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BVY 13-017

February 28, 2013

U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852

SUBJECT: Vermont Yankee Overall Integrated Plan In Response To March 12, 2012 Commission Order To Modify Licenses With Regard To Requirements For Mitigation Strategies For Beyond-Design-Basis External Events (Order Number EA-12-049)
Vermont Yankee Nuclear Power Station
Docket No. 50-271
License No. DPR-28

REFERENCE:

1. NRC Order Number EA-12-049, Order To Modify Licenses With Regard To Requirements For Mitigation Strategies For Beyond-Design-Basis External Events, dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-01, Compliance with Order EA-12-049, Order Modifying Licenses With Regard To Requirements For Mitigation Strategies For Beyond-Design-Basis External Events, Revision 0, dated August 29, 2012 (ML12229A174)
3. Nuclear Energy Institute (NEI) 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, dated August 2012
4. Initial Status Report in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), BVY 12-071, dated October 26, 2012

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to Vermont Yankee. Reference 1 was immediately effective and requires provisions for mitigating strategies for beyond-design-basis external events. Specific requirements are outlined in the Enclosure of Reference 1.

Reference 1 requires submission of an Overall Integrated Plan by February 28, 2013. The NRC Interim Staff Guidance (ISG) (Reference 2) was issued August 29, 2012 which endorses industry guidance document NEI 12-06, Revision 0 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 3 provides direction

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regarding the content of this Overall Integrated Plan. The purpose of this letter is to provide that Overall Integrated Plan pursuant to Section IV, Condition C.1.a, of Reference 1.

Reference 3, Section 13, contains submittal guidance for the Overall Integrated Plan. The enclosure to this letter provides Vermont Yankee's Overall Integrated Plan pursuant to Reference 3.

Reference 4 provided the Vermont Yankee initial status report regarding Mitigation Strategies for Beyond-Design-Basis External Events, as required by Reference 1. Entergy has not yet identified any impediments to compliance with the Order, i.e. within two refueling cycles after submittal of the integrated plan, or December 31, 2016, whichever is earlier. Future status reports will be provided as required by Section IV, Condition C.2, of Reference 1.

This letter contains no new regulatory commitments.

If you have any questions regarding this report, please contact Mr. Robert J. Wanczyk at (802) 451-3166.

I declare under penalty of perjury that the foregoing is true and correct; executed on February 28, 2013.

Sincerely,

CJW / JTM

Enclosure:

1. Vermont Yankee Diverse and Flexible Coping Strategies (FLEX) Overall Integrated Implementation Plan

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Enclosure to

BVY 13-017

Vermont Yankee Diverse and Flexible Coping Strategies (FLEX) Overall Integrated Implementation Plan

General Integrated Plan Elements (PWR & BWR)	
Determine Applicable Extreme External Hazard **Ref: NEI 12-06 section 4.0 -9.0 JLD-ISG-2012-01 section 1.0**	*Input the hazards applicable to the site; seismic, external flood, high winds, snow, ice, cold, high temps.* *Describe how NEI 12-06 sections 5 – 9 were applied and the basis for why the plant screened out for certain hazards.*

The applicable extreme external hazards for Vermont Yankee Nuclear Power Station (VYNPS) are seismic, external flood, severe storms with high winds, ice, snow, extreme cold, and extreme high temperature as detailed below:

Seismic Hazard Assessment:

Per NEI 12-06 Section 5.2 (Reference 1), all sites will consider the seismic hazard.

Protection of FLEX equipment will be met by meeting the guidelines in Section 5.3 of NEI 12-06. The design earthquake for Vermont Yankee has been established at 0.07g horizontal ground acceleration and the maximum hypothetical earthquake at 0.14g horizontal ground acceleration. The seismic evaluation consisted of a review of historical data from the New England area, an analysis of instrument and historical records for the Vermont area, and a study of earthquake intensity attenuation with distance for the northeast United States (Reference 2, Section 1.6.1.1.7).

The major structures of VYNPS, including the reactor building and turbine building, are supported on rock. Bedrock exists at or near the foundation grades for the reactor building, the turbine building, the radwaste building, and the circulating water intake structure (Reference 2, Section 2.5.2.1). It is expected that there are no liquefaction susceptible soils within the area of the plant including the deployment routes.

[**OPEN ITEM**: FLEX Storage locations have not been finalized, therefore, investigation of deployment routes for possible impacts due to liquefaction have not been performed.]

Thus the Vermont Yankee site screens in for an assessment for seismic hazard.

External Flood Hazard Assessment:

VYNPS is considered a "wet" site per NEI 12-06 Section 6.2.1. The nominal plant grade is 252.0 feet MSL (Reference 2, Section 2.4.3.4). It is slightly below the design basis flood level. The controlling source of flooding at the site during the licensing process was identified as a Probably Maximum Precipitation (PMP) induced Probable Maximum Flood (PMF) of 252.5 feet Mean Sea Level (MSL) Stillwater and 254.0 feet MSL including wave effects on the Connecticut River and on shore near the plant (Reference 3, Section 2.1).

Thus the Vermont Yankee site screens in for an assessment for external flooding.

High Wind Hazard Assessment:

The site coordinates are approximately 42°47' north latitude and 72°31' west longitude (Reference 2, Section 1.6.1.1.1). Per NEI 12-06 guidance hurricanes and tornado hazards are applicable to Vermont Yankee. NEI 12-06 Figures 7-1 and 7-2 were used for this assessment. Sections 2.3.6.2 and 2.3.6.3 of the VYNPS UFSAR (Reference 2) considered the effects of hurricanes and tornadoes, respectively.

General Integrated Plan Elements (PWR & BWR)
Thus the Vermont Yankee site screens in for an assessment for High Wind Hazard. <u>Extreme Cold Hazard Assessment:</u> Vermont Yankee's historical records show that annual snowfall varies between 30 inches and 118 inches (Reference 2, Section 2.3.5.3). The annual average snowfall is about 60 inches with the heaviest snowfalls occurring in December, January, and February (Reference 2, Section 2.3.5.3). The mean number of days with temperatures less than 32°F is 175 (Reference 2, Section 2.3.5.1). Freezing rain and ice are expected in this area (Reference 2, Section 2.3.5.3). The Vermont Yankee site is located within the region characterized by EPRI as ice severity level 4 (Reference 1, Figure 8-2). Per NEI 12-06 Section 8.2 Vermont Yankee will consider snow, ice, and extreme cold hazards. Thus the Vermont Yankee site screens in for an assessment for snow, ice, and extreme cold. <u>Extreme High Temperature Hazard Assessment:</u> Per NEI 12-06 Section 9.2, all sites will address high temperatures. Thus the Vermont Yankee site screens in for an assessment for extreme High Temperature. <u>Summary of extreme external hazards Assessments:</u> The hazards applicable to VYNPS are seismic, external flood, high winds, ice, snow, extreme cold and extreme high temperature. <u>References</u>: 1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Revision 0, August 2012 2. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25 3. Entergy Engineering Report Number VY-RPT-12-00020, "Flooding Walkdown Submittal Report for Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Flooding per NEI-12-07 and NRC 10CFR50.46(f), Rev. 0, November 2012

Key Site assumptions to implement NEI 12-06 strategies. **Ref: NEI 12-06 section 3.2.1**	*Provide key assumptions associated with implementation of FLEX Strategies:* • *Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes.* • *Exceptions for the site security plan or other (license/site specific) requirements of 10CFR may be required.* • *Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.* • *Certain Technical Specifications cannot be complied with during FLEX implementation.*

General Integrated Plan Elements (PWR & BWR)

Key assumptions associated with implementation of FLEX Strategies for VYNPS are described below:

- Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 have been completed. The appropriate issues have been entered into the Entergy corrective action system.
- The following conditions exist for the baseline case:
  - Seismically designed DC battery banks are available.
  - Seismically designed AC and DC distribution systems are available.
  - Plant initial response is the same as Station Blackout (SBO) event.
  - Best estimate analysis and decay heat is used to establish operator time and action.
  - No single failure of SSC assumed except those in the base assumptions, i.e. EDG operation. Therefore, RCIC will perform either via automatic control or with manual operation capability per the guidance in NEI 12-06.
- The designed hardened connections are protected against external events or are established at multiple and diverse locations.
- FLEX components will be designed to be capable of performing in response to screened in hazards in accordance with NEI 12-06. Portable FLEX components will be procured commercially.
- Margin will be added to the design of the FLEX components and hard connection points to address future requirements as re-evaluation warrants. This margin will be determined during the detailed design or evaluation process.
- Phase 2 FLEX components stored at the site will be protected against the "screened in" hazards in accordance with NEI 12-06. At least N+1 sets of equipment will be available after the event they were designed to mitigate.
- Deployment strategies and deployment routes are assessed for hazards impact.
- Phase 3 FLEX equipment will be provided by the Regional Response Center and will be available beginning within 72 hours of the event. Therefore, the goal considered in the development of the Phase 2 FLEX strategy is to be able to maintain the key safety functions for up to 72 hours using a combination of both installed equipment (Phase 1) and portable FLEX equipment available on-site (Phase 2.)
- Additional staff resources are expected to begin arriving at 6 to 8 hours and the site will be fully staffed 24 hours after the event.
- Maximum environmental room temperatures for habitability or equipment availability is based on NUMARC 87-00 (Reference 1) guidance if other design basis information or industry guidance is not available. Extreme high temperatures are not expected to impact the utilization of off-site resources or the ability of personnel to implement the required FLEX strategies.
- This plan defines strategies capable of mitigating a simultaneous loss of all alternating current (ac) power and loss of normal access to the ultimate heat sink resulting from a beyond-design-

General Integrated Plan Elements (PWR & BWR)

basis event by providing adequate capability to maintain or restore core cooling, containment, and SFP cooling capabilities at the Vermont Yankee site. Though specific strategies are being developed, due to the inability to anticipate all possible scenarios, the strategies are also diverse and flexible to encompass a wide range of possible conditions. These pre-planned strategies developed to protect the public health and safety will be incorporated into the unit emergency procedures and guidelines in accordance with established change processes, and their impact to the design basis capabilities of the unit evaluated under 10 CFR 50.59. The plant Technical Specifications contain the limiting conditions for normal unit operations to ensure that design safety features are available to respond to a design basis accident and direct the required actions to be taken when the limiting conditions are not met. The result of the beyond-design-basis event may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p).

Exceptions for the site security plan or other (license/site specific) requirements of a nature requiring NRC approval will be communicated in a future 6-month update following identification.

Open items where Vermont Yankee does not have clear guidance to complete an action related to this submittal are listed below:

1. Structure, content and details of the Regional Response Center playbook will be determined.

References:

1. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
2. Task Interface Agreement (TIA) 2004-04, "Acceptability of Proceduralized Departures from Technical Specifications (TSs) Requirements at the Surry Power Station," (TAC Nos. MC4331 and MC4332)," dated September 12, 2006. (Accession No. ML060590273).

Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06. **Ref: JLD-ISG-2012-01** **NEI 12-06 13.1**	*Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.*

Entergy has no known deviations to the guidelines in JLD-ISG-2012-01 and NEI 12-06 at this time. However, if deviations are identified, then the deviations will be communicated in a future 6-month update following identification.

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Provide a sequence of events and identify any time constraint required for success including the technical basis for the time constraint. **Ref: NEI 12-06 section 3.2.1.7 JLD-ISG-2012-01 section 2.1**	*Strategies that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walkthrough of deployment).* *Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 1A* *See attached sequence of events timeline (Attachment 1A).* *Technical Basis Support information, see attached NSSS Significant Reference Analysis Deviation Table (Attachment 1B)*

Discussion of time constraints identified in Attachment 1A table.

- 10-35 minutes, Operators override the auto-swap of RCIC and HPCI suction valves in accordance with EOPs to maintain suction from the CST (table item 2) – Time critical at the point when torus water level reaches the high level setpoint which would initiate the automatic swap of the RCIC and HPCI suction from the CST to the torus. It is desirable to maintain suction from the CST because it is a source of higher quality and potentially cooler water and is also a step directed by EOPs (Reference 1)
- 1 hour, Entry into ELAP (table item 4) – Time critical at a time greater than 1 hour. Time period of one (1) hour is selected conservatively to ensure that ELAP entry conditions can be verified by control room staff and it is validated that emergency diesel generators (EDG) are not available (Reference 7). One hour is reasonable assumption for system operators to perform initial evaluation of the EDGs. Entry into ELAP provides guidance to operators to perform ELAP actions.
- 1 hour, DC load shed complete (table item 5) – Load shed is initiated by the SBO procedure and will be completed by approximately 1 hour (Reference 7). DC buses are readily available for operator access and breakers will be appropriately identified (labeled) to show which are required to be opened to effect a deep load shed (Reference 2). From the time that ELAP conditions are declared, it is reasonable to expect that operators can complete the DC bus load shed in approximately 10 minutes. A formal validation of the timeline will be performed once the procedure guidance is developed and related staffing study is completed.
- 2.4 hour, operator actions to open MCR doors, remove ceiling tiles and deploy smoke ejectors (Item 6) to ventilate the MCR. – Time critical at approximately 2.4 hours to stem the rise in MCR temperatures. The actions required are easily accomplished by the MCR or non-licensed operators or maintenance personnel. MCR habitability will be maintained for the duration of the ELAP.
- 7.5 hour, using manual control of SRVs, depressurize the RPV IAW EOPs (to approximately 200 – 400 psig) to keep in the Safe Region of the HCTL curve – Time critical at the point of entry to the unsafe region of the HCTL curve (Reference 3) (table item 7). Per MAAP analysis (Reference 4), at approximately 7.5 hours reactor pressure and Suppression Pool temperature

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cannot be maintained outside of the Unsafe Region. This would normally require full emergency depressurization. However, EOPs will be changed to allow stopping the depressurization at a pressure that is sufficient to continue operation of RCIC (200 – 400 psig). These activities are performed from the MCR. Sufficient pneumatic pressure is available from the nitrogen storage bottles to operate the SRVs throughout Phases 1 and 2 (Reference 2). Battery power for SRV control is available throughout Phases 1 and 2 by providing a FLEX diesel generator to power the battery chargers at approximately 8 hours.

- 8 hours, power up both divisions of the Class 1E battery chargers using a FLEX 480 VAC DG to supply power to both divisions of Class 1E emergency 480 VAC buses 8 or 9 (table item 8). Battery durations are calculated to last at least 9 hours (Reference 2). FLEX DG will be staged beginning at approximately 5 hour time frame (Reference 2). FLEX DG will be maintained in on-site FLEX storage buildings (Reference 2). FLEX DG will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards (Reference 2). Modifications to buses 8 and 9 are required. Programs and training will be implemented to support operation of FLEX DGs. Two hours is a reasonable assumption to transfer and place the FLEX portable DG into service.
- 9.5 hours, provide makeup to CST when CST level becomes depleted for RCIC suction and injection for Core Cooling (table item 9) – Time critical when CST level drops to near empty at approximately 9.5 hours (Reference 4). Diesel driven FLEX pumps will be staged beginning at approximately 6-8 hours to provide makeup to CST for continued RCIC suction. Diesel driven FLEX pumps will be maintained in on-site FLEX storage buildings (Reference 2). Diesel driven FLEX pumps will be transferred and staged via haul routes and staging areas evaluated for impact from external hazards (Reference 2). Programs and training will be implemented to support operation of diesel driven FLEX pumps.
- 14 hours, Initiate use of Hardened Containment Vent System (HCVS) per EOPs to maintain containment parameters below design limits (table item 10) – The early venting will result in the lower torus level, temperature, and pressure during the 72 hours (Reference 4). The reliable operation of HCVS can be met because HCVS is seismic and the new design will be operated by nitrogen supplied from the nitrogen storage bottles to operate the HCVS valves per EA-12-050. Critical instruments associated with containment and HCVS are DC powered and can be read in the MCR (Reference 5).

<u>Technical Basis Support information</u>

1. On behalf of the Boiling Water Reactor Owners Group (BWROG), GE-Hitachi (GEH) developed a document (NEDC-33771P, Revision 1 (Reference 6)) to supplement the guidance in NEI 12-06 by providing additional BWR-specific information regarding the individual plant response to the Extended Loss of AC Power (ELAP) and loss of Ultimate Heat Sink (UHS) events. The document includes identification of the generic event scenario and expected plant response, the associated analytical bases and recommended actions for performance of a site-specific gap analysis. In the document, GEH utilized the NRC accepted SUPERHEX (SHEX) computer code methodology for BWR's long term containment analysis for the ELAP analysis. As part of this document, a generic BWR 4/Mark I containment NSSS evaluation was performed. The BWR 4/Mark I containment analysis is applicable to the VYNPS (a BWR 4 Mark I plant) coping strategy because it supplements the guidance in NEI 12-06 by

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providing BWR-specific information regarding plant response for core cooling, containment integrity, and spent fuel pool cooling. The guidance provided in the guidance was utilized as appropriate to develop coping strategies and for prediction of the plant's response.

2. Vermont Yankee containment integrity for Phases 1 through 3 was evaluated by use of computer code MAAP 4.05 (Reference 4).
3. Environmental conditions within the station areas were evaluated utilizing methods and tools in NUMARC 87-00 (Reference 8) or GOTHIC 7.0 (EPRI software).
4. Per the guidance in 10 CFR 50.63 and Regulatory Guide 1.155 Vermont Yankee is an alternate AC, 8-hr coping plant for Station Blackout (SBO) considerations. Applicable portions of supporting analysis have been used in ELAP evaluations (Reference 9, Section 8.5.5.1) as starting point for the evaluations performed to meet the guidance from NEI 12-06. Key assumptions not addressed in the EA-12-049 order were per the existing SBO evaluations. Some of these SBO based assumptions used for ELAP are:
   a) Reactor coolant system (RCS) inventory losses are limited to normal system leakage and recirculation pump seal leakages.
   b) Credit is taken for operator actions where appropriate.
   c) Equipment needed for the SBO coping duration is available at the site once Phase 2 is implemented.
   d) There is reasonable assurance that the equipment will remain operable during and subsequent to an SBO event.

References:

1. EOP-1, RPV Control, Revision 4
2. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1
3. EOP-3, Primary Containment Control, Revision 5
4. ENERCON Calculation ENTGVY033-CALC-002, "Vermont Yankee Nuclear Power Station Containment Analysis of FLEX Strategies", Revision 0
5. Submittal for NRC Order EA-12-050, Hardened Containment Vent System
6. NEDC-33771P, GEH Evaluation of FLEX Implementation Guidelines, Revision 1
7. Plant procedure OPOT-3122-02, "Station Blackout", Rev. 1
8. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
9. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25

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Identify how strategies will be deployed in all modes. **Ref: NEI 12-06 section 13.1.6**	*Describe how the strategies will be deployed in all modes.*

The VYNPS deployment strategy will be included within an administrative program.

- VYNPS procedures and programs will be developed in accordance with NEI 12-06 to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.
- Figure 3 identifies the proposed deployment paths onsite for the transportation of FLEX equipment to the deployment areas.
- The identified paths and deployment areas will be accessible during all modes of operation. The administrative program will have elements that ensure pathways will be kept clear or will require actions to clear the pathways.
- The chosen pathways will be evaluated for applicable hazards including the liquefaction for the non-power block areas utilized for the deployment path or storage locations for phase 2.

References:

1. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Provide a milestone schedule. This schedule should include: • **Modifications timeline** o **Phase 1 Modifications** o **Phase 2 Modifications** o **Phase 3 Modifications** • **Procedure guidance development complete** o **Strategies** o **Maintenance** • **Storage plan (reasonable protection)** • **Staffing analysis completion** • **FLEX equipment acquisition timeline** • **Training completion for the strategies** • **Regional Response Centers operational** **Ref: NEI 12-06 section 13.1**	*The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.* *See attached milestone schedule Attachment 2*

See milestone schedule in Attachment 2.

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Identify how the programmatic controls will be met. **Ref: NEI 12-06 section 11** **JLD-ISG-2012-01 section 6.0**	*Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality. See section 11 in NEI 12-06. Storage of equipment, 11.3, will be documented in later sections of this template and need not be included in this section.* *See section 6.0 of JLD-ISG-2012-01.*
VYNPS will implement an administrative program for implementation and maintenance of the VYNPS FLEX strategies in accordance with NEI 12-06 guidance. • The equipment for ELAP will have unique identification numbers. Installed structures, systems and components pursuant to 10CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout. • VYNPS will utilize the standard EPRI industry PM process for establishing the maintenance and testing actions for FLEX components. The administrative program will include maintenance guidance, testing procedures and frequencies established based on type of equipment and considerations made within the EPRI guidelines. • VYNPS will follow the current programmatic control structure for existing processes such as design and procedure configuration	
Describe training plan	*List training plans for affected organizations or describe the plan for training development*
New training of general station staff and EP will be performed no later than November 2014. These programs and controls will be implemented in accordance with the Systematic Approach to Training.	
Describe Regional Response Center plan	*Discussion in this section may include the following information and will be further developed as the Regional Response Center development is completed.* ▪ *Site-specific RRC plan* ▪ *Identification of the primary and secondary RRC sites* ▪ *Identification of any alternate equipment sites (i.e. another nearby site with compatible equipment that can be deployed)* ▪ *Describe how delivery to the site is acceptable* ▪ *Describe how all requirements in NEI 12-06 are identified*
VYNPS will utilize the industry Regional Response Centers (RRC) for phase 3 equipment. VYNPS will have contractual agreements in place with the Strategic Alliance for FLEX Emergency Response (SAFER). The two (2) industry RRC will be established to support utilities in response to beyond design-basis external events (BDBEE). Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will	

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have equipment in a maintenance cycle. Communications will be established between the affected nuclear site and the SAFER team and required equipment mobilized as needed. Equipment will initially be moved from an RRC to a local staging area, established by the SAFER team and the utility. The equipment will be prepared at the staging area prior to transportation to the site. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered to the site within 24 hours from the initial request.
Notes:

Maintain Core Cooling
Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • **RCIC/HPCI/IC** • **Depressurize RPV for injection with portable injection source** • **Sustained water source**
BWR Installed Equipment Phase 1:
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC) and strategy(ies) utilized to achieve this coping time. <u>Power Operation, Startup, and Hot Shutdown</u> At the initiation of the BDBEE, main steam isolation valves (MSIVs) automatically close, feedwater is lost, and safety relief valves (SRVs) automatically open to control pressure, causing reactor water level to decrease. The RCIC and HPCI System starts automatically upon receipt of a low-low reactor water level signal, and provides its design flow rate with suction from the Condensate Storage Tank (CST) within a specified initiation time and over a wide range of reactor vessel pressures (Reference 2). This injection recovers the reactor level to the normal band. The SRVs control reactor pressure. (Reference 1, Section 2.2 B). The RCIC and HPCI valves and controls are powered by station DC power. HPCI and RCIC automatically start upon a receipt of a reactor vessel low-low water signal (Reference 9, Sections 4.7.5 and 6.4.1). At or before approximately one hour, HPCI is secured and RCIC provides all makeup flow to the reactor vessel. After determination that Emergency Diesel Generators (EDGs) cannot be started, the shift manager determines the event is a beyond-design-basis event at approximately 1 hour. RCIC is maintained feeding the reactor vessel with suction from the CST. Additionally, the automatic depressurization system (ADS) will be either placed in 'inhibit' or closely monitored to prevent automatic initiation of ADS. This is necessary to ensure reactor pressure is not reduced to a pressure which would prevent operation of RCIC. RCIC will trip on low steam line pressure of approximately 50 psig (Reference 4). The TS limit is $\geq$ 50 psig (Reference 1, Table 3.2.2). As stated above, the primary method of reactor pressure control is by operation of the SRVs. SRVs require nitrogen from the Nitrogen Supply system with backup from compressed gas system containing a sufficient volume of nitrogen to support manually lifting the SRVs. Since the piping from the 15,000 gallon Nitrogen Storage tank to the SRVs is not seismic, there is the possibility that this piping will not be available in this BDBEE. If the piping and all components are intact, the Nitrogen Supply system can be used by manually opening TCV-1002A, TCV-1002B or TCV-1002C (References 13 and 15). If this source of nitrogen has been compromised and is not available, the nitrogen storage bottles automatically supply backup pneumatic pressure for SRV operation with enough capacity to provide for 72 hour of operation (References 5, 12 and 14). By this time, additional nitrogen bottles can be supplied from onsite or off site to allow for continued SRV actuation.

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Core Cooling

The maximum level allowed in the torus while the vessel is pressurized is provided by or governed by curves in the Emergency Operating Procedures (EOPs). EOP-1 (Reference 6) contains the curves for Heat Capacity Temperature Limit (HCTL), which provides the limits or requirements which govern or prescribe actions such as emergency depressurization based on or related to level in the torus. Per MAAP analysis (Reference 11), at approximately 7.5 hours, reactor pressure and Suppression Pool temperature cannot be maintained outside of the Unsafe Region. This requires full emergency depressurization. However, EOPs will allow stopping the depressurization at a pressure that is sufficient to continue operation of RCIC.

The Vermont Yankee Condensate Storage Tank (CST) is a seismically classified structure (Reference 9, Sections 11.8.3.9 and 12.2.1.1.2) and will be available as a source of makeup water to the reactor via the RCIC system in the event of a BDBEE. The enclosure walls surrounding the tank provide protection from tornado missiles up to elevation 260'-0". Currently, only 75,000 gallons can be credited for RCIC and HPCI suctions in a BDBEE due to the configuration of the stand-pipes inside the tank. As a solution to allow crediting additional volume in the tank the two shortest standpipes will be modified by increasing their height and raising them 9" to the 260'-0" elevation of the CST (the other higher standpipes will remain unchanged since they are above the proposed new height of the lower two standpipes). The two lower pipes provide flow to the Condensate Transfer Pumps and the Core Spray Pumps. The standpipes prevent drawing down the tank past the required level if the non-safety related/non-seismic pipes connected to the CST fail. These two standpipes need to be raised to provide for a greater volume that is reserved for RCIC suction. The connection to the Core Spray system is not required to support the core cooling function and is not assumed in licensing basis analysis (Reference 8). This modification will not adversely impact Core Spray or Condensate Transfer operations. Raising the standpipes will allow the CST to last greater than the 7 hour limit that is currently in effect due to the limited 75,000 reserve gallons (Reference 9, Section 4.7.5). The increased height of the standpipes allow for crediting another 11,000 gallons (a total of 86,000 gallons) and provide for the CST inventory to last approximately 9.5 hours. This will allow time for Phase 2 equipment to be staged and put into operation.

The BWROG has commissioned GEH to perform an evaluation of the effects of RCIC system operation at extended pumped fluid temperatures (Reference 10). The purpose of the study is to identify recommendations for allowing the RCIC turbine/pump to operate at extended pump fluid temperatures (as high as 300F) for an extended period of time (up to 168 hours). The study has not been issued for use; however, the draft study has been issued for industry review and comment. The draft study provides recommendations for increasing the availability for the RCIC system for the extended fluid temperatures.

The RCIC System is designed to provide a minimum of 20 ft. Net Positive Suction Head Available (NPSHA) to the RCIC pump at rated conditions. RCIC will be taking suction from the CST throughout Phase 1 of the FLEX event. Since the CST maximum design temperature is 135°F, the minimum NPSH available to RCIC would be 53.9 ft. (Reference 2). Even though the FLEX strategy for core cooling does not operate the RCIC system outside of its currently defined design criteria; the recommendations provided in the GEH study (Reference 10) will be evaluated for consideration of providing additional margin for the Phase 1 core cooling coping capabilities.

Maintain Core Cooling

Cold Shutdown and Refueling

The strategy for core cooling for Cold Shutdown and Refueling are in similar to those for Power Operation, Startup, and Hot Shutdown.

If an ELAP occurs during Cold Shutdown, water in the vessel will heatup. When temperature reaches 212°F (Hot Shutdown), the vessel will begin to pressurize. The turbine driven systems (RCIC and HPCI) are generally available for emergency use at the beginning and end of an outage, thus during the pressure rise RCIC can be returned to service, after testing, with suction from the CST to provide injection flow. When pressure rises to the SRV setpoints then pressure will be controlled by SRVs.

During Refueling, many variables could impact the ability to cool the core. In the event of an ELAP during Refueling, there are no installed plant systems available to cool the core, thus transition to Phase 2 will occur immediately. To accommodate the activities of vessel disassembly and refueling, water levels in the reactor vessel and the reactor cavity are often changed. The most limiting condition is the case in which the reactor head is removed and water level in the vessel is at or below the reactor vessel flange. If an ELAP/LUHS occurs during this condition then (depending on the time after shutdown) boiling in the core occurs quite rapidly.

Strategies for makeup water during Phase 2 of the event include utilizing diesel driven FLEX pumps at the deep basin or UHS/river as described in the Power Operation, Startup, and Hot Shutdown descriptions. This strategy would discharge into the RHRSW piping (to cross-connect into the RHR injection flow path) as shown in Figure 1, Flow Diagram for FLEX Strategies.

Pre-staging of FLEX equipment can be credited for some predictable hazards, but cannot be credited for all hazards per the guideline of NEI 12-06. Deploying and implementation of portable diesel driven FLEX pumps to supply injection flow must commence immediately from the time of the event. This should be plausible because more personnel are on site during outages to provide the necessary resources. Guidance will be provided to ensure that sufficient area is available for deployment and that haul paths remain accessible without interference from outage equipment during refueling outages.

References:

1. Vermont Yankee Nuclear Power Station Technical Specifications and Bases
2. Vermont Yankee Nuclear Power Station Design Basis Document for Reactor Core Isolation Cooling System , Revision 20
3. OP 4365, RCIC Steam Line Low Pressure Functional/Calibration, Revision 26
4. OP 2121, "Reactor Core Isolation Cooling System", Revision 56
5. Vermont Yankee Nuclear Power Station Design Basis Document for Main Steam System, Revision 20
6. EOP-1, RPV Control, Revision 4
7. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Maintain Core Cooling	
8. Vermont Yankee Nuclear Power Station Design Basis Document for Core Spray System, Revision 21 9. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25 10. 0000-0155-1545-Draft, dated January 2013, BWROG RCIC Pump and Turbine Durability Evaluation – Pinch Point Study 11. ENERCON Calculation ENTGVY033-CALC-002, "Vermont Yankee Nuclear Power Station Containment Analysis of FLEX Strategies", Revision 0 12. VYC-1835, "ADS Nitrogen Bottle Sizing for 72 Hour Standby Period", Revision 1 13. G-191160, Sh. 3, Flow Diagram Instrument Air System, Revision 30 14. G-191160, Sh. 4, Flow Diagram Instrument Air System, Revision 22 15. G-191175, Sh. 2, Flow Diagram Nitrogen Supply System, Revision 21	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
Raise the level of the two lower standpipes approximately 9 inches to allow for the CST water inventory to last for approximately 9.5 hours and allow for Phase 2 equipment to be set up in a timely manner.	
Key Reactor Parameters	*List instrumentation credited for this coping evaluation.*

Reactor Vessel Essential Instrumentation	**Safety Function**
RPV Level - LI-2-3-91A&B (CRP 9-3)	Reactor vessel inventory and core heat removal
RPV Pressure - PI-2-3-56A&B (CRP 9-5)	Reactor vessel pressure boundary and pressure control
Containment Essential Instrumentation	**Safety Function**
Containment Pressure - LI/PI-16-19-12A&B (CRP 9-3)	Containment integrity
Suppression Pool Level - LI/PI-16-19-12A&B (CRP 9-3)	Containment integrity
Suppression Pool Water Temperature – TI-16-19-33A&C (CRP9-3)	Containment integrity
Spent Fuel Pool Essential Instrumentation	**Safety Function**
SFP Level - LI-19-63A&B (CAD PNL A&B)	SFP inventory

In addition, the Key Reactor Parameters can be determined from a local reading using standard I&C instruments and local indications exist such as CST tank level.

Maintain Core Cooling
Notes: The duration of each station battery was calculated to last at least 9 hours. References: 1. ENERCON Calculation ENTGVY033-CALC-005, "Station Batteries A-1 and B-1 Discharge Capacity during Extended Loss of AC Power", Revision 0 2. ENERCON Report ENTGVY033-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Maintain Core Cooling
BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC) and strategy(ies) utilized to achieve this coping time.

Primary Strategy

During Phase 2, water will be transferred from the west deep basin to the CST to supplement the water available for RCIC suction and injection to cool the core (Figure 1). The west deep basin is a Class I Seismic structure and is therefore protected from all tornado loads (wind, pressure drop, and missiles) (Reference 3). The west deep basin has a storage capacity of approximately 1.48 million gallons (Reference 5, Sections 11.9.3 and 12.2.1.1.1). This transfer will occur approximately 8 hours after event initiation by placing the portable diesel driven FLEX pump into operation (Reference 2). The portable diesel driven FLEX pump would take suction from the deep basin and be flanged connected to the CST drain line via approximately 500 feet of hoses run through the Protected Area fences. Prior to the need for deployment, the station personnel must commence staging and connection activities to implement portable diesel driven FLEX pump installation. The onsite diesel driven FLEX pumps stored in the FLEX buildings are brought to the west deep basin. The diesel driven FLEX pump discharge will be connected with flexible hoses and run though the Protected Area fence, by cutting a hole, to the 4" Storz Wye splitter which will then discharge to another hose. This splitter will be portable and have one, 4" inlet and two, 4" outlets. Each outlet will have a valve to allow for flow through one, or both of the outlets. This hose will then be routed over the CST wall (approximately 7 feet high) to the flange connection on the CST drain line through the door in the CST enclosure building (Figure 1). This CST drain line connection is located in the tornado missile protected CST enclosure.

A portable diesel driven FLEX pump will supply the required flow rate of 120 gpm at 140 feet of head at the beginning of Phase 2 while also restoring the water level in the CST.

With sufficient CST water volume now available with makeup from the west deep basin via the diesel driven FLEX pump, the CST will be available as a suction source for the RCIC pump through the duration of Phase 2 (Reference 2).

A 600KW 480V AC Diesel Generator will be staged and connected to BUS-9 via the breaker for the John Deere Diesel Generator (Figure 2). The connection will be made at the cable connection near the John Deer DG to the Seismic cable connection on the installed underground cable that feeds the breaker in BUS-9 using short cables.

Alternate Strategy

Providing defense in depth for RCIC pump is to deploy the diesel driven FLEX pump to the west deep basin. While taking suction from the deep basin, the diesel driven FLEX pump will then discharge to a 4" flexible hose which will be run approximately 500 feet through the Protected Area fences, by cutting a hole, to the south side of the reactor building. There, the hose will be run through the new penetration on the south wall of the reactor building (FLEX Connection #1) (Figure 1). Per Reference 6, approximately another 200 feet of 4" flexible hose will then be run from the interior side of this penetration in the reactor building, split into two, 2" hoses and tie into the 'A' loop RHR system via valves V70-320A and V70-320B. The system will be lined up per existing plant procedure (Reference 1) and provide make up to the vessel using the RHR

Maintain Core Cooling
BWR Portable Equipment Phase 2:
seismically qualified piping. A first alternate strategy for the 600 KW 480V AC Diesel Generator is to stage the DG near the outside doors to the switchgear room and run cables to the breaker in BUS-9 for the John Deere DG and replace the cables from the John Deere DG with the cables from the 600 KW DG to supply BUS-9 from the breaker. The cable run for this connection is less than 60 feet. A second alternate strategy for the 600 KW 480V AC Diesel Generator is to stage the DG near the outside doors to the switchgear room and run cables to a spare breaker in BUS-8 and supply BUS-8 via the installed spare breaker. The cable run for this connection is less than 90 feet. Welding receptacles and disconnect switches are provided on each of the battery chargers and distribution transformers for the instrument AC Bus to connect 480V AC DGs as alternate power supplies for Phase 2 operation. See Figure 1 for the flow diagram for FLEX strategies and Figure 2 for the electrical diagram for FLEX strategies. If onsite diesel fuel reserves are needed to operate temporary equipment, there are two locations to obtain diesel fuel. The first option would be the Fuel Oil Storage Tank. The second option would be the two DG day tanks. A minimum of 36,000 gallons of diesel fuel is stored in the Fuel Oil Storage Tank and two day tanks have a nominal capacity of 800 gallons each (Reference 5, Section 8.5.4). The fuel could be accessed through a hose connected to accessible drain valves of the day tanks. The oil in the Fuel Oil Storage Tank can be transferred to the day tanks using the fuel oil transfer pumps or with a portable transfer pump connected to the system. Adequate fuel supplies are available and accessible to operate emergency response equipment. <u>References</u>: 1. PP7019, Appendix G, Loss of Large Area of the Plant due to Fire or Explosion, Rev. 15 2. ENERCON Report ENTGVY033-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1 3. Vermont Yankee Nuclear Power Station Design Basis Document for External Events, Revision 2 4. OPOP-SW-2181, Service Water/Alternate Cooling Operating Procedure, Revision 6 5. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25 6. G-191148, General Arrangement Reactor Building Plans Sheet 1, Revision 23

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control	

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
strategies in the current EOPs.	
Identify modifications	*List modifications*
• New penetration will be installed in the south wall of the Reactor Building near the CST. This eliminates the need to run significant amounts of hose outside and around buildings. Operator time is saved, and the hose path is simplified by running the hose to the V70-320A & B valves in the North East Corner room by running the hose from the south wall and inside the Reactor Building. • New transfer switches and welding receptacles will be installed adjacent to battery chargers 1C and 1D and near MCCs 8A and 9A to provide connection points for the 480 VAC FLEX DGs for the battery chargers and instrument transformer power.	
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Same as instruments listed in above section, Core Cooling Phase 1 Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • VYNPS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • VYNPS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.	

Maintain Core Cooling	
BWR Portable Equipment Phase 2:	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • VYNPS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
Structures to provide protection of the FLEX equipment will be constructed to meet the requirements identified in NEI 12-06 section 11. The schedule to construct the structures is still to be determined. • VYNPS procedures and programs are being developed to address storage structures requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
Storage structures will be ventilated to allow for equipment to function. The schedule to construct structures is still to be determined. • VYNPS procedures and programs are being developed to address storage structure requirements, haul path requirements, and FLEX equipment requirements relative to the hazards applicable to VYNPS.	

Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
Storage location and structure have not yet been decided. Figure 3 identifies the proposed locations and deployment paths onsite for the transportation of FLEX equipment. For this function a clear deployment path has been shown from the identified roads to the diesel driven FLEX pump staging	New penetration will be installed in the south wall of the Reactor Building near the CST. This eliminates the need to run significant amounts of hose outside and around buildings.	• Plant piping and valves for FLEX connections, specifically valves V70-320A/B, V73-26 and 4" Storz splitter will be missile protected and enclosed within a Seismic Category 1 structure which will inherently protect it from local

Maintain Core Cooling		
BWR Portable Equipment Phase 2:		
areas next to the west deep basin and portable diesel generator locations near the switchgear room.		hazards such as vehicle impact. • Connection point to the CST via the drain valve is Seismic Category 1 and located in the CST enclosure to protect it from tornado missiles. • Electrical connection points for the FLEX 480 VAC DGs will be established in the respective switchgear rooms and designed to withstand the applicable hazards.

Notes:

References:

1. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide", Rev. 0, August 2012
2. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Maintain Core Cooling
BWR Portable Equipment Phase 3:

Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (RCIC/HPCI/IC)and strategy(ies) utilized to achieve this coping time.

Primary Strategy

For Phase 3, the reactor core cooling strategy is to place one loop of RHR into service. This will be accomplished by powering up a 4160V Class 1E Switchgear Bus No. 3 or 4160V Class 1E Switchgear Bus No. 4 (see Figure 2) for RHR and RHR Service Water pumps by utilizing a 4160V RRC FLEX portable diesel generator (i.e., from the RRC) and supplying the RHR Heat Exchanger with water from cooling tower deep basin using the RHR Service Water pumps and existing Alternate Cooling System (ACS) piping (Reference 2, Section 10.8).

The 4160 V RRC FLEX diesel generator will be capable of carrying approximately 3000 kW load which is sufficient to carry all of the loads on the 4160V Switchgear Bus No. 3 or 4 needed to power plant equipment to support the Phase 3 FLEX strategy (i.e., MOVs, room coolers, etc.).

The ACS is designed for Seismic Class I and Safety Class 3 system to provide a heat sink to remove decay heat and sensible heat from the primary system so that the reactor can be safely shut down in the event the Service Water pumps are not available (Reference 2, Section 10.8.3, 12.2.1.1.1, and 12.2.1.1.2). During a seismic event, a rupture of non-seismic portions of the SW piping in the Turbine Building could potentially result in a loss of some basin inventory until manual action is taken to isolate the breaks. Calculation VYC-1279J has determined that resulting water loss would not reduce basin inventory below acceptable levels (Reference 2, Section 10.8.3). This ensures a backup source to the normal Service Water System in the event of loss or inoperability of the Intake Bay caused by submergence of the Intake Structure during maximum flood conditions or failure of various upstream dams, failure of the Vernon Dam and subsequent drop in the river level, or fire at the Intake Structure which disables the Service Water pumps. The cooling tower basin is sized such that the system can be operated for one week (7 days) before makeup water is required from off-site sources. Prior to emptying of the deep basin, offsite fire truck tankers will deliver water to replenish the deep basin for additional water inventory as part of Phase 3 strategy (Reference 1).

In addition to providing RHR for cooling during Phase 3, the ACS system can also provide cooling flow to the plant for such loads as RHRSW pump room coolers, pump motor bearing oil coolers, RHR pump seal coolers, then returned to the cooling tower where the latent heat is transferred to the atmosphere. Since the power supply of cooling tower fan from MCC-8C or MCC-9C is available during Phase 3 coping strategy, the cooling tower fan, CT-2-1 will be available for cooling tower operation to remove heat.

Alternative Strategy

Alternate means of core cooling can be provided by injecting river water through RHRSW, the RHRSW – RHR cross-connect valves (V70-320A/320B) and then to the RHR injection valves (Figure 1) and venting containment with the RHV system to remove heat.

Welding receptacles and disconnect switches are provided on battery chargers 1C and 1D to connect 480V AC DGs as alternate power supplies for Phase 2 operation.

Maintain Core Cooling	
BWR Portable Equipment Phase 3:	
See Figure 1 for the flow diagram for FLEX strategies and Figure 2 for the electrical diagram for FLEX strategies. Reference: 1. ENERCON Report ENTGVY033-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1 2. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
There are no modifications for Phase 3.	
Key Reactor Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Same as Phase 1 not including instrumentation to support portable equipment. Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Deployment Conceptual Modification **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
Phase 3 equipment will be provided by the Regional Response Center (RRC) which is to be located in Memphis, TN. Equipment transported to the site will be either immediately staged at the point	No modifications identified for Phase 3 deployment issues	• The diesel driven FLEX pump makeup connections at the CST and connection points at RB penetrations will be designed to withstand the applicable hazards and have diverse

Maintain Core Cooling		
BWR Portable Equipment Phase 3:		
of use location (diesel driven pumps and generators) or temporarily stored at the lay down area shown on Figure 3 until moved to the point of use area. Deployment paths identified on Figure 3 will be used to move equipment as necessary.		connections.
Notes:		

Maintain Containment
Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • **Containment Venting or Alternate Heat Removal** • **Hydrogen Igniters (Mark III containments only)**
BWR Installed Equipment Phase 1:
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain containment integrity. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.
During Phase 1, containment integrity is maintained by normal design features of the containment, such as the containment isolation valves. In accordance with NEI 12-06, the containment is assumed to be isolated following the event. As the torus heats up and begins to boil, the containment will begin to heat up and pressurize. The containment design pressure is 56 psig (Reference 1, Section 5.2.3.2 and Table 5.2.1). Containment pressure limits are not expected to be reached during Phase 1 of the event. However, if the maximum containment pressure is reached, EOP requires operators to vent the containment (Reference 2). In this case, the Reliable Hardened Vent (RHV) System will be used as implemented per EA-12-050 to vent containment with control from the Control Room (CRP 9-25). Thus, containment integrity will not be challenged and remains functional throughout Phase 1 following event initiation. Monitoring of containment (drywell) pressure will be available via normal plant instrumentation using the coping strategy described below for instrumentation and controls. As determined by the MAAP analysis (Reference 3), torus venting is assumed to open at an approximate pressure of 30 psig via the RHV system at approximately time t = 14 hours. Phase 1 (i.e., the use of permanently installed plant equipment/features) containment integrity will be maintained throughout the duration of the event. No non-permanently installed equipment will be required to maintain containment integrity. Therefore, there is no defined end time for the Phase 1 coping period for maintaining containment integrity. <u>References</u>: 1. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25 2. EOP-3, Primary Containment Control, Revision 6 3. ENERCON Calculation ENTGVY033-CALC-002, "Vermont Yankee Nuclear Power Station Containment Analysis of FLEX Strategies", Revision 0

Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Vermont Yankee EOP-3, Primary Containment Control, exists to direct operators in protection and control of containment integrity. Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI	

[2] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Containment	
Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
Modification of Hardened Containment Vent System (HCVS) (i.e., Reliable Hardened Vent) will be implemented in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents.	
Key Containment Parameters	*List instrumentation credited for this coping evaluation.*

Containment Essential Instrumentation	Safety Function
Containment Pressure - LI/PI-16-19-12A&B (CRP 9-3)	Containment integrity
Suppression Pool Water Level - LI/PI-16-19-12A&B (CRP 9-3)	Containment integrity
Suppression Pool Water Temperature - TI-16-19-33A&B (CRP 9-3)	Containment integrity
Torus Pressure – PI-16-19-36A&B	RHVS operability
RHV system valve position indication (Component No. TBD)	RHVS operability
RHV system pressure indication (Component No. TBD)	RHVS operability
RHV system power status	RHVS operability
Nitrogen system supply status (Component No. TBD)	RHVS operability
RHV effluent temperature (Component No. TBD)	RHVS operability

Notes:

Reference:

1. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Maintain Containment	
BWR Portable Equipment Phase 2:	
Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain containment integrity. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time. Containment pressure limits are not expected to be reached during the event as indicated by MAAP analysis (Reference 1), because the HCVS is opened prior to exceeding any containment pressure limits. Containment integrity is maintained throughout the event by permanently installed equipment. Portable FLEX diesel generators will be employed, as discussed in Phase 2 Core Cooling section, to charge the station batteries and maintain DC bus voltage. See Phase 1 description for discussion of containment integrity applicable throughout the event. <u>Reference</u>: 1. ENERCON Report ENTGVY033-PR-002 Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See procedures listed in Phase 1 section	
Identify modifications	*List modifications*
See modifications listed in Phase 1 section • New transfer switches and welding receptacles will be installed adjacent to battery chargers 1C and 1D and near MCCs 8A and 9A to provide connection points for the 480 VAC FLEX DGs for the battery chargers and instrument transformer power. (This is the same modification noted in the Core Cooling Phase 2 section)	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
See instrumentation listed in Phase 1 section Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Maintain Containment	
BWR Portable Equipment Phase 2:	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
The HCVS will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or scheduled to protect*
The HCVS will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
The HCVS will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
The HCVS will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
The HCVS will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02. The HCVS will meet the design requirements as specified for reasonable protection per NEI 12-06.	

Maintain Containment		
BWR Portable Equipment Phase 2:		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
HCVS is designed as permanently installed equipment. No deployment strategy is required.	Modification of the Hardened Containment Vent System (HCVS) will be implemented and enhanced in accordance with NRC Order EA-12-050, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents and guidance in JLD-ISG-2012-02.	HCVS is designed as permanently installed equipment. No connection points are required.
Notes:		

Maintain Containment

BWR Portable Equipment Phase 3:

Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain containment integrity. Identify methods (containment vent or alternative / Hydrogen Igniters) and strategy(ies) utilized to achieve this coping time.

See Phase 2 discussion.

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*

See Phase 2 discussion.

Identify modifications	*List modifications*

See Phase 2 discussion.

Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*

See Phase 2 discussion.

Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.

Deployment Conceptual Design

(Attachment 3 contains Conceptual Sketches)

Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
See Phase 2 discussion.	See Phase 2 discussion.	See Phase 2 discussion.

Notes:

Maintain Spent Fuel Pool Cooling	
Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-1 of NEI 12-06: • **Makeup with Portable Injection Source**	
BWR Installed Equipment Phase 1:	
Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time There are no phase 1 actions required that need to be addressed. Fuel in the SFP is cooled by maintaining 21' of water over top of fuel. Boiling of the SFP does not occur until 29 hours into the event.	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Phase 1 strategy is to use plant design to maintain cooling to fuel in the SFP. Water level is maintained at least 21 feet above the top of irradiated fuel assemblies seated in the SFP (Reference 1).	
Identify modifications	*List modifications*
Modification to install SFP level instrumentation per Order EA-12-051	
Key SFP Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051	
Notes: References 1. Vermont Yankee Nuclear Power Station Technical Specifications and Bases	

[3] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Maintain Spent Fuel Pool Cooling
BWR Portable Equipment Phase 2:

Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time.

The normal SFP water level at the event initiation provides for 21' (Reference 1) of water inventory above the top of the stored spent fuel. Using the design basis maximum heat load, the SFP water inventory will heat up from 110 to 212°F during the first 29 hours (Reference 2). Thus, the transition from Phase 1 to Phase 2 for SFP cooling function will occur at approximately T=29 hours in the normal condition in which fuel has been transferred to the pool after a 20 day refueling outage. Phase 2 equipment (i.e., provisions for makeup to the SFP) will be in place for utilization at approximately 8 hours. Makeup to the SFP will be provided by one of three baseline capabilities.

Full Core Offload

ENERCON Report ENTGVY033-PR-002 (Reference 4) concludes that the time to boil in the SFP for full core offload is 8.5 hours and the water loss is approximately 439 ft^3/hr. This equates to a minimum required makeup rate of approximately 55 gpm. As the SFP water heats up, it expands and thus the water level rises. This rise in water level also takes into account evaporation from SFP while heating up to 212°F. This results in water level increase of 1 ft from normal water level of 21 ft at 8 hours and it would take approximately 60.5 hours to boil off 21 feet of water. However maintaining the SFP full at all times during the ELAP event is not required, the requirement is to maintain adequate level to protect the stored spent fuel and limit exposure to personnel onsite and offsite. Thus, Phase 2 actions after 8 hours will be acceptable since there is adequate water level in the SFP above the fuel (Reference 4). See Cold Shutdown and Refueling_discussion in Core Cooling section for discussion on actions required if an ELAP occurs during a refueling outage.

Primary Strategy Method 1

The first method is with the same diesel driven FLEX pump used to provide RPV injection, connected from the west deep basin and providing flow to the SFP system via a new valve header installed upstream of valve V19-50 (Figure 1). Hose will be run approximately 500 feet from the diesel driven FLEX pump located at the west deep basin through the Protected Area fence, by cutting holes in the fence, the 4" Storz valve splitter (valve X004 closed and X002 open) then to the new reactor building penetration on the south wall (FLEX Connection #1). Reversal of a spectacle flange in the line between the RHR system and the FPC system is not required since the new tie in will be downstream of the spectacle flange (Reference 3). Then, open the SFP cooling valves, X005 and V19-50, thus providing makeup flow to the SFP via seismically qualified piping. The maximum required makeup rate that is required to maintain fuel pool level is approximately 20 gpm.

Primary Strategy Method 2

The second means to provide water to the SFP utilizes the diesel driven FLEX pump connected from the west deep basin to the SFP system. The hose will be connected to valve X005 as specified above. Valve V19-50 will be closed. A hose long enough to reach the SFP will be staged nearby to allow filling of the SFP utilizing water from the west deep basin via a diesel driven FLEX pump. The hose will be connected to valve X007. Valves X007 and X005 will then be opened to provide the flow through the hose (Figure 1).

Maintain Spent Fuel Pool Cooling
BWR Portable Equipment Phase 2:

Primary Strategy Method 3

The third method is to use the hose connection on valve X006, which is detailed above, on elevation 303'-0". A hose will then be connected to valve X006 and run up to the refuel floor where a spray nozzle will then be connected. The monitor spray nozzle would be used as necessary to provide the minimum required spray flow of 250 gpm over the SFP

Alternate Strategy

Any of the three Primary Strategy Methods can be achieved by taking makeup suction from the Connecticut River as opposed to the west deep basin. This will also require cutting through the Protected Area fence and running approximately 500 feet of hose. This alternate water source is provided in the event that the west deep basin is inaccessible.

References:

1. Vermont Yankee Nuclear Power Station Technical Specifications and Bases
2. VYC-2170, "Time to Boil Cases for VY", Revision 1
3. G-191173, Sh. 1, Flow Diagram Fuel Pool Cooling & Cleanup System, Revision 40
4. ENERCON Report ENTGVY033-PR-002, Engineering Report, Diverse and Flexible Coping Strategies (FLEX) and Conceptual Design in Response to NRC Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events, Revision 1

Schedule:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*

Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

Identify modifications	*List modifications*

- Modification to install SFP level instrumentation per Order EA-12-051.
- Modification to install new connection to the SFP System upstream of valve V19-50. This new 4" connection will split into three lines, each with an isolation valve. One line will be used as the makeup inlet from the west deep basin to the existing SFP piping. One line will be used to connect the hose for SFP makeup, and the third will be used to connect the hose for spray over the SFP.
- New transfer switches and welding receptacles will be installed adjacent to battery chargers 1C and 1D and near MCCs 8A and 9A to provide connection points for the 480 VAC FLEX DGs for the battery chargers and instrument transformer power. (This is the same modification noted in the Core Cooling Phase 2 section)

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 2:	
Key SFP Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Per NRC Order EA-12-051 Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
FLEX equipment will be stored in storage structures designed and constructed to meet the requirements of NEI 12-06.	

Maintain Spent Fuel Pool Cooling		
BWR Portable Equipment Phase 2:		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
• The pump used to provide the SFP cooling and makeup function is the same diesel driven FLEX pump described in the Core Cooling section. See Phase 2 Core Cooling for discussion of deployment strategy for diesel driven FLEX pump. • The monitor spray nozzle and fire hoses needed to spray and/or makeup to the SFP will be kept at an accessible and protected area of the refueling floor or reactor building.	• Install a new connection off of the SFP cooling line upstream of valve V19-50. This new 4" connection will split into three lines, each with an isolation valve. One line will be used as the makeup inlet from the west deep basin to the existing SFP piping. One line will be used to connect the hose for SFP makeup, and the third will be used to connect the hose for spray over the SFP.	See Phase 2 Core Cooling for discussion of protection of connection points for diesel driven FLEX pumps.
Notes:		

Maintain Spent Fuel Pool Cooling	
BWR Portable Equipment Phase 3:	
Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time. Same as Phase 2.	
Schedule:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
See Phase 2 discussion.	
Key SFP Parameter	*List instrumentation credited or recovered for this coping evaluation.*
Spent Fuel Pool Level Per Order EA-12-051 Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
See Phase 2 discussion	See Phase 2 discussion	See Phase 2 discussion
Notes:		

Safety Functions Support
Determine Baseline coping capability with installed coping[4] modifications not including FLEX modifications.
BWR Installed Equipment Phase 1

Provide a general description of the coping strategies using installed equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.

Main Control Room Accessibility

MCR habitability must be maintained for the duration of the ELAP. During the ELAP, some control room vital electronics, instrumentation and emergency lighting remain energized from emergency DC power sources. The current VY calculation for MCR heatup (Reference 1) documents the loss of ventilation analysis for the MCR using the GOTHIC code. The calculation in Reference 1, using a conservative heat load of 61.08 BTU/sec, determined that the MCR temperature reached 110°F around 2.5 hours into the transient. The maximum control room temperature at the end of 4 hours was determined to be 118.1°F. This temperature exceeds 110°F which is the assumed maximum temperature for efficient human performance as described in NUMARC 87-00 (Reference 2).

The Phase 1 FLEX strategy is to remove 11 full size ceiling tiles in the control room back panel area per procedure OP-2192 (Reference 3). The removal of the ceiling tiles allows the air to mix between the two volumes and creates a larger surface area for heat removal from the MCR. A new GOTHIC calculation (Reference 4) indicates that by introducing 10,000 cfm of air at 90°F at 2.4 hours, combining with removing ceiling tiles, the MCR temperature will maintain at 110°F for 72 hours. Procedure OP-2192, Step P.2.b.5 states that "using two smoke ejectors or other portable cooling equipment to create temporary air flow paths" to ventilate the MCR. These smoke ejectors are gasoline powered and are capable of providing 10,000 cfm of flow. These smoke ejectors will be placed in the vicinity of the MCR for easy access and will be stored in a manner that meets the storage requirements of NEI 12-06 for storage of FLEX equipment. In addition to removing ceiling tiles and using two smoke ejectors, procedure OP-2192, Step P.2.b also requires that the MCR doors to be opened and Security notified that the Control Room doors will be opened.

RCIC Room Accessibility

The RCIC room will have a continuous heat load under ELAP conditions in Phases 1 and 2 of the BDBEE, since RCIC is utilized throughout the event as the primary source of core cooling. The current calculation for RCIC room heat up (Reference 5), determined that the RCIC room temperature went from 100°F to 118°F in three hours when no ventilation was assumed. At three hours, the doors were opened and the temperature dropped to a steady state value of 105°F within half an hour due to the chimney effect of air draft through this space. The design area temperature limit for equipment qualification is 148°F as listed in RCIC DBD Section 2.3.9 (Reference 6). Since the temperature in the RCIC room reached steady state value of 105°F within half an hour of opening the doors, the RCIC room temperature is maintained well below design limits during RCIC

[4] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

Safety Functions Support	
operations in Phase 1. Site industrial safety procedures currently address activities with a potential for heat stress to prevent adverse impacts on personnel (Reference 7). References: 1. EC Markup (EC # 17283) to VYC-1502, "Control Room Heatup due to Loss of HVAC", Revision 0 2. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1 3. OP-2192, "Heating, Ventilating, and Air Conditioning System", Revision 71 4. ENERCON Calculation ENTGVY033-CALC-003, "Vermont Yankee Station Control Room Heatup for Extended Loss of AC Power in Support of FLEX", Revision 0 5. Calculation Change Notice 01 to VYC-415, "Appendix R/RCIC, HPCI, & ECCS Room Cooling", Revision 0 6. Vermont Yankee Nuclear Power Station Design Basis Document for Reactor Core Isolation Cooling System , Revision 20 7. EN-IS-108, Working in Hot Environments, Revision 10	
Details:	
Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.	
Identify modifications	*List modifications*
None.	
Key Parameter	*List instrumentation credited for this coping evaluation phase.*
Temperature indication for the MCR is available from a battery powered thermometer the MCR.	
Notes:	

Safety Functions Support

BWR Portable Equipment Phase 2

Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.

Main Control Room Accessibility

The strategy for maintaining the environment of the MCR during Phase 2 will be the same as that for Phase 1.

RCIC Room Accessibility

The temperature in the RCIC room reached a steady state value of 105°F within half an hour of opening the doors. The RCIC room temperature is maintained well below design limits during RCIC operations in Phases 1 and Phase 2.

Engineered Safety Feature (ESF) Switchgear Rooms

Per Reference 1, the maximum operating temperature for the equipment in the switchgear room is 114°F. The current switchgear room heat up GOTHIC calculation VYC-1086 (Reference 1) showed that the East switchgear room temperature reached a steady state value of 110°F while the West switchgear room temperature reached a steady state value of 114°F at the end of 24 hours without ventilation. This case assumed that all doors were closed. If the doors were opened, the steady state temperatures at 24 hours in the East and West switchgear room were 108°F and 105°F, respectively. The normal operation heat loads, which are the highest heat loads, were used in these calculations. Since no electrical equipment will be operating during an ELAP, there are essentially no heat loads in the switchgear rooms. Since the temperature will remain below 114°F even with normal operation heat loads, no modifications are proposed for the ESF switchgear rooms.

Battery Room Ventilation

During battery charging operations in Phase 2, ventilation will be required in the main battery rooms due to hydrogen generation. At Vermont Yankee, a common ventilation system is supplied for the rooms in which Main Station Batteries A-1 and B-1 are located. On loss of ventilation system, the temperature in the battery rooms would not exceed 100°F in the summer and would not fall below 60°F in the winter. The Main Station Batteries A-1 and B-1 are capable of delivering their rated output at these temperatures (Reference 2, Section 8.6.4).

The accumulation of hydrogen from the batteries located in the Battery Room would not exceed 4% concentration in the Battery Room in 2 ½ days (36 hours) with a complete loss of the ventilation system (Reference 2, Section 8.6.4).

Because the battery load calculations indicate the batteries will remain with sufficient power for at least 9.5 hours (Reference 3), the batteries will likely not be placed on charge until at least 7 hours after event initiation. Hydrogen generation does not occur unless the batteries are on charge.

There are two strategies for venting the battery rooms. The primary strategy will be to repower the existing exhaust fan which is connected to the Emergency Power bus. The alternate strategy will be to prop open doors and set up portable fans.

Safety Functions Support

BWR Portable Equipment Phase 2

Spent Fuel Pool Area

Per the NEI 12-06 guidance, a baseline capability for Spent Fuel Cooling is to provide a vent pathway for steam and condensate from the SFP. Currently, there are no vents in the Spent Fuel Pool area aside from personnel hatch. As identified in the plant procedure PP 7019 (Reference 4), the following operator actions will be taken to promote natural circulation air cooling over the SFP:

a. Open stairway doors at all Reactor Building elevations.
b. Ensure equipment hatch is not blocked.
c. Prop open Reactor Building airlock doors to allow air flow up stairways and equipment hatch.
d. If possible, create a high point opening above the Reactor Building 345' elevation.

References:

1. VYC-1086, "Vermont Yankee Switchgear Room Heatup Analysis Using GOTHIC", Revision 0
2. Vermont Yankee Nuclear Power Station UFSAR, Rev. 25
3. ENERCON Calculation ENTGVY033-CALC-005, "Station Batteries A-1 and B-1 Discharge Capacity during Extended Loss of AC Power", Revision 0
4. Plant procedure PP 7019, Appendix G, "Loss of Large Area of the plant due to Fire or Explosion", Rev. 15

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*

Entergy will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

Identify modifications	*List modifications*

New transfer switches and welding receptacles will be installed adjacent to battery chargers 1C and 1D and near MCCs 8A and 9A to provide connection points for the 480 VAC FLEX DGs for the battery chargers and instrument transformer power. (This is the same modification noted in the Core Cooling Phase 2 section)

Key Parameter	*List instrumentation credited for this coping evaluation phase.*

Phase 2 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.

Safety Functions Support	
BWR Portable Equipment Phase 2	
Storage / Protection of Equipment : **Describe storage / protection plan or schedule to determine storage requirements**	
Seismic	*List how equipment will be protected or scheduled to protect*
FLEX fans will be stored in storage buildings designed and protected for seismic concerns in accordance with NEI 12-06.	
Flooding Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level.	*List how equipment will be protected or scheduled to protect*
FLEX fans will be stored in storage buildings designed and protected for external flooding concerns in accordance with NEI 12-06.	
Severe Storms with High Winds	*List how equipment will be protected or scheduled to protect*
FLEX fans will be stored in storage buildings designed and protected for storms and high winds in accordance with NEI 12-06.	
Snow, Ice, and Extreme Cold	*List how equipment will be protected or scheduled to protect*
FLEX fans will be stored in storage buildings designed and protected for snow, ice, and extreme cold in accordance with NEI 12-06.	
High Temperatures	*List how equipment will be protected or scheduled to protect*
FLEX fans will be stored in storage buildings designed and protected for high temperatures in accordance with NEI 12-06.	

Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection will be protected*
The fans that will be used for battery room ventilation will be stored in the FLEX Storage Building.	No other modifications are necessary.	No connections are required.

Safety Functions Support
BWR Portable Equipment Phase 2
Notes:

Safety Functions Support
BWR Portable Equipment Phase 3

Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.

Main Control Room Accessibility

During Phase 3, the MCR HVAC system will be powered by the RRC FLEX 4160 DG.

RHR Rooms Accessibility

As part of Phase 3 strategies, an RHR pump and two RHR Service Water pumps will be placed into service in order to perform torus cooling and shutdown cooling. Therefore heat will be added to the RHR rooms due to heat generated by the RHR and RHRSW pump motors as well as heat dissipated from the associated piping and RHR heat exchanger. For long term RHR and RHRSW pump operation, the RHR pump room must be cooled to maintain room temperatures below the maximum design temperature of 148°F.

At the beginning of Phase 3, the RRUs (room coolers) will become available. The heat load generated by the RHR and RHRSW pumps will be removed by the RRUs so no room heatup is expected during Phase 3. Reference 1 determined that the RHR rooms will reach a steady state temperature below the maximum design temperature of 148°F.

Other Support Requirements

Other areas of support required in Phase 3 are the same as described in the Phase 2 section of Safety Function Support.

References:

1. ENERCON Calculation ENTGVY033-CALC-004, "Vermont Yankee Station ECCS Room Heatup for Extended Loss of AC Power in Support of FLEX", Revision 0

Details:

Provide a brief description of Procedures / Strategies / Guidelines	*Confirm that procedure/guidance exists or will be developed to support implementation*
See Phase 2 discussion.	
Identify modifications	*List modifications*
See Phase 2 discussion.	
Key Containment Parameters	*List instrumentation credited or recovered for this coping evaluation.*
Phase 3 FLEX equipment will have installed local instrumentation needed to operate the equipment. The use of these instruments will be described in the associated procedures for use of the equipment. These procedures will be based on inputs from the equipment suppliers, operation experience and expected equipment function in an ELAP.	

Safety Functions Support		
BWR Portable Equipment Phase 3		
Deployment Conceptual Design **(Attachment 3 contains Conceptual Sketches)**		
Strategy	**Modifications**	**Protection of connections**
Identify Strategy including how the equipment will be deployed to the point of use.	*Identify modifications*	*Identify how the connection is protected*
See Phase 2, Safety Functions Support	See Phase 2, Safety Functions Support	See Phase 2, Safety Functions Support
Notes:		

BWR Portable Equipment Phase 2							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Maintenance*
List portable equipment [(1)]	Core	Containment	SFP	Instrumentation	Accessibility		Maintenance / PM requirements
Two (2) Self-Priming diesel driven FLEX Pumps	X		X			500 gpm with total dynamic head of 500 ft @ 1700 rpm Diesel fuel and required hoses	Will follow EPRI template requirements
Two (2) Vehicles					X	Vehicles with sufficient rating that can tow the pumps and DGs.	Will follow EPRI template requirements
Two (2) 480 VAC 600kW Diesel Generators	X	X		X		600kw, 480 VAC, 3 Phase	Will follow EPRI template requirements
Four (4) 480 VAC 60kW Diesel Generators				X		60kw, 480 VAC, 3 Phase	Will follow EPRI template requirements
Four (4) Portable fans					X	5000 CFM	Will follow EPRI template requirements
Two (2) 500 gal. Diesel Tank Carts	X		X	X		500 gallon tank	Will follow EPRI template requirements
Two (2) Monitor Spray Nozzles for SFP Spray and required hoses			X			Sized for 250 gpm	Will follow EPRI template requirements
Two (2) Fuel Transfer pump/cart	X	X		X		28 gallon capacity	Will follow EPRI template requirements
Two (2) 4" Storz splitters for makeup to CST, SFP and RPV injection	X		X			Size: 4"	Will follow EPRI template requirements
Two (2) Portable Generator with Wheeled Cart – CR lighting, fans, lights					X	12kw, 92amp, 120V Cables - #1 per Phase	Will follow EPRI template requirements
Two (2) 125 cubic feet Nitrogen Bottles	X					125 cubic feet	Will follow EPRI template requirements

Notes:

(1) The number of storage locations has not been determined. For the purposes of this table two storage locations have been assumed which results in the number of sets of FLEX equipment to be equal to 2N.

BWR Portable Equipment Phase 3							
Use and (potential / flexibility) diverse uses						*Performance Criteria*	*Notes*
List portable equipment	Core	Containment	SFP	Instrumentation	Accessibility		
Tanker Truck	**X**		**X**			N/A	Supply as required to supply makeup to West Deep Basin
One (1) 4160VAC Diesel Generators	**X**	**X**	**X**	**X**		3000 kW, 4160 VAC, 3 Phase	To power RHR, and RHRSW pumps etc.
One (1) set of Suction hoses and strainers, 5" discharge hoses, and fittings	**X**	**X**	**X**			N/A	Discharge hoses shall fit on diesel driven FLEX Pump and connect to existing RHRSW manifold in the North East Corner Room via new penetration to be installed in the south wall of the Reactor Building near the CST.
Two (2) sets of cables for connecting portable generators	**X**			**X**	**X**	N/A	Supply as required
Six (6) Portable ventilation fans	**X**	**X**	**X**	**X**		N/A	Supply as required
Three (3) Diesel Generator fuel transfer pump and hoses	**X**	**X**	**X**	**X**		N/A	Supply as required. To ensure transfer capability of site fuel to portable equipment

Phase 3 Response Equipment/Commodities	
Item	**Notes**
Radiation Protection Equipment • Survey instruments • Dosimetry • Off-site monitoring/sampling	
Commodities • Food • Potable water	
Fuel Requirements • Diesel Fuel	
Heavy Equipment • Transportation equipment • Debris clearing equipment	
Portable Lighting	
Portable Toilets	

Attachment 1A
Sequence of Events Timeline

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
	0	**Event Starts**	N	Plant @100% power
1	60 sec	RCIC/HPCI starts on reactor water level low-low signal	N	Reactor operator initiates or verifies initiation of reactor water level restoration with steam driven high pressure injection.
2	10-35 min	Operators override the auto-swap of RCIC and HPCI suction valves in accordance with EOPs to maintain suction from the CST	Y	Time critical at the point when torus water level reaches the high level setpoint which would initiate the automatic swap of the RCIC and HPCI suction from the CST to the torus. Swap must be overridden to keep suction on CST as required by EOPs.
3	1 hour	HPCI secured.	N	If operators do not secure HPCI, HPCI will trip automatically when reactor level reaches the high level setpoint. With RCPB intact, RCIC can recover/maintain level.
4	1 hr	Attempts to start EDGs have been unsuccessful. Enter FLEX event response Procedure	Y	Time critical at a time greater than 1 hour. Entry into ELAP provides guidance to operators to perform ELAP actions.
5	1 hr	DC Load shed complete	Y	DC buses are readily available for operator access and breakers will be appropriately identified in SBO procedure to indicate which breakers are required to be opened.
6	2.4 hr	Operator actions to open MCR doors, remove ceiling tiles and deploy smoke ejectors to ventilate the MCR.	Y	Time critical at approximately 2.4 hours to stem the rise in MCR temperatures.
7	7.5 hr	Using manual control of SRVs depressurize the RPV IAW EOPs (to approximately 200 – 400 psig) to keep	Y	Time critical at the point of entering the Unsafe Region of the HCTL Curve.

[5] Instructions: Provide justification if No or NA is selected in the remark column
If yes include technical basis discussion as requires by NEI 12-06 section 3.2.1.7

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
		in the Safe Region of the HCTL curve. During the heatup of the SP, EOPs direct operators to take action to stay out of the Unsafe Region of the HCTL curve. This is accomplished by reducing reactor pressure. However per MAAP analysis, at approximately 7.5 hours reactor pressure and SP temperature cannot be maintained outside of the Unsafe Region. This requires full emergency depressurization. However, EOPs will allow stopping the depressurization at a pressure that is sufficient to continue operation of RCIC.		(Approximately 7.5 hours). EOPs require operators to keep reactor pressure and temperature from causing entry into unsafe region of HCTL curve
8	8 hr	Power up the station battery chargers using a FLEX 480 VAC DG to supply power to Bus 8 or 9.	Y	Time critical after 8 hours. Batteries durations are calculated to last at least 9 hours
9	9.5 hr	Transition from Phase 1 to Phase 2 for Core cooling function by placing diesel driven FLEX pump in service to make up to the CST.	Y	Diesel driven FLEX pumps will be staged beginning at approximately 6 – 8 hours time frame. This activity is time critical at the time that CST inventory becomes depleted of its initial volume. CST volume is estimated to be sufficient out to 9.5 hours.
10	14 hr	Initiate use of Hardened Containment Vents per EOPs to maintain containment parameters within limits.	Y	Containment is vented to prevent containment pressure from reaching its design limit of 56 psig and to maintain other containment limits (containment temperature, torus temperature, torus level) at reasonable values below their limits. MAAP analysis indicates that the containment pressure limit would be exceeded at approximately 20 hours. However, to keep from approaching this limit and the other containment limits (noted above), the vents are assumed to open early at approximately 30 psig which is reached at approximately 14 hours. The early venting will result in the lower torus level,

Action item	Elapsed Time	Action	ELAP New Time Constraint Y/N [5]	Remarks / Applicability
				temperature, and pressure during the 72 hours. The constraint can be met because CHVS is seismic and powered by DC buses with nitrogen supplied from the Nitrogen storage bottle to operate the RHVS valves
11	28 hr	Begin makeup to SFP as necessary to maintain adequate level in the SFP. (Boiling under design basis conditions begins at 29 hours and requires approximately 20 gpm makeup). The following actions will be taken to promote natural circulation air cooling over the SFP: a. Open stairway doors at all Reactor Building elevations. b. Ensure equipment hatch is not blocked. c. Prop open Reactor Building airlock doors to allow air flow up stairways and equipment hatch. d. Create a high point opening above the Reactor Building 345' elevation.	N	Boil-off rate is slow with a large volume of water in the SFP
12	72 hr	Transition from Phase 2 to Phase 3 for Core Cooling function by placing RHR System in shutdown cooling mode. Cooling water supplied to RHR HX from the existing ACS System.. Requires staging and operation of 4160 VAC RRC Portable DGs	N	If some reason exists that prevents going to cold shutdown, then the plant can be maintained in a stable condition with diesel driven FLEX pumps in service for injection or makeup to CST.

Attachment 2
Milestone Schedule

The following milestone schedule is provided. The dates are planning dates subject to change as design and implementation details are developed. Any changes to the following target dates will be reflected in the subsequent 6 month status reports.

Original Target Date	Activity	Status *{Include date changes in this column}*
10/26/12	Submit 60 Day Status Report	Complete
2/28/13	Submit Overall Integrated Implementation Plan	Complete
Spring 2014	Purchase Equipment	
8/28/13	Submit 6 Month Status Report	
Fall 2013	Develop Mods	
Spring 2014	Develop Strategies/Playbook with RRC	
Spring 2014	Procure Equipment	
Summer 2013	Perform Staffing Analysis	
Summer 2014	Issue FLEX Support Guidelines (FSGs)	
2/28/14	Submit 6 Month Status Report	
Summer 2014	Create Maintenance Procedures	
8/28/14	Submit 6 Month Status Report	
Summer 2014	Procedure Changes Training Material Complete	
Spring 2014	Develop Training Plan	
Fall 2014	Implementation Outage	
Fall 2014	Implement Training	
Fall 2014	Implement Mods	
Fall 2014	Submit Completion Report	

Attachment 3
Conceptual Sketches

(Conceptual sketches, as necessary to indicate equipment which is installed or equipment hookups necessary for the strategies.)

Figure 1 –Flow Diagram for FLEX Strategies

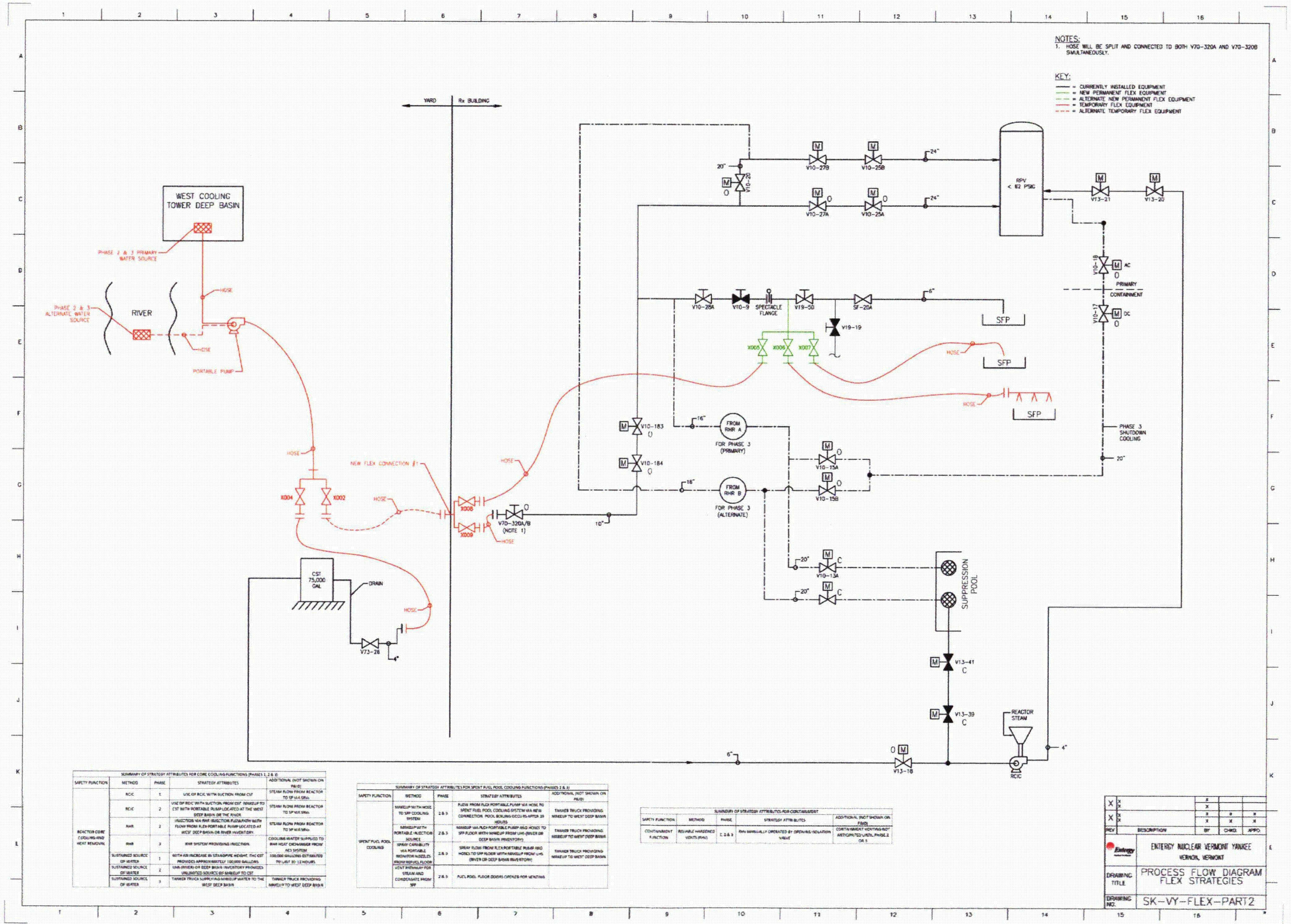
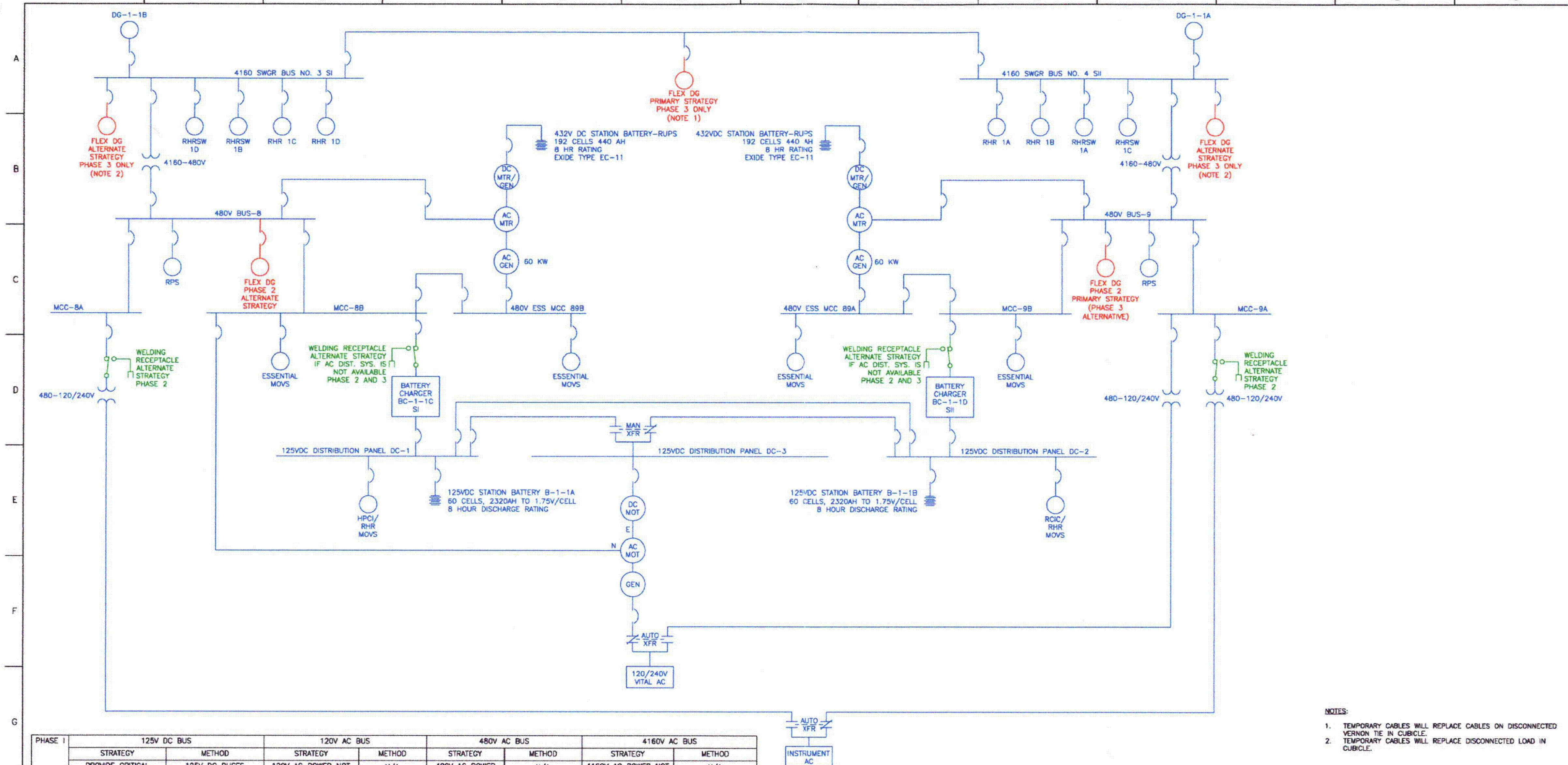


Figure 2 - Electrical Diagram for FLEX Strategies



PHASE I	125V DC BUS		120V AC BUS		480V AC BUS		4160V AC BUS	
	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD	STRATEGY	METHOD
	PROVIDE CRITICAL INSTRUMENTATION RCIC	125V DC BUSES SUPPLIED BY STATION BATTERIES B-1-1A & B-1-1B	120V AC POWER NOT AVAILABLE	N/A	480V AC POWER NOT AVAILABLE	N/A	4160V AC POWER NOT AVAILABLE	N/A
PHASE II	CHARGE 125V DC BATTERIES CRITICAL INSTRUMENTS RCIC CR EMERGENCY LIGHTING	POWER 480V BUS 8 OR 9 FROM FLEX DG TO SUPPLY BATTERY	POWER 120V AC INSTRUMENT POWER BUS POWER PLANT PA POWER PLANT COMMUNICATIONS	POWER 120V AC INSTRUMENT BUS VIA FLEX DG WITH 480V BUS	POWER 480V BUS 8 & 9 POWER BATTERY CHARGERS POWER 480V MCC	POWER 480V BUS 8 & 9 VIA FLEX DG	4160V AC POWER NOT AVAILABLE	N/A
PHASE III	CHARGE 125V DC BATTERIES POWER CRITICAL INSTRUMENTS POWER RCIC CR EMERGENCY LIGHTING MISCELLANEOUS LOADS	POWER 480V BUS FROM FLEX DG	POWER 120V AC INSTRUMENT BUS POWER PLANT PA	POWER 120V AC INSTRUMENT BUS VIA FLEX DG WITH 480V BUS	POWER 480V BUS 8 & 9 POWER BATTERY CHARGERS POWER 480V MCC	POWER 480V BUS 8 & 9 VIA FLEX DG	POWER 4160V AC BUS	POWER 4160V AC BUS VIA RRC FLEX DG DISCONNECT 480V DG AS POWER TO 4160V AC BUS IS ESTABLISHED

NOTES:

1. TEMPORARY CABLES WILL REPLACE CABLES ON DISCONNECTED VERNON TIE IN CUBICLE.
2. TEMPORARY CABLES WILL REPLACE DISCONNECTED LOAD IN CUBICLE.

KEY:

BLUE - CURRENTLY INSTALLED EQUIPMENT
GREEN - NEW PERMANENT EQUIPMENT
RED - TEMPORARY FLEX EQUIPMENT

REV	DESCRIPTION	BY	CHKD.	APPD.
X	X X	x X		
X	X X	x X	x X	x X

Entergy — ENTERGY NUCLEAR VERMONT YANKEE, VERNON, VERMONT

DRAWING TITLE: ELECTRICAL DIAGRAM FOR FLEX STRATEGIES

DRAWING NO.: ENTGVY-FLEX - 1

Figure 3 - Site Layout