Dedeuteration - Containment Isolation Enhancements for Heat Transport Deuteration and Dedeuteration System	The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A in order to comply standards and licensing requirements. The heat transport (HT) deuteration and dedeuteration system (BSI 33360) is located in the reactor building (R/B) and is considered open to the containment environment. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
20.	43	33410	Primary Heat Transport and Auxiliary Systems - Shutdown Cooling System -Perform a one-time internal and external inspection of SDC heat exchanger 1-3341-HX1 and 3341-HX2	The HTS SDC System (BSI 33410) is equipped with two heat exchangers (HXs) (3341-HX1 and HX2), to cool the PHTS D2O. The HXs are located inside the RB, under mild ambient conditions. The HXs are external inspected for insulation damage, leakage, looseness of fasteners, corrosion and general condition. There are some uncertainties as the tubes, internals and shell have never been inspected. Therefore, a one-time inspection of the HXs, including the thickness of the tubing and shell, and the conditions of impingement plates must be performed.		
21.	44	33530/ 73140	Primary Heat Transport and Auxiliary Systems - Containment Isolation Enhancement for Nitrogen Addition Circuit	This design modification is required for Cernavoda Unit 1 to comply with actual standards requirements for the containment isolation. The containment isolation enhancements involve changes in nuclear pressure boundary class for the existing valve and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The nitrogen addition circuit (BSI 33530) is located in the reactor building (R/B) and is connected to the nitrogen gas supply system (BSI 75700) located in the service building (S/B) just outside the R/B wall. Pressure boundary of the existing equipment that forms the containment extensions will be assessed and demonstrated to be compliant with Class 2 requirements.		
22.	45	33540/ 73140	Primary Heat Transport and Auxiliary Systems - Containment Isolation Enhancements for Hydrogen Addition Circuit	This design modification is required for Cernavoda Unit 1 to comply with actual standards requirements for the containment isolation. The containment isolation enhancements involve changes in nuclear pressure boundary class for the existing valve and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The hydrogen addition circuit (BSI 33540) is located in the service building (S/B) and connects directly to the primary heat transport system (PHTS) (BSI 33100) in the reactor building (R/B). Pressure boundary of the existing equipment that forms the containment extensions will be assessed and demonstrated to be compliant with Class 2 requirements.		
23.	46	33710/ 73140	Primary Heat Transport and Auxiliary Systems - Containment Isolation Enhancements for Heat Transport Heavy Water Sampling System	This design modification is required for Cernavoda Unit 1 to comply with actual standards requirements for the containment isolation. The containment isolation enhancements involve changes in nuclear pressure boundary class for the existing valve and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The HT D2O sampling line penetrates containment and then connects to sampling cabinet in the service building (SB) for analysis of the D2O. Pressure boundary of the existing equipment that forms the containment extensions will be assessed and demonstrated to be compliant with Class 2 requirements.		
24.	48	33810/ 73140	Primary Heat Transport and Auxiliary Systems - Containment Isolation Enhancement for Heat Transport Heavy Water Collection System	This design modification is required for Cernavoda Unit 1 to comply with actual standards requirements for the containment isolation. The containment isolation enhancements involve changes in nuclear pressure boundary class for the existing valve and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The heat transport (HT) D2O collection system (BSI 33810) is located in the reactor building (R/B) and connects to the D2O clean-up system (BSI 38410) located in the service building (S/B). Pressure boundary of the existing equipment that forms the containment extensions will be assessed and demonstrated to be compliant with Class 2 requirements.		
25.	49	34110	End Shield Cooling System -Perform a one-time internal inspection of at least one of the heat exchangers 1-3411-HX1 or HX2	The Shield Cooling System provides heat removal by circulating demineralized water separately through each end shield and the calandria vault, thereby transferring the heat to the recirculated cooling water system (BSI 71340) via two heat exchangers. There are uncertainties with the internal condition as these have never been internally inspected. To perform a one-time internal inspection of at least one of the heat exchangers 1-3411-HX1 or HX2, to determine the internal condition is required. Inspection of the Tube Bundle by Eddy Current Technique and the Shell Inside Surface for any signs of degradation and NDE inspection to verify wall thickness of CS heat exchanger shell in support of corrosion allowance will be performed. If deficiencies are identified, shall be fixed and the condition shall be extent to the second heat exchanger.		
26.	50	34110/ 73140	End Shield Cooling System - Containment Isolation Enhancement End Shield Cooling	This design modification is required for Cernavoda Unit 1 to comply with actual standards requirements for the containment isolation. The containment isolation enhancements involve changes in nuclear pressure boundary class for the existing valve and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The end shield cooling system (BSI 34110) is located in the reactor building (R/B) and service building (S/B). The end shield cooling system is considered an open system to containment, since it is directly vented to the R/B ventilation system (BSI 73120). Pressure boundary of the existing equipment that forms the containment extensions will be assessed and demonstrated to be compliant with Class 2 requirements.		

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27.	51	34310	Dousing Tank Refurbishment	Dousing System - Dousing Tank Refurbishment (Develop and implement strategies for repairing the dousing tank; Repair / replace some sections of the dousing tank)	The Dousing System is contained in the upper part of the reactor building. The system is essentially selfcontained the only interfaces being those required for supply or drainage. The dousing tank is a cast-in-place reinforced concrete structure. The lower dome is the main support of the dousing system water reservoir. As there are signs of leakage on the underside of the dousing tank (lower dome), there must be discontinuities in the fiberglass reinforced epoxy liner system inside the dousing tank making reinforced concrete exposed to deteriorative actions of demineralized water. Reinforced concrete structure of the dousing tank as well as joint sealants in the construction joints and joints around penetrations through the tank should also be degrading and have some discontinuities to allow the water to leak. The vapour barrier between the Dousing Tank and Upper Dome is in bad condition, torn and open at a number of locations. In order to ensure that dousing tank and that the vapour barrier will continue to perform its functions until the end of extended operation life, it is neccessary to develop and implement strategies for repairing. This includes repairs of the joint sealant in three (3) construction joints accessible from inside the tank, joint sealant around penetrations inside the tank and repairs to the fiberglass reinforced epoxy liner system inside the tank and concrete as applicable. Dousing Tank refurbishment" include scope index#51 and 52.		
28.	52						
29.	53	34310	Dousing System - Rotate spray dousing valves		The Dousing system is a sub-system of the containment system, and operates to limit the magnitude and duration of containment overpressure due to a Loss of Coolant Accident (LOCA) or Main Steam Line Break (MSLB). Following a LOCA or MSLB, steam released by flashing of the discharged hot fluid pressurizes the containment envelope. Upon detection of a high building pressure (or initiated manually), a pair of dousing valves for each of the six individual downcomers opens. Downcomers are attached to the dousing tank, providing water to a system of spray headers suitably arranged in the upper portion of the reactor building. Headers distribute a well distributed fine spray to condense steam and thus minimize the pressure rise following failure inside containment. Two issues are addressed in this change: ingress of corrosion products into the lower bearings of the downstream dousing isolation butterfly valves impairing valve operation and insufficient separation between upstream and downstream dousing valves resulting in the valves being unable to fully open. This modification involves rotating the valves (1-3431-PV2, PV4, PV6, PV8, PV10, PV12) axially by 45° clockwise to the flow direction. The implementation of the 45° rotation requires the modification of the pneumatic lines towards the valve actuators (relative change in position due to increased separation and rotation).		
30.	54	34310	Dousing System - Increasing the capacity of 63431- TK3, TK7, TK11		The capacity of the air tanks 63431-TK3, -TK7, -TK11, serving valve pairs 63431-PV3/PV4, -PV7/PV8, -PV11/PV12, respectively, is not enough to assure the 9 stroke cycles called for by the design and safety requirements. Therefore, this change is recommended to improve the instrument air back-up capacity. As per design purpose, the specified air tanks, 63431-TK3, -TK7, and -TK11, will increase in vessel volume to 1.91 m3 from 1.27 m3 (~50% increase). The support locations will change for the length of the tank but will remain the same for the width of the tank. Piping and instrumentation tubing will need to be rerouted for the tank inlet, outlet, relief, and drain connections due to this design change.		
31.	55	34320	Emergency Core Cooling System - Refurbishment of motorized gate valves 3432-MV39 to MV46, MV59 to MV66		The ECC System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. Presently these valves 1-3432-MV39/ MV40/ MV45/ MV46; 1-3432-MV59/ MV60/ MV65/ MV66 have a chronic problem of passing and they have been passing since commissioning. Refurbishment and internal inspection of valves and rectification of sealing surfaces is necessary for 1-3432-MV39 to MV46; 1-3432-MV59 to MV66.		
32.	56	34320/ 33410	Emergency Core Cooling System and Shutdown Cooling Systems -Continuously welding the VELAN valves guides for all Emergency Core Cooling (ECC) and Shutdown Cooling (SDC) motor operated valves (MOV's).		The valves included in the scope are: 1-3432-MV71/ 72/ 79/ 80/ 31/ 50; 1-3432-MV41/ 42/ 43/ 44/ 61/ 62/ 63/ 64; 1-3432-MV39/ 40/ 45/ 46/ 59/ 60/ 65/ 66 and 1-3341-MV1/ 2/ 9/ 10/ 17/ 18/ 5/ 6/ 16/ 15. These carbon steel valves are motor operated (MOV) isolating gate valves. For MOVs identified under this scope, it was found that the distance between the bottom end of the last weld bead and the end of the guide is relatively large. This creates a possibility that at the end of the stroke, the force in the valve disc would act on the free ends of the guides. This creates a risk that the guides would bend, due to the force of the fluid, in conditions of maximum pressure differential. Based on VELAN's proposal the implemented solution will consist in replacement of the internal components of the valves. New set of seats, wedge and guides for each valve as well as instructions for the on-site/ in-line seat replacement and for the installation of the wedge guides with continuous weld can be generated, specifically tailored to the valves in the scope.		
33.	57	34320	Emergency Core Cooling System and Shutdown Cooling Systems - Replace any damaged portions of the buried piping, particularly the sections that are projected to fall below the minimum wall thickness within the 30 years after refurbishment.		The ECC System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. The buried piping of Emergency Core Cooling (BSI 34320) is made for carbon steel containing light water. The buried portion of the Emergency Core Cooling System have sections of pipe (1-3432-16W-81 and 1-3432-2W-77) that are predicted to reach their minimum allowable wall thickness before 30 years after refurbishment. These pipes should be repaired or replaced.		
34.	59	34320	Emergency Core Cooling System - Medium pressure (MP) Emergency Core Cooling (ECC) valves MV31 and MV50 control logic modification		The ECC System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. Medium pressure ECC draws water from the dousing tank and injects water into the break using an ECC pump via the header isolation valves. The medium pressure phase occurs following completion of high pressure ECC, which injects water from pressurized accumulator tanks, once the high-pressure tanks are depleted. Valves 3432-MV31 and MV50 isolate the medium pressure pumped ECC flow from the downstream header injection lines. Their opening after high pressure injection is completed allows the medium pressure pumped phase of ECC to proceed. The design change is to modify MP ECC valves MV31 and MV50 control logic such that these valves open on low accumulator tank level instead of opening 90 seconds after HP ECC initiation. In this way, the HP ECC injection phase is completed and the pressure downstream of the MP ECC injection valves (3431-MV31/50) is significantly reduced to permit MP ECC injection. Hence, this change eliminates the possibility of ECC impairment during HP injection due to single failure of check valves 3432-V76 or V77.	Yes	

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35.	60	34320	Emergency Core Cooling System - Second steam generator crash cooldown system	The Emergency Core Cooling (ECC) System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. This design change is to add a second independent steam generator crash cool system as a backup to the function performed by the Emergency Core Cooling (ECC) system. The crash cooldown depressurizes the steam generators through use of the Main Steam Safety Valves (MSSVs), which in turn rapidly cools down and depressurizes the Primary Heat Transport (PHT) system. Independent of the Emergency Core Cooling (ECC) system, the Main Steam Safety Valves (MSSVs) have existing control through the Emergency Water System (EWS) in conjunction with control logic in the Digital Computer Controllers (DCCs). This DCC and Emergency Water System (EWS) interface will be used to perform the Second Crash Cooldown function. Automatic instrumented control of the Main Steam Safety Valves (MSSVs) is implemented by a parallel set of solenoid valves, each capable of opening the relief valve against its spring-closed position. Using signals wired to the DCC, the MTC program will be modified to include the Second Crash Cooldown (SCC) logic. To complement the logic, eight handswitches (two per steam generator) will be installed on the main control room panel; 66110-PL11. Window alarms will be provided in Main Control Room (MCR), also contact scanner alarms will be provided.	Yes	
36.	61	34320	Emergency Core Cooling System - Provide redundancy for 1-3432- PV10/ PV11 closure at the end of MPECC stage	The ECC System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. In the current ECC system design, valves 3432-PV10/ 11 isolate the ECC pump suction from the Dousing Tank. These valves are normally closed (fail closed) pneumatically operated butterfly valves. These valves are air to open and spring to close on air failure. Each valve has one solenoid in the air supply circuit. When the solenoid is de-energized, the valve is closed. Energizing the solenoid will cause the valve to open. It is noted that the current design does not meet single failure criterion. Their safety function is to provide a flow path during MP ECC injection and isolate the dousing tank during LP ECC operation. The dousing tank isolation valves 3432-PV10/ 11 are normally closed and open automatically on a Loss of Coolant Accident (LOCA) signal, to allow water to be drawn from the dousing tank by the ECC pumps and delivered to the HTS. On completion of the MP stage, hence the beginning of LP stage, these valves are manually closed to prevent air from entering the recovery pump suction and causing the pump to cavitate. They are arranged in parallel to provide redundant paths for H2O injection to the reactor. This design modification will add two new butterfly valves, 3432-PV162/ 163, in series with the existing 1-3432-PV10/ 11, to provide redundancy for closure at the end of MPECC, and to allow for testing of 3432-PV10/ 11.	Yes	
37.	62	34320	Emergency Core Cooling System - ECC Heat exchanger	<i>The ECC System is a safety system that is initiated automatically following a LOCA to refill the Heat Transport System (HTS), to remove residual and decay heat from the reactor core, and to limit component fuel damage. During long term ECC operation, a plate type heat exchanger (HX) is provided to cool the mixture of H2O and D2O which is recovered from the reactor building basement following a Loss of Coolant Accident (LOCA). Currently at Cernavoda Unit 1, there is one 100% heat exchanger. The secondary side cooling water will be changed from RSW to Recirculated Cooling Water (RCW). Use of RCW instead of RSW will improve the unavailability of the ECC HX by minimizing the potential problem of corrosion and /or biological fouling of the ECC HX resulting from stagnant raw service water in the secondary side of the HX. All the associated piping, pipe supports, instruments and components of the RSW need to be removed. As EWS is still provided as a back-up water supply system, the EWS lines and equipment on the supply side to the ECC heat exchanger (currently connected to RSW) are to be retained and connected to the new RCW inlet lines. The implementation of RCW loop will require new piping and new supports. On the outlet side, additional isolating valves are required since the EWS cannot be discharged into the RCW system.</i>	Yes	
38.	64	34320	Emergency Core Cooling System - ECC pump differential pressure measurements	It was identified in an ECC System design review that if the check valve on the operating ECC pump failed closed, the ECC System is failed because the standby pump is prevented from starting by the operating pump differential pressure since the measurement is taken upstream of the check valve. ECC system pumps have differential pressure monitoring to provide feedback on pump operation. Failure to establish adequate differential pressure will initiate a trip on the pump running in automatic mode and trigger the standby pump to start. This design change will provide triplicated differential pressure measurement loops complete with test circuits to produce two 2-out-of-3 pump trip circuits and two 2-out-of-3 standby pump start circuit. This also includes retaining one of the two differential pressure measurement loops per pump to monitor leakage of check valves and providing differential pressure indicators on MCR ECC control panel.	Yes	
39.	65	34320	Emergency Core Cooling System - Upgrade ECC Code Class Improvements to ECC System Unavailability	This design change is required to increase the level of compliance with the actual standards and regulatory requirements. The following approach will be applied: Class 5 and Class 6 portions of the HP ECC portion outside of the reactor building will be upgraded to Class 3; Class 5 and Class 3 of the HP ECC portion between the reactor building penetration and the high-pressure injection valves will be upgraded to Class 2; Class 3 portions of the MP and LP ECC system will be upgraded to Class 2. Qualification of existing components and piping should be assessed for feasibility.		
40.	68	34510/ 73140	Containment Isolation - Containment Isolation Enhancement for Resin Transfer System	This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The resin transfer system (BSI 34510) facilitates the transfer of fresh resin from shipping containers to the process systems and spent resin from the process systems to the spent resin storage tanks through several lines which penetrate containment. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
41.	69	34610	Emergency Water Supply System - The corroded pump support be repaired/ replaced with appropriate material	The Emergency Water Supply System (EWS) ensures that there is an adequate heat sink available for removal of decay heat after the normal heat removal systems are no longer available. Facilities are provided with a separate water supply to the steam generators, emergency core cooling (ECC) heat exchanger, and heat transport system. The accident modes that could lead to the loss of normal heat removal systems are loss of feedwater and loss of service water, and the loss of Class II and Class IV power, and common failures, such as earthquakes or fires. Water is taken from an earth dike reservoir fed by the Danube River. Corrosion of all parts that are underwater has been identified as problem in the suction part of EWS system, which causes difficulty to perform maintenance and to isolate some valves affecting both units, difficulty to clean underwater suction pipe which supplies both units and difficulty to raise and lower strainers for periodic cleaning. The supports, which are used for pump alignment are in poor condition (corroded) and must be repaired/ replaced with appropriate material.		

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
42.	70	34610	Emergency Water Supply System - Duplication of EWS Valves 3461- PV7 and PV41		The Emergency Water Supply System (EWS) ensures that there is an adequate heat sink available for removal of decay heat after the normal heat removal systems are no longer available. Facilities are provided with a separate water supply to the steam generators, emergency core cooling (ECC) heat exchanger, and heat transport system. The accident modes that could lead to the loss of normal heat removal systems are loss of feedwater and loss of service water, and the loss of Class II and Class IV power, and common failures, such as earthquakes or fires. Valves 1-3461-PV7 and -PV41 connects to the SG secondary side for accessing the dousing tank water to provide make-up to the SGs. To remove single failure possibility and to improve EWS system reliability new valves 1-3461-PV107 and PV141 will be added parallel to existing valves 1-3461-PV7 and PV41. Controls and displays associated with the new valves will be provided.	Yes	
43.	72	34610/ 73140	Emergency Water Supply System - Containment isolation enhancement to EWS system		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
44.	73	34710/ 73140	Liquid injection shutdown system - Containment isolation enhancement to liquid injection shutdown system - LISS		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. LISS is located in the reactor building (RB) with two containment penetrations, one line for helium make-up and another for supply of helium to the gadolinium mixing tank. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
45.	74	34980/ 73140	Annulus Gas System -Containment isolation enhancement to Annulus Gas System		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The annulus gas system supply is located in the service building (SB) and penetrates the reactor building (RB) through a single line which leads to a distribution panel located in Room R1-008. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
46.	75	35000	Fuel Transfer and Storage System - Addition of Containment gate in fuel transfer canal.		<i>This modification involves the installation of a containment gate at the entrance to the spent fuel transfer canal in the spent fuel discharge bay. Its function is to provide a containment boundary in conjunction with the fuel transfer canal water lock during the transfer of spent fuel from the Fuelling Machine to the spent fuel discharge bay. The change will provide a robust and verifiable containment boundary. The containment gate will be kept normally open and will not be used as part of fuel handling operation and will only be used for containment isolation following an accident. The mechanical gate will be manually closed by operator.</i>		
47.	78	36100/ 73140	Main Steam Supply and Relief System - Containment isolation enhancement Main Steam, Feedwater, Reheater Drains		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. The portion of the main steam, feedwater and reheater drains inside the RB are all considered closed to the containment environment. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
48.	79	36110	Main Steam System - Replace parts of the lines 1-3611-26S-1, 1-3611-26S-2; 1-3611-26S-3 and 1-3611-26S-4		The function of the Main Steam System is to supply steam to the Turbine Generator group for power generation providing, at the same time, Steam Generator pressure control through steam discharge by means of the ASDVs and suitable overpressure protection for the secondary side through the MSSV's. Parts of the lines 1-3611-26S-1, 1-3611-26S-2; 1-3611-26S-3 and 1-3611-26S-4 on Main Steam System undergo a more pushed degradation and the residual thickness cannot guarantee their integrity in the LTO and must be replaced: Line 1-3611-26S-1-2, Elbow 26", between welds 1500-1501; Line 1-3611-26S-1-5, Pipe 26", between welds 1513-71; Line 1-3611-26S-2-2, Elbow 26", between welds 1531-86; Line 1-3611-26S-2-3, Pipe 26", between welds 1536-1537; Line 1-3611-26S-3-2, Elbow 26", between welds 1557-1558; Line 1-3611-26S-3-3, Pipe 26", between welds 1562-1563; Line 1-3611-26S-3-6, Pipe 26", between welds 1575-1576; Line 1-3611-26S-4-2, Elbow 26", between welds 1593-1594.		
49.	80	36310	Boiler Blowdown System Refurbishment	Steam Generator Blowdown System - Increase blowdown capacity; replace components (1-3631-HX001, 1-3631-HX002 Heat Exchangers)	Boiler (Steam Generator) Blowdown is credited with the following safety functions: maintain the capability to remove heat from the heat transport system; prevent steam generator corrosion and tube failure during normal plant operation; limit the release of radioactive material by maintaining containment boundary and is a system partly located in the nuclear island and partly in the balance of plant. This design modification will focus on upgrading the blowdown system in order to meet the requirements of an isolatable containment boundary for the Steam Generator (SG) Blowdown System in accordance with regulatory requirements and improve steam generator blowdown system by allowing for increased blowdown capacity to improve SG chemistry, maintaining within chemical parameter specification limits during various operating scenarios. This design modification will require the replacement of the heat exchangers 1-3631-HX001, 1-3631-HX002, increase of piping and process equipment sizing to accommodate the increased blowdown flow. Also, replacement of the following control valves will be implemented: 1-63631-FCV301; 1-63631-LCV302; 1-3631-PCV303; 1-63631-FCV304, by taking in consideration the increased capacity.		
50.	81			Steam Generator Blowdown System - Increase blowdown capacity; replace components (control valves are obsolete and should be replaced: 1-63631-FCV301; 1-63631-LCV302; 1-3631-PCV303; 1-63631-FCV304)			

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
51.	84	41100	Moisture Separator and Reheater Refurbishment	Moisture Separator and Reheater System - Replace Reheaters tube bundles for both MSRs to improve plant performances	The steam turbine of Cernavoda Unit 1 is equipped with two Moisture Separator and Reheaters (MSR), "KE2" type. The MSRs are located between the high pressure and low-pressure turbine sections. Their function is to reduce the moisture content of the cycle steam flowing through the low-pressure turbine. This is accomplished by direct moisture removal followed by superheating of the steam before the LP turbine. By reducing the moisture content of steam and the associated mechanical efficiency losses in the LP turbine, the MSR system improves the overall cycle efficiency and the LP turbine reliability. Tube bundle shall be replaced in order to warranty good operational performances for the new service life cycle of the plant.		
52.	90			Moisture Separator and Reheater System - Moisture Separator and Reheater inspection and repairs	The whole pressure parts of the MSR shell and the drain nozzles are in Carbon Steel SA-105. For this reason, these areas are subjected to degradation because of the combination of flow accelerated corrosion (FAC) and liquid droplet impingement (LDI) erosion phenomena, leading to material thinning. It is strongly recommended to inspect the shell areas at the bottom of the Carbon Steel shell, around the separator drain outlet nozzles. Some repairs are necessary to restore the design condition and permit the operation of the equipment for the new service life cycle of the plant.		
53.	91	41100	Turbine - Steam System - Replace both lines 1-41190-G001, sch. 40 portion		Lines 4119-G001-14" that connect the main steam header to the MSR vessels undergo a more pushed degradation and there are concerns whether the residual thickness can guarantee their functionality in the LTO. Replace both lines 1-41190-G001, sch. 40 portion will be performed.		
54.	82	41100	Turbine System - Retrofit Option - Perform an overall LP turbine retrofit		The retrofit solution for the LP turbine will be implemented. This will include replacement of all LP internals, inner cylinder, rotor, diaphragms, pressure plates, all utilizing modern technology. The LP rotor will be welded drum type design This eliminates the major stress concentration area providing enhanced reliability and availability of the unit for the duration of design life of the rotor. The rotor coupling will be designed to replicate the existing design. The new cast blade carriers are included in scope. The blade carriers will be designed with the similar interface as the current one to fit into the retained inner casing to minimize the site machining and modification required for installation. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
55.	86	41100	Turbine System - Refurbish the HP internals		The current HP turbine is not suitable for a further 30 years of operation. In addition to the normal maintenance requirements, this would require replacement of the first four stages of moving blades, full borescopic inspection as well as a full refurbishment of diaphragms. Based on the findings of the life extension study, the early stages of HP moving buckets were recommended for replacement, including stages 1 through to 4 front and rear ends. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
56.	89	41100	Turbine System - Perform replacement of all bearing liners; refurbishment of oil deflectors		Replacement of all bearing liners; refurbishment of oil deflectors; replacement of thrust pads, refurbishment of "D" coupling to correct face runout and resolve bearing 9 high vibration issue must be implemented. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
57.	83	41100	Turbine Protection, Control and Monitoring System Refurbishment	Turbine System - Replace turbine electro hydraulic controller; improve turbine trip (review turbine trips)	The existing control system at U1 is Mark-II, and it is an old system not manufactured by GE since 1988. It is now an obsolete solution. Furthermore, it is a control system with trip sequence "1 out of 1", which is not the state-of-the-art in terms of actual safety regulations. In comparison to U2, where a trip system is implemented with sequence "2 out of 3", it can be stated that the existing configuration not only is obsolete, but also less reliable due to the lack of redundancy. The scope of these modification is to use the new generation turbine electro-hydraulic controller instead of Mark II, i.e. Mark Vie; review turbine trips that are actuated by one-out-of-one logic and implement two-out-of-three logic. Replace remote switches with analog transmitters. Together with the turbine control system, new Turbine Supervisory System (TSI) Bentley Nevada 3500 will be delivered as an independent system built in a separate cabinet. The new configuration of the U1 Turbine Protection, Control and Monitoring System will be as much is possible similar with U2 configuration. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>	Yes	Yes
58.	85			Turbine System - Replace turbine electro hydraulic controller; improve turbine trip (replace all remote switches with analog transmitters)			
59.	88			Turbine System - Replace turbine electro hydraulic controller; improve turbine trip (replace Pressure switch fittings)			
60.	92			Turbine System - Replace turbine electro hydraulic controller; improve turbine trip (use the new generation turbine electro hydraulic controller instead of Mark II)			
61.	93	41200	Generator and Auxiliaries - Replace Stator Cooling Water System skid		Many of the components currently skid-mounted are in a critical status, and need replacement. For instance, the SCWS coolers are in poor condition. Replacement of Stator Cooling Water System skid will automatically resolve the obsolescence status of all Stator Cooling Water System components, and permit the transition to the LTO with no problems. Thus, will include replacement of current H2 Control Cabinet with a new 4-bay cabinet containing dual hydrogen analyzers, and Modbus communication with a potential modern turbine controller, valves 1-4123-RV008 / RV016, pumps 1-4125-P6, P7 and related motors, valves 1-4124-V04, V03, all remote switches from current type to analog instruments. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
62.	96	41200 / 41300	Generator and Auxiliaries - Replace Seal Oil skid.		The modification consists in the replacement of the existing, obsolete Seal Oil skid with an upgraded skid, equipped with modern equipment, which will ensure redundancy and system functioning after the entire unit has been refurbished. Will include: Seal oil pumps and motors, Main filtration unit, Differential pressure control valve, Float Trap and Optional design modification description for the Oil Mist Extractor, modification in terms of Instrumentation, Controls and electrical systems (controlling the seal oil unit will be connected to the control system and turbine protection system). <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
63.	98	41300	Turbine and Auxiliary Systems - Governor Oil System - Replace the whole Hydraulic Power Unit		Governor Oil System is part of the HPU (electro-Hydraulic Control Unit) that controls the turbine operation and prevents from over-speed, by providing pressurized oil to the steam admission valves and to the turbine trip system. Some of the major system components that are obsolescent. Replacement of the whole HPU with a new state-of-the-art solution will be completed. The new equipment would ensure safer reliable, trouble-free operation over an extended period of time. This will include replacement of central fluid reservoir, pumping systems, valves, fluid coolers, accumulators, fluid transfer and filtering unit, air dryer, space heaters and fans, piping. The controllers are also obsolete. In order to provide higher reliability and better performance of the turbine, the existing instruments will be exchanged with fully analog transmitters. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
64.	102	41300	Turbine and Auxiliary Systems - Oil Systems - Implement SIL criteria according to modern norms and standards		Will be part of the "Skid replacement" for Oil Systems. Since instrumentation is to be replaced, they will have to undergo the modern safety integrity levels (SIL) requirements. <i>The OEM - GE will be involved in the solution development and will cover like a separate part of the refurbishment works the procurement for major equipment and partial implementation of the field work.</i>		
65.	104	42100	Main Condenser Refurbishment	Main Condenser System - Condenser Retube to Recover Margin	To ensure the operability and the performance of the main condenser for a new service life cycle of the plant it is necessary to provide significant repair/ replacement activities to be carried out during the refurbishment outage. The project scope includes replacement of all condenser tube bundles to ensure thermal performance of the condenser. In addition, the scope includes the increase of the condenser water box drainage pipes.		
66.	106			Main Condenser System - Replacement of deflectors plates	Tube bundle protective plates "deflectors" have multiple repair-welded joints due to frequent cracking. Replacement of tube bundle deflectors plates that were already repaired by welding due repeated cracking through years is required. Replacement will be done with new stronger or thicker plates and will be corelated with the main condenser tube bundles.		
67.	105			Main Condenser System - Replace condenser parameters measurements instrumentation	There is not enough instrumentation to monitor all parameters that influence condenser pressure. Actual instrumentation is old, obsolete, not enough accurate to detect any parameter modification that may affect the condenser vacuum. Condenser parameters measurements instrumentation on Main Condenser System will be replaces. The remotely transmitted signals will be acquired by a dedicated acquisition system, so as the operator can retrieve the stored data, perform their download. However, the acquisition of these signals will be taken in charge by the DCS itself, and a DCS node with a local workstation (containing a Visual Display Unit) will be provided for use of the field Operator.		
68.	107	43210/ 43230	Main Condenser System/ Feedwater System - Improve heater by-pass valve.		For Unit 1 the heater bypasses, both for condensate (BSI 43210) and feedwater (BSI 43230) systems, will be hydraulically sized in order to guarantee the nominal thermal power also in case of isolation of a heater train. For this reason, it is proposed a size change of the present heater bypass lines in such a way to provide the pressure drop satisfying the hydraulic conditions determined to guarantee the nominal thermal power. In Unit 1, the bypasses of all the heaters (BSI 43210 & BSI 43230) were sized in order to assure 90% of the normal condensate or feedwater flowrate in case of isolation of one heater train. This resulted in a thermal power decrease of about 10% whenever a heater train was isolated for any reason. The bypasses of all the heaters (BSI 43210 & BSI 43230) shall be sized in order to assure 100% of the normal condensate or feedwater flowrate in case of isolation of one heater train. The advantage of this design solution is that in case of heater isolation power maneuvers by the operator will be no longer required. Furthermore, the non-isolated heater train will not be overloaded more than established by its design conditions thus preventing a subsequent isolation and reactor setback or trip. An increase in the bypass line diameters with a larger control valve will be necessary to accommodate the increased feedwater or condensate flowrate, and the need to balance the various Δp's through the different branches. Therefore, the existing bypass lines will have to be replaced with pipes of larger size. Hence, new motorized isolation valves shall be procured to substitute the old ones not suitable for the scope of this design change. Also, they will be replaced the two isolation valves (1-43230-V624/V625) installed upstream and downstream of the motorized valve 1-43230-MV115.	Yes	
69.	108	43220	Make-up and Condensate Storage System - Provide enhanced anchorage for Condensate Storage Tank 43220 – TK99		Existing Condensate Storage Tank 1-43220-TK99 has been installed with the construction of the Integrated Building. The original seismic input and storage tank loads were used to design the concrete basement and the steel base plate (and related anchors) on the slab of the Integrated Building at El. 121.40 (TOC). As the seismic loads have been updated through time, the original design sizing is to be refreshed to consider the new request of seismic input for this basement. This design modification applies to the anchorage of the Condensate Storage Tank TK99, BSI 43220. This anchorage is currently a weak point of the entire structure, since it is not sized to cope with a DBE Earthquake class D, and, if it fails, the risk of a tank relocation or collapse would become likely, the possibility to feed with demi-water the Auxiliary Feedwater pump would be impaired, thus preventing the defence-in-depth action of the pump itself, with a consequent intervention of the safety systems. For this reason, the TK99 anchorage should be revised. The required modification consists in the replacement of the anchorage and basement of the TK99 with new ones that could ensure the strength of the base connections of the tank as a result of the change in the loads transferred from it to the civil structure.		
70.	110	43230	Feedwater System - Implement deaerator retrofit, including replacement of spargers, internal plates		The Deaerator is composed of two main parts; two Deaerator towers and the Deaerator storage tank. Condensate from System 43210, is delivered to the Deaerator towers, in counter current with the Extraction steam, in order to preheat it and strip the gases. The condensate is then collected in the Deaerator storage tank below. In fact, the Flow Accelerated Corrosion and Liquid impact erosion phenomena already provided significant damages to the spargers and to the other internal components of the deaerator and therefore they shall be replaced. Additional activities are assumed to be included to add two additional nozzles for second new Auxiliary Feedwater pump suction and recirculation.		

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
71.	111	43230	Feedwater System - Replacement of check valve 1-4323-V168		1-43230-V168 swing check valve prevent feed water backflow into the HP5 when the auxiliary pump 1-43230-P04 is working. Check valve 1-4323-V168 has suffered of excessive wear during its operating life and must be replaced during refurbishment outage due to the difficult position in which it is placed.		
72.	113	43230	Feedwater System - Addition of an independent Auxiliary Feedwater Pump powered by Class III Power		The Unit 1 Feedwater system was designed with three Main feedwater pumps operating in configuration 3x50% (1-4323P01, P02, P03), i.e., two pumps in operation and one in standby, plus one auxiliary feedwater pump (1-4323-P04). The AFWP is powered by Class III and shall operate only during plant start-up, shut-down and abnormal conditions (such as loss of Class IV power supply). This modification refers to the installation of an additional and independent AFWP, including associated process, EC&I, mechanical and civil/ structural modifications. The second AFWP must be of the same design of the existing 1-4323-P04; the two AFWPs (the existing and the new one) will be installed in parallel and will operate in redundant configuration (2X100%). The additional auxiliary feedwater pump system needs to be independent from the existing one. The suction line of the additional AFWP will be provided with its isolation valve, expansion joint, sample probe, connections with sampling system 45110, connection with chemical control system 45400, connection with condensate storage system 43220. The additional AFWP will be equipped with its own automatic recirculation valve and delivery isolation valves. The new recirculation line is routed back to deaerator through a new 3" nozzle on deaerator tank or through an available spare.	Yes	
73.	114	51000	Transformers (Main, UST, SST, Main Interconnecting) and Protection System - Modernization of the protection system of the transformer and main generator		These systems are obsolete, with a high failure rate that can impact the operability of the plant. The purpose of this design modification is the replacement of the existing Protection System (type GSX-5E) for Generator and Power Transformers with latest up-to-date technology System with higher performances and reliability. The modification includes replacement of Protection Panels 1-65100-PL773, PL774, PL775, PL776, PL777, PL778 and PL779, including all the necessary auxiliaries (protection relays, control equipment, interposing relays, injection units, tripping matrix, PC interfaces, all requested hardware, etc.) and automatic voltage regulator for Unit & Service Transformer tap changers, located in the relevant boards. As the actual design of the protection system is an integrated one with seven panels interconnected, the implementation of the design change will also include an analysis of the whole system, thus including also the following associated protection system panels: 1-65100-PL773; 1-65100-PL774; 1-65100-PL779 (protection system panels which contain lockout relay and interface between protections panels); 1-65100-CR01-A, B, C, D, E (panels located in Relay Cabinet CR01), to ensure system compatibility with protection system from 400 kV Cernavoda Substation; Neutral grounding protection 4121-G01 Main Generator (100 % and 95% stator earth fault), which receives the signal from 1-4122-PL1621 panel; Fault Recorder in panel 1-69100-PI789 whose function will need to be restored or replaced.		Yes
74.	115	51120	High Voltage System - Replace the obsolete 400 kV disconnect switches		The following 400kV disconnect switches have been assessed and identified as degraded and to be replaced: 1-5112-DS05 – Isolation for transformer 1-5114-T01; 1-5112-DS06 – Isolation for transformer 1-5114-T02; 1-5112-DS07 – Ground for transformer 1-5114-T01 line side; 1-5112-DS08 – Ground for transformer 1-5114-T02 line side; 1-5112-DS11 – Isolation & Ground for both transformers and 400 kV line from switchyard. To provide reliability to the 400kV system, the following design changes are proposed: replace the disconnect switches on the existing steel structures; confirm steel support structure will be adequate for the new disconnect switch; confirm foundation will be adequate for the new disconnect switch; replace the conductor on each end of the disconnect switch; replace electrical protection equipment, control switches, and auxiliaries for each disconnect switch; replace control and power cables between the disconnect switch and relays and switches.		
75.	120	52300	Stand-by Diesel Generators System - Class III Standby Diesel Generators (SBDG) and related Auxiliary Systems Replacement		The Stand-by Diesel Generators (SBDGs) constitute a safety support system that provides the electrical supply for the Class III users when the normal source is failed. The Class III standby power supply system is a backup power source for Class III distribution electrical system. Each SBDG can start automatically on its own stored energy, running its own requirements and supplying power via Class III 6 kV buses to various plant equipment in the event of a Class IV power failure. The general condition of the stand-by diesel generator and related auxiliary systems and components are degrading due to aging and obsolescence issues. The design modification scope is to replace the existing four standby diesel generators and related auxiliary systems: Alternator & Auxiliaries (EC&I - BSI 52310); Fuel oil system (BSI 52320); Combustion air system (BSI 52330); Exhaust system (BSI 52340); Starting air system (BSI 52350); Glycol water cooling system (BSI 52380); Lube oil system (BSI 52390).The RSW (Raw Service Water) System 52370, that in the present configuration is used for the engine cooling heat sink, will be eliminated as the Glycol Water Cooling System (BSI 52380) of the new SBDGs will be cooled by an independent air cooler. In addition, the following other systems are part of the Standby Diesel Generator Station: Generator field exciting system (BSI 52160); Back-up batteries (BSI 55320); Control and Instrumentation System (BSI 65260); Fire Detection and Protection Systems (BSIs 67140, 71400); Cathodic Protection System (BSI 58400); Lightning Protection (BSI 58744); Grounding Equipment (BSI 58219); Lifting Devices (BSI 76150).	Yes	Yes
76.	121	52900	Emergency Power System - Emergency Power Supply (EPS) and related Auxiliary System Replacement		The purpose of this modifications is to improve the existing EPS design to increase the reliability and availability of the EPS system, and to address obsolescence issue by replacing the aging and obsolete EPS equipment. Replace the EPS diesel generators and all auxiliaries associated systems and components (associated distribution switchgears and panels, etc.). EPS is seismically qualified to design basis earthquake (DBE) category B and is the source of power after a DBE event leading to loss of Group 1 power. To meet the new safety goals, the following design changes are proposed to increase the availability of the EPS system. This include also "Replace the ECC pump motor vacuum contactors (1-5290-PL1465/4M and 1-5290-PL1466/4M)" (index#132) and "Relocation and replacement of emergency lighting fixtures in the existing EPS and SCA rooms" (index#133).		Yes
77.	122	53000	Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and	Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (replacement of the 6 kV busducts)	The required modification consists in the complete replacement of the MV switchgears (6kV and 10kV) including all circuit breakers and protections, MV Switchgears class III (6kV – BSI 53230) and class IV 6 & 10kV (BSI 53140 – 53240). The replacement also involves transfer panels (1-5314-PLA, 1-5314-PLB, 1-5323-PLG, 1-5323-PLH, 1-5324-PLC, 1-5324-PLE, 1-5324-PLD, 1-5324-PLF) and the 6kV and 10kV busbars. <i>Regarding the busbars total replacement will be performed for outside portions. For internal portions will be replaced the insulator assemblies.</i> The Medium Voltage switchgears pieces of equipment are obsolete and are reaching the end of the expected lifetime and became obsolescent. The new equipment shall be in compliance with the requirements as per actual standards. The MV electrical system shall be designed based on the grouping concept of ODD and EVEN trains, and on the separation of Class III and Class IV supplies, depending on their availability requirements. The ODD and EVEN subsystems are physically separated in different rooms in order to meet the separation distance requirements. Switchgears will be of the latest proven technology and equipped with state-of-the-art equipment such as electronic, microprocessor based,	Yes	Yes

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
78.	123		Busbars Replacement	Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (replace, for the MV equipment inside the switchgear, the obsolete equipment)	protection relays. The circuit breakers will be withdrawable, three-pole with tulip (or equivalent) type contacts, vacuum type for indoor installation. The refurbished Medium Voltage Distribution System will ensure also power supply for new consumer, that will be installed as result of the implementation of the design modification in scope of the Refurbishment Project, and will accommodated these supplementary electrical loads, as required. Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars will include Index# 122; 123; 124; 125; 126; 127		
79.	124			Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (replacement of the transfer panels with modern ones)			
80.	125			Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (complete refurbishment of the medium voltage protection system including the current and voltage transformers)			
81.	126			Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (replacement of the 10 kV busducts)			
82.	127			Medium Voltage Systems - Replacement of Medium Voltage (MV) Equipment, MV Protection System, Transfer Panel and Busbars (complete replacement of Class III 6 kV medium voltage switchgear station 1-5323-BUG and BUH)			
83.	128	54000	Motor Control Center Replacement	Low Voltage Distribution System - Motor Control Center Replacement (replace the Class IV and III MCCs with modern ones)	The electrical distribution system in CANDU stations is differentiated by Classes, which indicate the level of reliability of the power source. The loads are assigned to the buses according to their reliability requirements, including: Class IV can support prolonged interruption of power supply and Class III can support short interruption of power supply. MCCs provide power supplies to motor loads having rated power $P \leq 56$ kW and all heater loads of less than 81 kW. Most of the components installed inside the Class IV and Class III MCCs are obsolete (manufacturing date 1986). Even if several minor components have already been substituted, the entire replacement of Class IV and Class III MCCs with modern ones is necessary to guarantee a life extension of 30 years. The refurbished Low Voltage Distribution System will ensure also power supply for new consumer, that will be installed as result of the implementation of the design modification in scope of the Refurbishment Project, and will accommodated these supplementary electrical loads, as required. Motor Control Center Replacement will include index#128; 129		Yes
84.	129			Low Voltage Distribution System - Motor Control Center Replacement (replace the following Class III MCCs 5433-MCC31;32;45;46 for Diesel Generator Stations)			
85.	131	55000	UPS System - Replacement of UPS Equipment		The UPS System is composed of Class I and Class II power. The Class I power system supplies all direct current loads which cannot experience any interruptions in power. Class I power is normally derived from Class III (AC power interruptible for short periods) system via rectifier with a battery floating across the rectifier. Class II power system supplies all alternating current loads, which cannot experience any interruptions in power. The uninterruptible 50 Hz ac power is produced by an inverter supplied from the Class I DC system or a separate battery. The Class I and II systems provide a corresponding degree of redundancy in the electrical power supply system. The general condition of the UPS system equipment is degrading due to aging and obsolescence issues. This design change addresses the replacement of the Group 1 Uninterruptible Power Supply (UPS) system components (Rectifiers, Inverters, Voltage Regulators, transfer Switches Distribution Panels, and Ground Fault Detectors (GFDs)).		Yes
86.	132	55000	Replace the ECC pump motor vacuum contactors		The ECC vacuum contactors are obsolete and there are no spares to support continued safe operation for the ECC motors, this will need to be addressed to ensure ECC system availability. Note the ECC is a Seismically Qualified (SQ) safety system and the replacement contacts must also be SQ. These activities will be included in Emergency Power Supply (EPS) System upgrade, index#121.		

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
87.	134	57000	Cable System NSP - Replacement of EQ qualified cables having PVC insulation		Cable with PVC insulation have decreased performance when exposed to harsh environments such as: high pressure, temperature, and humidity, similar to those encountered during a postulated Design Basis Accident (DBA). A reduction of cable insulation resistance can occur which may cause false signal currents for instrumentation cables. Additionally, PVC cables are susceptible to cable cracking caused by deterioration due to continued exposures to high radiation and/or high temperatures. The purpose of this modification is to replace the EQ qualified cables which have PVC insulation in the NSP areas of the plant, including the R/B.		
88.	135	58000	Station Grounding, Cathodic and Lightning Protection System - Completely refurbish the Cathodic Protection System for both the EPS and the SDG systems		The Cathodic Protection (CP) is used to control the deterioration of a metal surface which can be exposed to galvanic corrosion, by making it the cathode of an electrochemical cell, and connecting the metal to be protected to a more easily corroded "sacrificial metal" that acts as the anode. The sacrificial metal then corrodes in lieu of the component metal that, consequently, gets protected. The Cathodic Protection for SDG and EPS although still currently protecting the serviced structures up to the Refurbishment Outage, has to be totally refurbished by replacing all the involved equipment, as it is obsolete. Replacing Cathodic Protection System can be performed together with SDG and EPS replacement. Scope of the work is the replacement of the following obsolete Cathodic Protection system equipment: Buried piping lines near/under 52320-TK6/TK8; Buried piping lines near/under 52320 TK5/TK7; Measuring stations 1-58400-P1C/P2C/PTK5/PTK6 for EPS; Measuring stations 1-58400-P1C through P10C for the SBDG.		
89.	136	60000	Cyber Security		This design change is necessary to address cyber security requirements within the station, and within the refurbishment program, which is a regulatory requirement. The Cyber Security Program to be developed during the Pre-project phase to ensure that the Cyber Security Program is in place at the start of the refurbishment to allow Cyber Security requirements to be included in procurement documents, design requirements, etc. related to other design changes that involve digital equipment.		
90.	137	60300	Annunciation System - Main Control Room and Secondary Control Area Annunciation System Replacement		The annunciation system provides the operator with information to help monitor the plant systems and processes. The rationale for the design change notes all annunciation equipment in the MCR and SCA is out of qualified life expectancy and contains degraded and obsolete components. The scope of this design change is to replace all components of the window annunciation system, including the window box assemblies in both the MCR and SCA. New window alarms proposed by other design changes in scope of the refurbishment project will be accommodated.	Yes	Yes
91.	140	63105	Failed Fuel Location System - Monitor Sample Tubing Routing		The Failed Fuel Location (FFL) system (BSI 63105) identifies in which channel of the particular coolant loop a fuel failure occurs and finds, in this particular channel, which bundle pair contains the failed bundle(s). The location system is a per channel system which extracts on demand a continuous sample from each feeder and brings it via the sample lines into room R-303 and R-304. In these rooms the sample lines are coiled into a grid of sample holders and are scanned by a mechanical carriage moving a detection system. It should be noted that some of the DN monitoring sample channels with the lowest flow are associated with the channels which bypass their respective reactor outlet header and connect directly to the outlet feeders and steam generator inlet line. The purpose of the design modification is to increase the flow through the sample lines by increasing the differential pressure across the lines. This will ensure accurate delayed neutron count measurements, leading to the accurate detection of the location of any failed fuel.		
92.	143	66200	Replacement of Nuovo Pignone and Marconi Panels with a Distributed Control System (DCS)	Control Centre Instrumentation - Nuovo Pignone Analog Control Panels - Replacement of Nuovo Pignone and Marconi Panels with a Distributed Control System (DCS)	Both Nuovo Pignone BSI: 66200 and Marconi Logic BSI: 66300 systems are obsolete equipments. These provide logic and control functions for all BOP part of plant. Modern solution is to replace all panels with flexible digital solution based on a DCS (Distributed Control System), with new digital equipment that will conform to requisite quality assurance standards and which could sustain control optimization modifications necessary during plant refurbishment. The proposed DCS shall at least mirror the functions accomplished by the equivalent system in Unit 2. As such, the scope of this design modification extends over the control and the supervision of all of the plant systems currently governed by the various Marconi, Nuovo Pignone, etc., control systems. In addition, the new DCS will take in charge the control of additional systems, as it is in Unit 2, spanning from the HVAC systems (S/B and T/B systems), the Pump House systems, the D2O Tower processes, local controllers (Chillers, Diesel Generators, etc.), electrical systems.	Yes	Yes
93.	144			Control Centre Instrumentation - Marconi Logic Control Panels -Replace Marconi Logic Panels - Replacement of Nuovo Pignone and Marconi Panels with a Distributed Control System (DCS)			
94.	145				Control Centre Instrumentation - Improve design requirements for pump motors of less than 75 KW power that trip on loss of 48V DC Class 1on BOP side		

Refurbishment activities for NSP and BOP						
No Crt.	Index #	BSI	Descriere/ Description	Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
95.	146	66400	Digital Computer Controllers (DCCs) hardware (BSI 66400) and software (66500) Systems - Station control computer system refurbishment	The station control computers system installed in Cernavoda Unit 1 of is the DCC system that was designed to have two nearly identical dual-redundant computers, DCCX and DCCY, which ensure that both high reliability and availability are achieved. Station control computers are critical equipments and have an outdated lifespan. There are concerns regarding a decrease of reliability. A sequential refurbishment plan was already started. Actual approved strategy requires gradual replacement of old and obsolete parts. The principal activities include: replacement of the contact scanner, analog input cards, keyboards, cable, chassis, power supplies, watchdog enclosures, supply of DCC offline tools and PDU. Also, the hardware and software modifications in scope of Refurbishment work will be completed. 1. Contact scanner: Replace DCC contact scanner with a new scanner from L3 MAPPS and increase the number of alarm inputs to 2688, including qualification or commercial grade dedication, as required. The proposed new scanner supports 2688 (640 new) CIs with only 33 existing spares. The total number of new CIs required along with the number of CIs to be included in the new contact scanner will be determined in detailed design. The number of new CIs required is also highly dependent on which design modifications are carried forward for implementation. Two panels may be required in the CER for the new scanner hardware. 2. Analog input cards: Add analog input cards for new AI's; Replace analog input card; Keyboards: Replace 12 DCC function keyboards (9 for DCCX and DCCY, 1 for DCCZ, and 2 spare). Note that the two touchscreen keyboards on the operator's desk (PL10) will not be replaced. 3. Cable, power supplies, chassis, watchdog enclosures: DCC Datapath 50 Chassis refurbishment/replacement and Power Supplies Replacement; Change DCC AC Power from 110 V to 220 V and eliminate transformers (include appropriate electrical protections); Perform Watchdog Enclosures Refurbishment with Seismic Qualification and Upgrade Behlman Power Supplies as per installation of L3 HARRIS solution kit up to and including the replacement of the power supply with a new redesigned model (perform appropriate QA dedication); DCC Intra-Cabinet Cable Replacement including terminals and power distribution (power distribution panel, power strips, and associated cabling). Will include Datapath old CCA cards replacement; chassis will include connectors and measurement circuit changes for power supplies monitoring. 4. DCC offline tools: XASSE, XLINK, XVF, WinEMAD, and VIRCON. Provide VIRCON reference scripts for DCC control programs for regression testing. The scope and use of the scripts are to be established during detailed design. 5. Hardware and software modifications in scope of Refurbishment work: design modifications being considered for the refurbishment project that affect the DCC software and 6. Other items: Add connection to a PDLC card (in the Fuel Handling Human Machine Interface (HMI) computer) and cable from the 2nd Bulk Memory Storage Unit (BMSU) port to create a new data link between the DCCs and the Fuel Handling Augmented HMI, to be located behind the fuel handling panels in the main control room; Provide and install L3 HARRIS solution kit for Display and Data Link chassis vulnerability due to interference with interrupt subsystem up to and including replacement of power supply solution with a redundant supply option; Provide and install solution kit for L3 HARRIS EC03422 and the updated MA268-100574-01/02/03 drawings for insert of capacitors on CACHE bus; Provide new PDU and modify EXEC and CSTAT to accommodate it; CHECK program rules needs to be adapted as a result of redundant 48V PS at DI.	Yes	Yes
96.	151	68200	Shut Down System (SDS) 1 and 2 - Trip coverage enhancements. Change interlocking logic. BSI 68300 SDS1 & SDS2 trip parameter	The purpose of this design change is to improve the defence-in-depth of SDS1 and SDS2 by providing additional trip coverage. For Shutdown System Number 1 (SDS1) with regards to process trip coverage the following trip improvements are to be implemented: 1. Moderator High Level (MHL) and Low Level (MLL) trips; 2. Heat Transport Low Pump Motor Speed (HTLPS) trip; 3. Heat Transport Low Pressure (HTLP) trip on HD3 and HD7; 4. Steam Generator Low Level (SGLL) instrumentation to cover all steam generators (add SDS1 on SG2 and SG3). For Shutdown System Number 2 (SDS2) with regards to process trip coverage the following trip improvements are to be implemented: 1. Moderator High Level (MHL) and Low Level (MLL) trips; 2. Heat Transport Low Pump Motor Speed (HTLPS) trip; 3. Heat Transport High Pressure (HTHP) trip on reactor outlet headers HD3 and HD7; 4. Steam Generator Low Level (SGLL) trip instrumentation on boilers BO1 and BO4; 5. Heat Transport Low Pressure (HTLP) trip on reactor outlet headers HD3 and HD7; 6. Improving reading accuracy of LOG-N rate indicator on 1-66110- PL2. <i>No header or boiler taps will be installed.</i>	Yes	
97.	152	68200 68300	Shutdown Systems - Replace Mercury wetted relays with dry relays	This design change is to replace Hg wetted-contact relays, utilized in the CER and SCA relay panels for safety related systems, with dry reed relays of the printed circuit board mount type.		
98.	153	68200 68300	Shutdown Systems - Replace the PDCs for both SDS1 and SDS2.	Main safety systems SDS1 and SDS2 of CANDU plant are controlled by digital equipments named PDC (Programable Digital Controllers) which actuate shutdown of plant. These are obsolete now and need redesign based on new technology and digital standards. The qualification process of such systems is long one. To avoid any common cause failure caused by any type of commonality between the two shutdown systems, diverse PDC platforms should be used for SDS1 and SDS2. New PDC hardware is being procured to replace obsolete equipment. The SDS1 and SDS2 PDCs are being procured from different suppliers to minimize probability of common mode failure. In addition, the software will be prepared to meet current requirements for QA including verification, validation and testing. To supplement local display, SDS 1 and SDS 2 PDC digital outputs will be fed to the DCC contact scanner with suitable buffering to allow for control room annunciation.	Yes	Yes
99.	154	68200 68300	Shutdown Systems - Plant Performance Digital ROP	In the CANDU design, variations from the nominal flux and power distributions are normal and to be expected, and must be considered in the ROP system design. With the current design, ROP calibration is performed manually at Cernavoda Unit 1. The design change consists of two steps: digitization of ROP trips (in the current C1 design, ROP trips are hardwired and implemented using analog relay logic) and computerization of ROP calibration.	Yes	
100.	155	68460	Hydrogen Control System - The Hydrogen behavior in containment	This change provides a Hydrogen Control System consisting of igniters, control cabinets and switches, and interfaces with the DCC's to alert the operator under alarm conditions. The following modification will be implemented: install 44 hot surface igniters, supplied from Class III power supply and alternatively from Emergency Power Supply. The igniters are to be distributed in the two Fueling Machine (F/M) vaults R-107 and R-108 and in the upper part of the R/B, in rooms R-501, R-601 and R-602. The two F/M vaults will be considered protected volume, each having sufficient redundancy in ignition capability; install two seismically qualified system dedicated cabinets. Cabinet 68460-PL 2501 will control the igniters on Channel N, ODD section, while cabinet 68460-PL 2502 will control the igniters on Channel Q, EVEN section; install two hand-switches on MCR to simultaneously power all igniters in the ODD group, and EVEN group of igniters. Provide Contact Inputs for DCC interface.	Yes	

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
101.	166	71310	Replacement of RSW large valves	Raw Service Water Systems - Replace Motor Operated Valves 1-7131-MV304 ÷ MV307	The valves manufacturer Vanessa no longer exists and the valves, are therefore obsolete due to the impossibility of finding spare parts on the market. As such, the valves have to be replaced by new valves, along with a significant number of spares for future utilization. Replacement of RSW large valves will include index#166; 167; 168		
102.	167			Raw Service Water Systems - Replace Large Check Valves 1-7131-V001 ÷ V004	Large Check Valves are obsolete. Existing valves presented problems with internals, fixed by the plant, but to reach LTO, they have to be fully replaced. Replacement of RSW large valves will include index#166; 167; 168		
103.	168			Raw Service Water Systems - Replace Gate valves 1-7131-V032÷V035	Gate valves are presenting recurrent leakages caused by bevel defects, as well as there is presence of MIC due to the operation in raw water which may have caused the reduction of the operation margins. This activity consists in the replacement. Replacement of RSW large valves will include index#166; 167; 168		
104.	169	71310	Raw Service Water Systems - Replace the impulse lines of less than 2" diameter, currently in CS, with lines in SS		Fouling of the impulse lines has occurred. Replacement of the impulse lines of less than 2" diameter, currently in CS, with lines in SS to avoid clogging problems is required.		
105.	170	71340	Recirculating Cooling Water System - Replace the Motor Operated Valves 1-7134-MV305+308		These valves must be considered obsolete as their manufacturer Vanessa, now part of Emerson company, does not fabricate nor assures spare parts for Butterfly Valves, 10000 series. As such, the valves have to be replaced by new valves, along with a significant number of spares for future utilization. This will be correlated with "Increase the heat transfer capacity at the interface of RSW and RCW systems" index#174.		
106.	171	71340	Recirculating Cooling Water System - Replace the Swing Check Valves 1-7134-V023 ÷ V026		The Swing Check Valves 1-7134-V023 ÷ V026 are obsolete. Their manufacturer Wagi no longer exists and there are no spare parts available for these valves which are Safety Critical 1. As such, the valves have to be replaced by new valves, along with a significant number of spares for future utilization. This will be correlated with "Increase the heat transfer capacity at the interface of RSW and RCW systems" index#174.		
107.	172	71340	Recirculating Cooling Water System - Replace the affected portion of pipe, line 1-71340-G027, near FW424 weld		It is necessary to replace the affected portion of pipe, line 1-71340-G027, near FW424 weld, where a shallow budge accidently formed.		
108.	173	71340	Recirculating Cooling Water System - Recirculating Cooling Water Pump Motor PM2 and PM4 must be refurbished and rewinded		Industry recommends rewind or replacement for the stator after 30-40 years of service life, however a condition-based approach is required to determine the actual condition of motor components, especially for motors which have been operating continuously. Recirculating Cooling Water Pump Motor PM2 and PM4 are not accessible in normal operation and must be refurbished and rewinded during long outage.		
109.	174	71340	Recirculating Cooling Water System - Increase the heat transfer capacity at the interface of RSW and RCW systems.		The corrosion includes erosion of channels, stress corrosion cracking on tubes, general corrosion and pitting extended to the whole surface of the HXs affect LTO operability. The presence of foreign contamination materials inside the channels and the tubes may generate high RCW temperature during summer season and requires frequent inspections and cleaning. Also, the heat exchangers currently installed have been sized according to a thermal load expected at the time of the construction of Unit 1. In addition, it is foreseen that during the Refurbishment Outage other utilities, with additional thermal loads, will be connected to the RCW system. For this reason, it is necessary to increase the thermal load that will be dissipated with the RCW / RSW exchangers and the flowrate through them. These design change must be implemented to solve the problem of low heat transfer capacity of 1-7134-HX1 ÷ HX4 heat exchangers, in the conditions of gradually increasing of Danube River temperature by increasing the heat transfer capacity at the interface of RSW (cold side) and RCW (hot side) systems.		
110.	175	71340/ 73140	Recirculating Cooling Water System - Containment isolation enhancement to the RCWS		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
111.	178	71400	Fire Protection System - Replace Gate manual valves 0-71400-V329, 330, 301, 302 on Fire Protection System intake basin		Valves installed on system suffer of MIC due to the operation with Raw water. Manual isolation valves of System BSI 71400 (fire protection) present degradation. In general, the system 71400, including its valves, presents sign of ageing due to corrosion, wear, and MIC. Gate manual valves 0-71400-V329, 330, 301, 302 on Fire Protection System intake basin present degradation due to corrosion, wear, and MIC must be replaced during refurbishment.		
112.	179	71400	Fire Protection System - Provide firewater supply to the R/B		The purpose of this design modification is to provide a standpipe and hose system to protect the RB from fire, including distribution, within the RB. The standpipe and hose system, with associate distribution piping, comprises of a 6-inch, Class 6, carbon steel standpipe, fire hose cabinets with 1.5-inch hose valves and distribution piping varying from 6-inches to 2.5-inches. The fire hose cabinets locations in this modification will be similar to Unit 2.		
113.	180	71400	Fire Protection System - Second Fire Water connection on RB		A standpipe and hose system are required to protect the RB as a defense-in-depth means of fire suppression. At least two independent connections to the main shall be provided for each building. The standpipe and hose system require supply from the main firewater system and a seismically qualified firewater source. Connections to the water supplies and standpipe are will be provided by two independent firewater connections to the RB.		
114.	184	71650/ 73140	Containment isolation enhancement for Demineralized Water Distribution System		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
115.	185	71690	Back-Up Cooling Water System - System layout reconfiguration		The actual function of the BCWS is to be an alternative cooling water source to the chiller units and to the SDGs. For a loss of raw service water (RSW) with Class IV power supply available, the system provides cooling water to the chiller units. The use of current piping routing, coupled with the operation of the pumps, introduces vibrations above the limits that affect pumps 71690-P033+P036 during operation, since the pump current operating point is not compatible with the hydraulic features of the system. Therefore, a hydraulic analysis should be completed to try to minimize the vibrations ARDM, that could bring to a different piping layout and configuration. Modification of the SDG cooling will be considered. The overall system layout will have to be reconfigured.		
116.	186	71690	Back-Up Cooling Water System - Rehabilitation of BSI 71690 (Backup Cooling) underground lines		The current carbon steel material for pipes 71690-G915-16"-AI and 71690-G001-16"-AI will be replaced with another material more resistant to corrosion / MIC, such as stainless steel or plastic. These materials are not susceptible to the listed degradation mechanisms thus assuring longer lifetimes and less repair activities than carbon steel. The modification will be reevaluated taking in consideration the SDG replacement project and also hydraulic analysis and the reconfigured system layout.		
117.	188	71900	Chilled Water System - Replace control and instrumentation panels of chillers.		The Chilled Water System has the function to produce and deliver an adequate supply of chilled water to the following buildings/users: NSP users in the Reactor Building; NSP users in the Service Building; D2O Upgrading Tower users in NSP; BOP users (HVAC units, BSI 73220, and Service and Breathing Air Compressors, BSI 75100). The installed PLC assemblies 1-67190-PL09+12, PL51/52 are out of production. The purpose of this design modification is to replace actual PLCs installed inside Local Control Panels (LCP) with others, equivalent or better, but of the new generation that guarantee the current functionality and long-term availability of spare parts.		
118.	191	71900/ 73140	Containment isolation enhancement for R/B Chilled Water		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
119.	192	73110	R/B Cooling System - Modification of concrete cooling fans in R-107 and R-108 in order to not exceed the temperature provided by the project		This design modification involves the modification of concrete cooling fans (1-7311-F51 to F54) in R-107 and R-108 to not exceed the temperature provided by the project in the respective areas. The modification ensures that the safety limits are not exceeded. As an alternative to a physical design modification to the R/B Cooling System (BSI 73110), the following two steps will be performed: 1. Update previous Process Design/ Engineering assessment ("Analytical Assessment of F/M Room Cooling and Reactor Vault Concrete Cooling"), considering the cumulative impact of the following interconnecting design modifications or Refurbishment outage repairs/ replacements; 2. Possible Civil Engineering re-analysis of the Calandria Vault after Refurbishment outage. However, if the temperature were within the acceptable design limits after implementation of interconnecting design changes (i.e., listed under item 1 above), then the re-analysis of the Civil structures would not be required.		
120.	193	73110	Ensure availability of local air coolers 1-7311-LAC1 to LAC16 during LOCA	Reactor Building Cooling System - Ensure availability of local air coolers 1-7311-LAC1 to LAC16 during LOCA (LAC's EQ)	Reactor Building Cooling System LACs provide cooling following a LOCA or MSLB and are part of the containment system. The LACs must continue circulating air in the R/B after a LOCA or Site Design Earthquake (SDE) to prevent build-ups of hydrogen concentration. Most recent technical specification for LAC required LAC 1 to 16 to play an essential role in limiting the pressure due to a LOCA or a MSLB accident with dousing unavailable. As a result, they are required to continue operation after accident. Environmentally qualified LACs will be procured and installed to replace the existing 1-7311-LAC1 to LAC16. Seismic qualification of LAC1 to LAC16 and their supports is required to operate following a LOCA + site design earthquake to assist with hydrogen dispersion. The fans of coolers 1-7311-LAC1 to -LAC16 should be equipped with a second low-speed operating mode to give heightened assurance of operability of the LACs in the conditions of the higher density air-steam mixture resulting from a LOCA or MSLB. Ensure availability of local air coolers 1-7311-LAC1 to LAC16 during LOCA will include index#193 and 194.		
121.	194		Ensure availability of local air coolers 1-7311-LAC1 to LAC16 during LOCA	Reactor Building Cooling System - Ensure availability of local air coolers 1-7311-LAC1 to LAC16 during LOCA (providing low speed operation mode to the fans)			
122.	195	73450	Service Building (SB) Heating Ventilation and Air Conditioning (HVAC) Systems - Control Room Air Conditioning System - Replace ACU3 and ACU4		The SB HVAC System (BSI 73400) is designed to control the pressure and temperature of air in areas of the service building and include Control Room Air Conditioning System (BSI 73450). The control room air conditioning units provide the air-conditioned clean air, to ensure adequate removal of equipment heat loads and prevent the airborne dust and dirt from contaminating the control room equipment. It also maintains a comfortable environment for the personnel in the control room. The air pressure in the control room is maintained at a nominally higher than the surrounding areas, to prevent the ingress of contaminated air from other parts of the service building. This design modification involves the replacement of the main control room (MCR) air conditioning units 73450-ACU3 and ACU4 and installation a new air filtering units (AFU) on the inlet to 73450-ACU3 and ACU4 to limit operator dose to within acceptable limits under accident conditions.		
123.	196	73940	EPS/SCA Heating and Ventilation Refurbishment	Service Building (SB) Heating Ventilation and Air Conditioning (HVAC) Systems - Auxiliary Service Building Ventilation (73940) - EPS/SCA Heating and Ventilation Refurbishment (Seismic Qualification of the SCA HVAC)	The HVAC System SCA is to be seismically qualified to Design Basis Earthquake (DBE) Category B to remain functional after a DBE. The change is needed to ensure the habitability of SCA following a common mode incident where the Main Control Room (MCR) must be abandoned. The HVAC system of the SCA is required to maintain habitable temperatures in the SCA. The existing HVAC equipment in the SCA includes a self-contained roof-top air conditioning unit 7394-ACU9. The other components are located inside the building and include fan assisted Electric Heaters, Fire Dampers, Motorized Dampers, fans and Manual Dampers. The scope of change is for replacement of the existing equipment with equipment having Seismic Qualification (SQ) DBE Category B. The duct work also will be qualified to DBE Category A and the duct work supports will be updated/replaced accordingly. This design change also covers the requirements of field instrumentation and local panels associated with the supplied equipment. Functional interlock of 1-7394-ACU9 with fire protection signal shall be established. The current roof-top air conditioning unit 7349-ACU9 is deemed to be undersized, and hence, needs to be replaced to ensure the habitability of the Secondary Control Area (SCA) during the summer time where the temperature shall be maintained at 24 C +/- 1 C with relative humidity of 50% +/- 10%. "EPS/SCA Heating and Ventilation Refurbishment" will include index#196 and 197.		
124.	197			Service Building (SB) Heating Ventilation and Air Conditioning (HVAC) Systems - Auxiliary Service Building Ventilation (73940) - EPS/SCA Heating and Ventilation Refurbishment (Replace ACU9 with unit of higher capacity)			
125.	198	75100	Compressed Air System Refurbishment	Compressed Air and Gas Systems - Air compressor replacement 1-7510- CP01-CP04	The required modification consists in the replacement of the four air compressors 1-75100-CP001+CP004 and the two air dryers 1-7512-DR007-DR008 with new generation ones as the equipment is approaching the end of its service life and is not able to support an LTO. The interfaces (air inlet and delivery ducts, piping connections of the cooling circuits, drains, tubing for instrumentation, electrical cables/cable trays) shall have to be modified/ adjusted in order to match the connecting points of the new compressors. Concerning the I&C design, the presence of the modern compressor controllers can provide the possibility to generate		Yes

Refurbishment activities for NSP and BOP							
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact	Vendor Training
126.	199			Compressed Air and Gas Systems - Replace the starting logic of Unit 1 compressors	alarms in the MCR indicative of a generalized malfunction of one of the compressors, to be investigated by locally system itself. This possibility will permit the operator to have more indications on the compressors operating status. I&C components for compressors and dryers and compressor, including the controllers are obsolete and will be replaced. " Air compressor Refurbishment" will include index#198; 199; 200		
127.	200			Compressed Air and Gas Systems - Replace the 7512-DR007 / DR008 Air Dryers			
128.	201	75100	Compressed Air and Gas Systems - Implement an “alternative” to post LOCA instrument air system		The present design of the Reactor Building (R/B) Instrument Air System (BSI 75120) from Cernavoda Nuclear Power Plant (NPP) Unit 1 isolates the normal instrument air supply to the R/B approximately three hours after a Loss-of-coolant accident (LOCA) by closing an isolation valve on the main instrument air supply line 7512-4A-1 to minimize containment pressurization. However, there are some air operated devices inside the R/B (“essential users”) that need to be supplied with instrument air during the mission period following a LOCA. The scope of this design modification for Unit 1 is to install an essential instrument air line to supply essential users which must remain functional three hours after a LOCA. The change involves installation of one new separate I/A supply line penetrating R/B.This would supply moderator TCV's, SDC TCV's and SDC gland seal stage valves.	Yes	
129.	204	75100/ 73140	Compressed Air and Gas Systems - Containment isolation enhancement for R/B Service Air		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
130.	205	75100/ 73140	Compressed Air and Gas Systems - Containment isolation enhancement for R/B Instrument Air		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
131.	206	75100/ 73140	Compressed Air and Gas Systems - Containment isolation enhancement for R/B Breathing Air		This design modification is required for Cernavoda Unit 1 to comply with the containment isolation standards and licensing requirements. The containment isolation enhancements involve changes in nuclear pressure boundary class and seismic qualification for the existing valves and piping that will form part of the containment extension boundary. The containment isolation valves are required to be nuclear Class 2 and seismically qualified to DBE Category B; while the containment extension piping must be Class 2 and DBE Category A. Pressure boundary of the existing equipment that forms the containment extension will be assessed and demonstrated to be compliant with Class 2 requirements.		
132.	208	OTHERS	EQ requirements for LTO		According to the Unit 1 Condition Assessment, the Time Limited Ageing Analyses (TLAA) for Environmental Qualification (EQ) is not validated for Long Term Operation (LTO); i.e., extended 30-year operation of the plant. Furthermore, the Unit 1 EQ program will be harmonized with that of Unit 2, both from the standpoint of the requirements and the EQ component lists. Refurbishment activities will impact the existing listing of EQ equipment; this list will have to be updated as existing equipment is replaced and new equipment that is EQed is added to the plant. For equipment that may not be replaced as part of refurbishment activities, an assessment or verification should be performed to ensure that the components still meet the updated EQ requirements for LTO.		
133.	210	66100/ 66611	Main Control Room Panels and Second Control Area Panels Systems - HFE and Control Centre		The Cernavoda Unit 1 Refurbishment project has several changes to the MCR and SCA panels. The changes included adding/ removing of control devices (hand switches, push buttons), displays (meters, electromagnetic indicators) and alarm windows. Several panels are impacted by multiple design changes.	Yes	
134.	211	36320	Wet Preservation of Boilers		This design change proposes to install a recirculation circuit to circulate water on the secondary side of each SG as needed to establish and maintain proper chemistry control of the four SGs in Unit 1 during extended unit outages. The recirculation circuit will have a recirculation pump connecting between the Steam Generator Blowdown System (BSI 36310) and Thermal Cycle Drains system (BSI 43130), to recirculate treated demineralized water. This recirculation circuit is also called Boiler Wet Layup/ Recirculation (BWLR) System. The purpose of this design change is to protect the internal surfaces of the steam generators against the corrosion phenomena during the plant outages, and also to help reduce the unit start-up time to reach the required chemical specifications in SGs.		
135.	212	33100/ 32100	Preservation of the nuclear systems - Primary Heat Transport and Moderator		The activity will consist in providing the methodology and equipment requirements to drain and dry the PHT and upper and lower Moderator and maintain nitrous-oxide control in the calandria; perform detailed design and manufacture of the vacuum drying and air purge skids; provide procedures to execute the preservation work on the upper and lower moderator and PHT; provide training and procedure validation. PHT will be drained and vacuum dried. While the HT system is being drained, nitrogen or other non-air cover gas can be added to maintain the cover gas pressure slightly above atmospheric to minimize air ingress. The cover gas needs to be maintained to assist pushing D2O out smaller lines and minimize hydrogen buildup and corrosion until the HT system dry is completed and opened for RFR activities. Maintaining a cover gas other than air is not practical once the HT system boundary is breached for RFR activities. Modifications will be required to vacuum dry the Heat Transport system. This may include tie-in points for vacuum dry and nitrogen injection skids, and valve alterations to support the vacuum dry flow path. After the PHT is drained and vacuum dried, and prior to the commencement of RFR activities, the cover gas should be replaced with an air purge in preparation for opening the PHT. Following the initial drain and dry of the PHT, the Feed & Bleed, Shutdown Cooling, Gland Seal Circuit, and primary side of the SGs will be placed under constant dry-air purge. Alternatively, nitrogen blanketing may be applied if airborne tritium emissions are excessive. Following PHT vacuum drying, the moderator ion-exchange columns should be slurried out, and the main moderator system separated into the lower and upper sections. The lower section of the Moderator system should be drained and vacuum dried. The auxiliary systems may be maintained wet and isolated if vacuum drying is not feasible, the LISS tanks should be isolated and depressurized, and the injection lines back flushed from the main Moderator system after poison removal. A negative pressure dry air purge should be applied to the upper section of the Moderator system once RFR activities begin. Once RFR activities begin, the upper portion of the Moderator should be maintained at a slightly negative pressure to control nitric acid buildup.		

Refurbishment activities for NSP and BOP						
No Crt.	Index #	BSI	Descriere/ Description		Detaliere Scop Activitate/ Scope of activity	Simulator Impact
136.	213	36000	Preservation of the BOP systems - Main Steam		Provide the methodology and equipment requirements to lay-up the SG steam head and main steam pipes up to the turbine isolation valves and place under nitrogen blanket; provide procedures to execute the preservation work on SG secondary side and steam line; perform detailed design and manufacture/ supply of the necessary skids; provide training and procedure validation. To maintain the heat in the SGs for PHT Vacuum Dry, heating blankets should be applied to the secondary side SG lay-up recirculation skid pipework. Following the installation of the SG chemical recirculation system on the secondary side utilizing the Steam Generator Blowdown System (BSI 36310) and Thermal Cycle Drains System (BSI 43130), there are two primary options for preserving the main steam piping, reheater tube bundles and gland steam system: nitrogen blanketing or dry-air purge.	
137.	214	41000/ 42000/ 43000	Preservation of the BOP systems: condensate and auxiliary, feedwater, turbine and auxiliaries		The activity will include providing the methodology and equipment requirements to drain, dry and maintain dry, the condensate and feedwater piping and heat exchangers; providing procedures to execute the preservation work on the feedwater and condensate system; perform detailed design and provide the necessary drain and dry skids. Relative humidity (RH) should be maintained at less than 40% in the entire circuit.	
138.	215	36000	Corrosion protection Preservation of water-steam cycle process "Film-Forming amines (FFA)"		The overall objective of the application of film forming amines is to establish a protective film on the inner surfaces of the secondary circuit, as a complementary measure, to prevent accelerated corrosion processes during the refurbishment period of NPP Cernavoda Unit 1. This Process is protected by valid and enforceable patents (European Patent EP 2 700 076 B1 and European Patent EP 2 700 075 B1) owned by Framatome. The activity will consist in providing work procedure (site adaptation), including timetable and dosing strategy (considering injection point and the available dosing station) as well as the analytical method (Phloxine B method) for the determination of the free FFA; design and supply dosing skid and additional equipment for on-line monitoring (degassed conductivity measurement devices), additional analytical laboratory device (UV Spectro-photometer) for FFA concentration measurements and laboratory related additional consumables and analytical chemicals (Phloxine B, Octadecylamine with a high purity); delivery of the FFA emulsion (ODACON F (5 wt.-%) emulsion including batch sample analysis in an accredited third-party laboratory); application of Film Forming Amines (including engineering and on-site support) and monitoring of the FFA refreshment application.	
139.	216	General	Simulator 1	Update the simulator's software and hardware to reflect all the plant modifications included in the scope of refurbishment.	The full-scope simulator shall be upgraded to include all the modifications resulting from Unit 1 refurbishment having impact on the simulator. The modifications shall include: software updates like simulations models, software tools, DCC programs; hardware updates like main control room panels layout and devices, computers and networking devices; environment modification in the main control room so that the simulator overall response and layout to be kept similar with the main control room in the plant. Acceptance tests shall be performed according to ANSI/ANS-3.5 latest edition. A preliminary evaluation of the refurbishment activities with simulator impact is presented in the "SIMULATOR IMPACT" column.	