EC6 Design Features and Pre-Project Licensing Review

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Abstract

The Enhanced CANDU® 6 (EC6®) is the new Generation III CANDU reactor design that meets the most up to date Canadian regulatory requirements and customer expectations. Candu Energy Inc. is finalizing development of the EC6 which incorporates the CANDU 6's well-proven features, and adds enhancements that strengthened reactor safety margin and improved operability. The EC6 builds on the proven high performance design and the defence-in-depth features of CANDU 6 units, and has incorporated extensive operational feedback including lessons learned from Fukushima.

This paper will provide status of the engineering program including progress on the pre-licensing review of the EC6 design by the Canadian Regulator, CNSC, and will also highlight the design and safety enhancements incorporated in the EC6 product. Safety enhancements to meet safety goals and to improve robustness of systems to respond to design basis accidents and beyond design basis accidents include: new severe accident recovery and heat removal system; improved emergency heat removal system; faster shutoff rods with improved safety margins; mechanical guaranteed shutdown rods; daily load cycling capability; robust containment with containment filter venting system; and improved backed-up electrical supply and cooling services.

1. Introduction

The Enhanced CANDU® 6 (EC6®) is the new Generation III CANDU reactor design that meets the most up to-date Canadian regulatory requirements and customer expectations. EC6 builds on the proven high performance design of the Qinshan CANDU 6 reactor, and has made generic improvements to safety, reliability and operational performance, and has incorporated extensive operational feedback to meet the most up to date regulatory requirements and customer expectations. The EC6 reactor builds on the defence-in-depth features of the CANDU design, and provides further improvements in accident prevention, accident mitigation, severe accident resistance and recovery, and post-accident control and monitoring.[1]

Building on the proven feature of the CANDU 6 technology, the EC6 has been designed to be competitive with other nuclear power plant for electricity generation, while achieving safety goals meeting new regulatory requirements, and addressing operational and performance expectations meeting operating utility owner requirements. Good progress has been made in the preliminary engineering of the EC6 design enhancements. The size of the EC6 makes it unique as a product for utilities whose requirements are for an economic, medium-sized reactor with a proven performance record.

2. Pre-licensing Review by Canadian Regulator

Candu Energy Inc. (hereafter referred to as "Candu") is designing a two-unit Enhanced CANDU 6® (EC6®[1]) nuclear power plant. The EC6 is based upon the proven CANDU® 6[2] design. It incorporates features common to many CANDU designs that have been operating successfully both in Canada and abroad. The design of EC6 is based on the reference CANDU 6 nuclear power plant designed in the late 1990s by Atomic Energy of Canada Limited (AECL)[3].

CNSC developed a process for a pre-licensing review of a vendor's reactor design (here after call "Pre-Licensing Review") which uses a three phase approach. The objective of this review is to verify at a general level, in Phase 1, that the design intent is compliant with CNSC design requirements (for new nuclear power plants as specified in RD-337, Design of New Nuclear Power Plants), and related regulatory requirements. Phase 2 goes into further detail with a focus on identifying whether there are any potential fundamental barriers to licensing the vendor's reactor design in Canada. Phase 3 is a follow-on review of certain aspects and selected Phase 2 findings identified by the vendor.

The Phase 1 of the Pre-Licensing Review of EC6 concluded on April 1, 2010. For Phase 2, the CNSC staff selected nineteen (19) focus review topics, representing key areas of importance for a future construction licence application, to identify whether there are any potential fundamental barriers to licensing the EC6 design in Canada.

To facilitate the main Phase 2 review, Candu submitted documentation to describe the EC6 design including documents to demonstrate how the design meets the regulatory requirements and expectations of the CNSC. The 20 interim PSAR (iPSAR) Chapters, which summarizes the EC6 safety design features and some bounding/limiting safety analyses, were the primary documents (out of a total of 113 documents) reviewed by the CNSC.

The Phase 2 review concluded on April 30, 2012. The findings in a formal CNSC Assessment Report, including the following conclusion:
Based on the Phase 2 pre-project review of the documentation submitted, the CNSC staff concludes that:

- *Candu Energy has, in general, provided sufficient design and analysis information for the purpose of this review;*
- *At an overall level the design is compliant with the CNSC regulatory requirements and meets the expectations for the new nuclear power plant designs in Canada. This conclusion will be further confirmed during the Phase 3 or CLA reviews of the specific areas when all required information for the open technical items identified for each review topic will be fully addressed; and*

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1 EC6® (Enhanced CANDU 6®) is a registered trademark of Atomic Energy of Canada Limited (AECL), used under license by Candu Energy Inc.

2 CANDU® (CANada Deuterium Uranium®) is a registered trademark of Atomic Energy of Canada Limited (AECL), used under license by Candu Energy Inc.

3 On October 2, 2011, SNC-Lavalin Group Inc. acquired certain assets of AECL's commercial operations. The business operates as a wholly owned subsidiary called Candu Energy Inc.

- *All observations raised from Phase 1 review have been addressed.*

The Phase 3 review, started in June 2012, follows up on selected aspects and findings from the Phase 2 review to confirm that Candu's activities to implement CNSC regulatory requirements has appropriately progressed EC6 towards licensing, design, and project readiness. Phase 3 is the final step in the Pre-Licensing Review process aimed at increasing licensing certainty and Candu has submitted 41 deliverables for Phase 3 follow-up. The CNSC will be completing Phase 3 of the Pre-Licensing Review of EC6 in 2013 June.

3. Safety Enhancements for EC6

3.1 Safety Concept and Design Approach

There are five fundamental safety functions that must be performed by plant systems to assure public safety, in normal operation, and during and following anticipated operational occurrences and design basis accidents. These safety functions also facilitate response to beyond design basis accidents to the extent practicable. These are as follows:

i) Control of reactivity (control)
ii) Removal of heat from the core (cool)
iii) Confinement of radioactive materials
iv) Control of operational discharges, as well as limitation of accidental releases (contain), and
v) Monitoring of critical safety parameters to guide operator actions (monitor).

A strong contributor to the robustness and redundancy of CANDU design is the two-group separation philosophy. This ensures a high degree of independence between safety systems as well as physical separation and functional independence in how essential safety functions are provided. Two-group separate provides two independent means of maintaining the essential safety functions for events which affect a limited area of the plant. Events with failure of a safety function in one group can be mitigated by the other group.

Allocating systems to Group 1 or Group 2 is based on the various event sequences and the overall plant responses to these events with the goal to create two independent pathways for maintaining the key safety functions. The safety systems are separated into the two groups to prevent failure of both SDS1 (Group 1) and SDS2 (Group 2) during the same event and to prevent failure of ECC (Group 1) and emergency heat removal system (EHRS) and the containment isolation system (both Group 2) during the same event (preventing large releases). The safety support features are grouped together with systems they are supporting. Back-up functions are assigned to the opposite group of the systems for which they are providing back-up. Second crash cool-down for EHRS provides a back-up to the crash cool-down function of ECC by initiating the depressurization of the steam generator secondary side using an independent set of signals. The EHRS also provides a back-up to the Recirculating Cooling Water (RCW) system by supplying flow to the secondary side of the ECC heat exchangers following an earthquake after a Loss of Coolant Accident (LOCA) that could fail the RCW system.
The two-group separation arrangement is supported by the design of the MCR and the SCA. The computer systems and hardwired control equipment belonging to Group 1 are located in or near the MCR, whereas those belonging to Group 2 are located in or near the SCA. The MCR and the SCA are

separated by the reactor building structure for protection against common-cause failures initiated by internal and external hazards. A similar layout is used to separate the electrical equipment in the Group 1 electrical system from that in the emergency electrical systems.

The concept of defence-in-depth is applied throughout the EC6 plant design to provide a series of levels of defence, including measures to prevent accidents and measures to provide protection in the event that prevention fails. Consistent with the overall safety concept of defence-in-depth, the design of the EC6 plant aims to prevent, as far as practicable, challenges to the integrity of physical barriers; failure of a barrier when challenged, and failure of a barrier as a consequence of the failure of another barrier. Two important aspects of defence-in-depth design provisions include:

i) a high degree of robustness, which incorporates sufficient redundancy within the design and
ii) a high degree of protection against a large range of accidents, including those whose probability is quite remote and which provide significant challenges for the reactor's ability to fulfil the key safety functions, namely to control, cool, contain and monitor.

To ensure that the EC6 design is licensable in Canada and to facilitate its licensability in other countries, the design complies with relevant Canadian nuclear safety requirements –RD-337 and related regulatory requirements, such as the environmental requirements for siting in Canada. The design also meets the intent of the IAEA requirements as specified in the IAEA Safety Standards Series No. SSR-2/1, "Safety of Nuclear Power Plants: Design Specific - Safety Requirements" and associated IAEA safety standards.

3.2 Safety System Design

The fundamental principle in the EC6 reactor design is to take all reasonable steps to prevent the occurrence of accidents and, in case of an accident, to ensure the facility can withstand the event without exceeding authorized limits. In case of lower probability accidents involving failures of safety functions to remove residual heat from the core, severe core damage may occur. In such cases, engineered safety design considerations – "complementary design features" – mitigate the severe accident so that consequences are reduced to the extent practical.

The design requirements for the safety systems include, but are not limited to, the following:

- Redundancy in safety equipment and clear procedures (to ensure single failure criterion is met).
- Fail-safe operation where practical.
- Separation and independence from each other and from process systems, to the extent practical, with a limited sharing of sensors between process and some safety systems.
- High reliability of system actuation on demand as well as during system operation.

Each unit has dedicated safety systems, which are systems designed to shut down the reactor, remove decay heat, and limit the radioactivity release subsequent to the failure of normally operating process systems.

3.2.1 Shutdown System No. 1 and No. 2

The EC6 maintains the cornerstone of traditional CANDU safety system design in having two fully capable, redundant and diverse fast acting shutdown systems. For any given design basis accident, either of these shutdown systems acting alone is completely effective in ensuring that the plant response is within the safety acceptance criteria.

The Shutdown System No. 1 (SDS1) quickly terminates reactor power operation and brings the reactor into a safe shutdown condition by dropping shutoff rods into the low pressure moderator.

In addition to improving reactor trip instrumentation response, the shutoff rods system (SDS 1) has been improved by optimizing the insertion spring strength and rod weight to increase insertion speed, and by parking the rods, in poised position, following the contour of the calandria shell. These design modifications enhance the effectiveness of SDS1 by reducing the time for rod insertion after a trip signal is initiated.

Four shut off rods (SORs) have been added to the four corner positions in the EC6 core to increase the number of SORs from 28 to 32. These four corner rods significantly increase the reactivity depth of SDS1 in accident scenarios where the two most effective rods are assumed unavailable in the safety analyses.

The Shutdown System No. 2 (SDS2) provides a second independent method of quickly terminating reactor power operation by injecting a strong neutron-absorbing solution (gadolinium nitrate) into the moderator. Reactor operation is terminated by SDS2 when any monitored parameter or combination of parameters enters an unacceptable range.

Each system contains three independent safety channels arranged in a 2-out-of-3 voting system. Channelized instrumentation is used to monitor a number of plant neutronic and process variables. If variables in any two channels of a single system are outside pre-determined envelopes, a shutdown is initiated. Improvements in EC6 digital safety systems include:

- New fast digital SDS platforms will be provided for both SDS1 and SDS2,
- Stronger hardware platform diversity and design process diversity between SDS1 and SDS2 will be implemented,
- Replacement of ion chambers with fission chambers will eliminate the need for out-of-core start-up instrumentation,
- Additional out-of-core neutronic detectors will be added to each SDS so that each SDS will have detectors on the both sides of the core,
- Additional in-core flux detectors will improve Regional Over-Power (ROP) trip coverage and performance,
- Digital neutronic trips will be implemented (including computer-assisted neutronic amplifier gain calibrations similar to the operating Darlington CANDU plant design),
- Additional fast neutronic linear rate trips will be added to both in-core and out-of-core detectors, and

- In order to provide direct trips for the moderator heat sink, and for the loss of moderator inventory events, and to improve trip effectiveness during loss of flow events for end of life conditions, the following trip parameters were added on both SDS1 and SDS2 for enhancing trip coverage:Moderator High Level Trip, Moderator Low Level Trip, and Heat transport pump motor low speed trip.

3.2.2 Emergency Core Cooling System

The ECC system is designed to supply emergency cooling water to the reactor core to cool the reactor fuel in the event of a LOCA. The ECC system enhancements are:

- Improve environmental qualification requirement for ECC equipment inside containment
- Remove ECC rupture discs for improved reliability
- Improve piping arrangement to reduce waterhamer probability
- Change ECC pump suction strainer to AECL “finned-tube” type

3.2.3 Containment System

The basic function of the containment system is to provide a continuous, pressure-retaining envelope around the reactor core and HTS. Following an accident, the containment system minimizes release of resultant radioactive materials to the external environment to below regulatory limits. The containment system automatically closes all penetrations open to the Reactor Building atmosphere when an increase in containment pressure or radioactivity level is detected.

The containment structure of the reference plant is changed to increase its structural robustness and improve plant safety. The improvements include:

- The containment system uses a carbon steel-lined, pre-stressed concrete Reactor Building containment structure to limit the containment leakage rate under accident conditions. The lower leakage rate will reduce potential reactivity release and to meet more stringent regulatory dose limits and to reduce an exclusion zone to 500 m which is a requirement of most utilities.
- The containment design pressure are increased to withstand higher internal accident pressures following a design basis event such a main steam line break as well as severe accidents for increased structural robustness.
- The containment building perimeter wall and dome thickness have been increased to provide resistance to higher impact loads, such as those from large aircraft crash.
- The mechanical seals of main and auxiliary airlocks, and testable cable penetrations have been redesigned to withstand higher containment design pressure.
- The containment low-flow cooling spray has been added for long term containment pressure suppression.

- The containment design ensures a low leakage rate while at the same time providing a pressure-retaining boundary for all design basis accidents causing high pressure and/or temperature inside containment.

3.2.4 Emergency Heat Removal System

CNSC regulatory document RD-337 requires a new safety system titled "emergency heat removal system" (EHRS) with the intent to provide an emergency heat removal function for removal of decay heat for design basis accidents (DBAs) that could lead to the loss of heat removal capability via steam generators. To meet this requirement, the existing CANDU 6 emergency water supply (EWS) system needs to be upgraded to meet safety system requirements.

The following improvements to upgrade the existing EWS system to the EHRS have been made:

- The water flow path from the RWT to steam generators is entirely located inside RB.
- The steam generator auto depressurization logic is seismically qualified. The backup control will be provided in secondary control area.
- EHRS pumps and emergency power supply start-up is automated.
- Inter-Unit tie is provided to allow for back-up.
- Other design improvements to meet single failure criterion as follows:
  - Duplication of check valves directly upstream of the steam generators.
  - Independent recirculation line for each EHRS pump.

3.3 Systems Important to Safety

For loss-of-coolant-accident (LOCA) analyses, the safety margin metrics include peak transient system reactivity, energy deposition to fuel, peak fuel centreline temperature and peak sheath temperature. All of these goals have been met with the CANDU 6 reference design and supporting analysis. However, new features and improvements are required to further improve safety margins for new build design in addition to the safety system improvements as described in Section 3.2. The design changes are:

a) Reducing void reactivity hold-up by an increase of pressure tube thickness to reduce creep rate.

   1) Reducing coolant void effect by tightened limits on operating conditions: Tighten moderator and coolant purity limits, Tighten moderator poison limit, and Lower side-to-side flux tilt limit.

b) Increasing safety margin by reducing maximum operating powers with a flatten core radial power distribution.

c) Lower core average moderator temperature to provide more subcooling during a LOCA with loss of emergency core cooling by relocating the moderator nozzles to produce more uniform temperature distribution of the moderator inside the calandria and reduction of the hot temperature spots at the top of the core.

The EC6 specific reactor core equipment design changes, which are incremental improvements to the CANDU 6 Qinshan Reference Plant design, include the following:

a) Fuel Channels: Pressure tube thickness has been increased slightly and manufacturing processes refined to minimize deformation. Calandria tube thickness is also increased slightly, and calandria tube – end shield rolled joint has been improved to increase core protection for pressure tube failures.
b) Reactivity Control Mechanisms: EC6 incorporates two design refinements for the reactivity control system. First, the number of adjuster rods has been reduced from 21 in the current CANDU 6 to 11 in the EC6. The neutronic and mechanical designs of these adjuster rods have also been significantly simplified, standardized and has been optimized to reduce the total reactivity load, while achieving a sufficiently flattened core flux and power distribution, with adequate load-cycling capability.
c) The reduction in the number of adjuster rods enables the EC6 to install additional absorber rods. The expanded system of absorber rods has sufficient negative reactivity to maintain the core in a guaranteed shutdown state (GSS) without requiring the addition of neutron poison in the moderator. This Rod-based GSS capability greatly reduces the time to enter and exit from a major maintenance outage, and also reduces occupational dose and moderator cleanup burden.

3.3.1 Severe Accident Recovery and Heat Removal System

This is a new complementary design feature that has been incorporated into the EC6 design in order to meet safety goals as defined in regulatory requirements, applicable codes and standards and other prescriptive requirements included, but not limited to RD-337.

The severe accident recovery and heat removal system (SARHRS) is a key improvement that contributes greatly to the defence in depth of the reactor design. It is designed to prevent and mitigate severe accidents.

The SARHRS is capable of providing make-up to the following systems as needed, to ensure accident progression can be halted at the corresponding states:

- Make-up to the calandria vessel to ensure that the fuel channels remain covered and halts an accident at the limited core damage accident state.
- Make-up to the calandria vault to allow cooling of the calandria vessel exterior in case of severe core damage accidents, ensuring the core debris can be retained inside the calandria vessel.
- The dousing system in the CANDU 6 design has been replaced by a low-flow containment spray system to mitigate the consequences of a severe accident. The SARHRS supplies make-up to the low-flow containment cooling spray by refilling the reserve water tank (RWT) to condense steam and maintain the containment building pressure within design limits.

Make-up from SARHRS can also be used to ensure the debris remains covered in the worst case scenario of a calandria vessel failure.

The SARHRS has capacity to supply water to either the calandria vessel or vault and to the low-flow spray simultaneously. A separate, dedicated power supply is provided to support the SARHRS.

3.3.2 Electrical Systems Enhancements

By design, the EC6 has incorporated improvements that help to prevent and mitigate consequences from a station black out event (SBO). Each unit has two Class III standby generators, capable of accepting loads within three and a half minutes, for a mission time of seven days.

In addition, each unit is provided with a dedicated emergency power supply (EPS) system, discussed below. Emergency power generators (EPGs), batteries as the uninterruptible power supply (UPS), and equipment distributing power from those sources. EPS is seismically qualified. EPS starts up automatically when required and is an alternate power source to selected safety and systems important to safety such as ECC, containment cooling, and emergency heat removal system. In case of a seismic event or station blackout (SBO) resulting from a seismic event, the seismically qualified UPS supply loads required for heat sink. At the onset of a Class III failure and EPS diesel generator failure to start, the UPS batteries are in a fully-charged state capable of supporting the EPS loads for up to 24 hours for severe accident scenarios (motorized valves for water supply from reserve water tanks).

A separated and seismically qualified dedicated power supply common to both units is provided to support SARHRS.

3.4 Accident Resistance, Core Damage Prevention and Accident Mitigation

The EC6 design minimizes the occurrence and propagation of initiating events that could lead to events of greater severity and resulting challenges to safety systems by the following:

- The CANDU severe accidents strategy is to retain fuel channel debris (corium) within the calandria vessel and to maintain containment integrity, with large amount of water surrounding the core. [2] A protective layer of refractory concrete is provided on top of the calandria vault floor. It delays molten core interaction with structural concrete, slows down the rate of production of non-condensable gasses, and hence reduces the rate of containment pressurization.
- In the event that accident prevention measures are not sufficient, the five (5) engineered safety systems are provided to prevent significant damage to the reactor core. Additionally, the SARHRS system is a completely independent means of transferring decay heat to the ultimate heat sink following severe accidents.
- Emergency Containment Filtered Venting System: In a worst case event of a prolonged loss of all other heat sinks (including the aforementioned complementary features), a provision exists for filtered venting of containment. Containment failure is avoided by relieving containment pressure via a purpose-built venting system, to mitigate radiological consequences of such an extremely low probability combination of events.

These features ensure slow progression of a severe accident in a CANDU 6, allowing operating staff more time to implement severe accident management guidelines. The risk of Core Damage Frequency of an EC6 unit, during normal at-power operation, due to internal events is estimated to be 1.1E-06 per reactor year. [3]

4. Enhancements for Operation and Human Factors

EC6 operation and performance improvements include improved plant operability and maintainability with advanced control room design.

4.1 Control Centres Enhancements

The EC6 plant control centres consist of: Main control area which consists of the main control Room (MCR), the work control area, and the control equipment room; Secondary control area which consists of the SCA and the secondary control equipment room; Technical Support Centre (the emergency operations support centre near the MCR); and Emergency Support Centre (the emergency operations support centre on-site, outside the protected area).

The **main control room** is housed in the EC6 service building. The service building is a seismically qualified structure designed to withstand a design basis earthquake. The MCR, containing the human-system interfaces, used for plant operation during all plant conditions other than an MCR uninhabitable or unusable scenario. It also houses operator consoles, and a shift supervisor desk.

The control room instrumentation is based on the philosophy of having sufficient information displayed to allow the unit to be controlled safely from the control room. The human-system interface provides the capability to display the current and historical values and trends of all plant parameters acquired by the data acquisition, processing and management subsystem, as well as calculated values.

Most normal operations are performed from the main control panels and the main operator console and the fuel handling operator interface system. Tasks required to manage any anticipated operational occurrences will be completed from a combination of the main operator console and MCR panels. During normal operations and anticipated operational occurrences, the SMS performs the role of the plant safety parameter display system.

The **secondary control area**, which is physically separate from the MCA, includes the secondary control equipment room and the SCA, as well as facilities to accommodate extended periods of habitability for control room operators when the MCR is uninhabitable. The SCA is used for emergency control and monitoring following events that may render the MCR uninhabitable or not functional. The SCA includes the following functionality: shutdown, maintain cooling, and monitoring.

The SCA is electrically buffered from the MCR so failures occurring in the MCR will not interfere with control and monitoring of Safety Systems from the SCA. The human-system interface in the SCA is similar to the one in the MCR to ensure expected human performance levels are achieved when the operator needs to relocate to the SCA.

4.2 Power Manoeuvring and Operational Flexibility

The objective of overall plant control is to coordinate reactor and turbine control actions in order to match reactor power and the turbine generator load. In doing so, the pressure in the steam drum of the steam generators is kept relatively constant. Two control modes are available: "reactor leading" (alternate) mode and "turbine leading" (normal) mode.

In the reactor leading mode of operation, reactor power is controlled to a setpoint supplied by the operator or an automatic setback. The steam generator pressure control program manipulates the plant secondary side loads to keep the steam drum pressure constant. The turbine output automatically seeks its highest value allowed by the reactor power level.

In the turbine leading mode of operation, the turbine control system adjusts the turbine generator load in response to requests from the operator and thereafter maintains the load at the desired setpoint. Reactor power is raised or lowered to maintain the steam generator pressure at its setpoint, and therefore follows the generator load changes. This mode is ideal for load following since the unit is inherently responsive to grid frequency changes. The plant is capable of satisfying load change demands of 10% of Unit rating at 2% of Unit rating per minute. The plant is also capable of continuously compensating for grid fluctuations of plus or minus 2.5% full power, while operating in the range 90% to 97.5% of full power.

During steady state full power operation, the EC6 reactor is capable of suddenly reducing reactor power down to lower than 60% of full load with the excess steam dumped directly to the condenser, and maintaining that reduced level without poisoning out. A reactor setback to 60% full power is automatically initiated on a turbine trip or loss of line. On loss of line, the plant is capable of transition to continued operation at house load.

The EC6 unit can accept a generator load rejection or turbine trip from 100% power or less without a reactor trip and without lifting the main steam safety valves, and be able to continue stable operation with minimum Unit electrical loads. Units shall also have the capability to operate in isolation from the grid.

The EC6 Units can operate in a daily load cycling profile for 90% of the plant design life: a) Starting at 100% power, power ramps down to 50% power in two hours; b) Power remains at 50% for up to ten hours; c) Power then ramps up to 100% in two hours; and d) Power remains at 100% for the remainder of the 24-hour cycle. To meet these requirements for daily load cycling, the EC6 reactor achieves a reduction of net power output to 50% rated power during the 24 hour load cycle by a combination of reactor power reduction and steam discharge to BOP (bypass to condenser).

4.3 Emergency Planning Measures

Appropriate measures are taken to safeguard the occupants of the control centres against potential hazards. The fifth and final level of defence-in-depth requires the mitigation of radiological releases resulting from accident conditions with the provision of an emergency support centre and plans for on-site and off-site emergency response. To fulfil this requirement, the EC6 design provides:

The technical support centre is located in the service building, and situated one floor below the MCR. In the event of an emergency, it provides an assembly location for the plant management and technical support team who provide assistance to operating personnel in the MCR in responding to abnormal operating conditions, without undue interference with control room activities. For any abnormal incidents (Alerts), or emergency conditions, a public address announcement will be made to inform the required personnel that they must report to the technical support centre. The technical support centre includes SMS workstations with safety parameter displays as well as general purpose workstations with access to the plant data historian and additional applications, to ensure that safety parameter data and other plant wide data can be monitored and evaluated independent from actions occurring in the MCR.

The emergency support centre is located on-site outside the protected area, shared between both units and is separate from each unit's MCR and SCA. The emergency support centre provides overall management of the Licensee's emergency response. The emergency support centre is provided with necessary equipment for acquisition, display, and evaluation of all radiological, meteorological, and plant system data pertinent to evaluate the magnitude and effects of actual or potential radioactive releases, and to determine offsite protective measures. The emergency support centre will have seismically qualified SMS workstations with access to safety parameter data including meteorological and radiological monitoring data.

5. Conclusion

Building on the proven feature of the CANDU 6 technology, the EC6 has been designed to be competitive with other nuclear power plant for electricity generation, while achieving safety goals meeting new regulatory requirements, and addressing operational and performance expectations meeting operating utility owner requirements. The CNSC will be completing Phase 3 the pre-project design review of EC6 in 2013 June that is a follows-up on selected aspects and findings from the completed Phase 2 review to confirm that Candu's activities to implement CNSC regulatory requirements has appropriately progressed EC6 towards licensing, design, and project readiness. Phase 3 is the final step in the Pre-Licensing Review process aimed at increasing licensing certainty.

6. References

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