VALLECITOS NUCLEAR CENTER

REACTOR FACILITIES
RADIOLOGICAL EMERGENCY PLAN

Revised & Approved

June 2019

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DOCUMENT REVIEW

This document is required to be reviewed **Biennially**.

Reviews finding technical or procedural errors will require immediate correction by revision. The first (original) review of any revision will be located on the front cover of this plan. Reviews finding administrative/format errors may be noted in the comments and corrected as time permits.

Electronic Signatures are authorized for review and approval.

Date	Reviewer	Comments (if necessary)

1 INTRODUCTION

Planning Standard (ANSI/ANS-15.16 Section 3.1 & NUREG-0849 Section 1.0)

The plan shall briefly introduce the type of reactor, the reactor's purpose, where it is located, and the purposes of the emergency plan.

The purpose of the introduction is to provide a general orientation and common understanding about the reactor and the objectives of the plan for those members of the reactor organization, the public, and local, county, state, and federal agencies that will read and study the plan.

1.1 Objective

This emergency plan contains security related information and describes the approach used to identify, communicate, respond to and minimize the consequences of classified emergencies; it documents regulatory compliance and site specific commitments; and provides a basis for the response and maintenance implementing procedure instructions. This plan will be provided to external stakeholders as appropriate.

1.2 Scope and Regulatory Basis

1.2.1 Scope

There are four reactor facilities at the Vallecitos Nuclear Center (VNC) that are licensed by the NRC under 10 CFR 50 requirements; the Nuclear Test Reactor (NTR), which has a current operating license, and the other three reactor facilities which are in a shutdown SAFSTOR decommissioning mode with possess only licenses:

- Vallecitos Boiling Water Reactor (VBWR) DPR-1
- ESADA Vallecitos Experimental Superheat Reactor (EVESR) DR-10
- GE Test Reactor (GETR) TR-1

This emergency plan has been developed for the NTR, license R-33, in accordance with the applicable regulations, guidance and information documents. Per NRC letter dated 03/19/13 and DRK-2013-14 response the NTR emergency plan and implementing procedures are sufficient to meet the emergency planning requirements for the three shutdown defueled reactors (spent fuel for the SAFSTOR facilities is no longer maintained or stored on site).

Other VNC facilities which are governed under Special Nuclear Material (SNM) federal and state licenses do not contain sufficient radioactive materials to require an emergency plan (NRC Letter SNM-960 Amendment 5 12/20/90 and GEH 03/08/18 Memo, Evaluation that a VNC Radiological Emergency Plan is not Required for Radioactive Material Authorized by the State of California).

- Building 102 contains administrative offices and shielded facilities (hotcells) for experiments, sealed source manufacture, and examination of irradiated materials. The building also includes radiological equipment repair and refurbishment shop areas, the storage pool and dry pit storage as well as a radiochemistry laboratory equipped with standard chemical and radiochemical apparatus.

- Building 103 consists of administrative offices and laboratories equipped and designed to handle small amounts of radioactive materials in the performance of research, development, and analytical chemistry and metallurgical services.
- Building 105 contains laboratory areas with equipment for research and special measurement that involves minimal amounts of radioactive material used in conjunction with spectrometric equipment.
- Building 106 houses support facilities (e.g., electrical shop, instrument shop, radiological instrument calibration facilities, etc.), an x-ray room, and offices.
- Building 349 contains the site low-level liquid waste evaporator.
- 400 and 401 Areas consists of offices and spaces that may contain laboratory quantities of radioactive material.
- Hillside Storage Area is used to store Low Level Radwaste. Irradiated fuel segments and hardware are stored in the [[ ]] area.

The VNC Emergency Response Organization (ERO) may be used to address events occurring at those facilities outside of a declared emergency. Event response involving SNM facilities are primarily controlled through site industrial / hazards procedures that are outside the scope of this emergency plan.

1.2.2 NTR Regulatory Basis

NRC Regulatory Guide 2.6, Emergency Planning for Research and Test Reactors, provides test and research reactor licensees with a method that the NRC considers acceptable for use in complying with the following regulations on the content of their emergency plans:

- 10 CFR 50.34(b)(6)(v) requires that each application for a Part 50 license to operate a facility include a final safety analysis report that contains, along with other information, the applicant's plans for coping with emergencies, including the items specified in Appendix E to 10 CFR 50.

  Note – NTR is the only facility at VNC that is required to maintain a safety analysis report.

- 10 CFR 50.54(q) requires Part 50 licensees to follow and maintain the effectiveness of emergency plans that meet the requirements of 10 CFR 50 Appendix E.

- 10 CFR 50 Appendix E identifies the minimum requirements for emergency plans. It also indicates that because operation of test reactors involve distinct considerations, the size of the emergency preparedness zone (EPZ) and degree of compliance with requirements in Appendix E, sections I through V, as necessary, will be determined on a case-by-case basis using this regulatory guide for research and test reactor, and other non-power production and utilization facility emergency response plans.

Regulatory Guide 2.6 Revision 2 endorses the consensus standard ANSI/ANS-15.16-2015, stating that it provides specific acceptance criteria that; (1) comply with the applicable requirements contained in the above listed regulations, and (2) supply a basis to develop acceptable emergency response plans and improve emergency preparedness.

Consistent with ANSI/ANS-15.16, NUREG-0849 provides areas of review, planning standards, and items for NRC staff to evaluate a licensee's compliance with the applicable emergency planning requirements. NUREG-0849 is used as a basis for the level of planning detail included in this document.

1.3 Location

VNC, owned and operated by General Electric Hitachi (GEH), is located in the west-central portion of the State of California about 15 miles east of the southern end of San Francisco Bay, approximately 35 air miles east-southeast of San Francisco and 20 air miles north of San Jose. It lies on the north side of the Vallecitos Valley. The nearest sizeable towns are Pleasanton, located 4.1 miles to the north-northwest and Livermore, located 6.2 miles to the northeast.

The site is on the north side of Vallecitos Road (State Route 84), which is a two and four-lane paved highway. The majority of the site is undeveloped with hills ranging in elevation from 600 to 900 feet above mean sea level. Access to Vallecitos Road from the south-west is via Interstate Highway 680, and from the north-east via Stanley Boulevard or Interstate Highway 580.

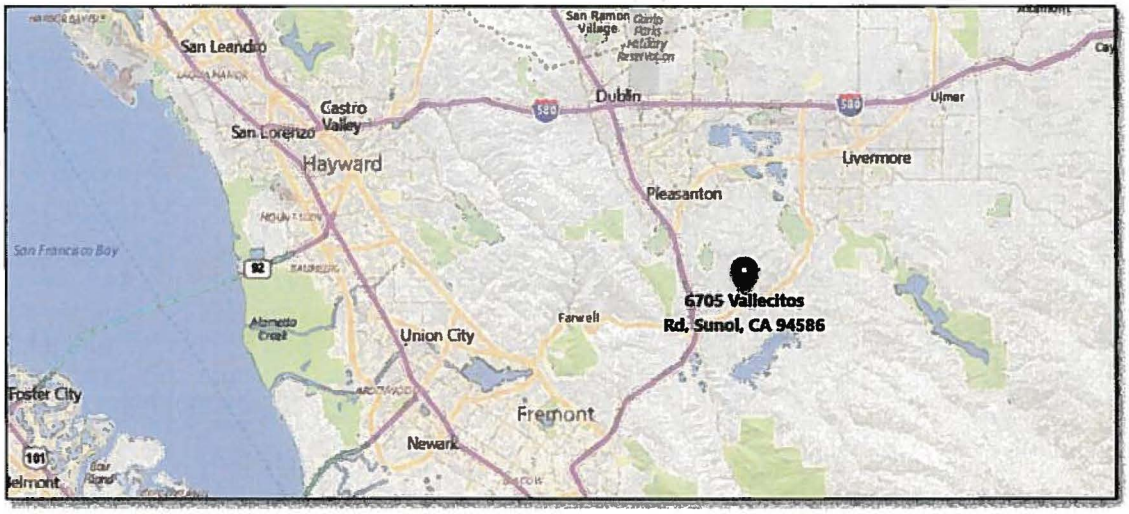

Figure 1-1 – VNC Bay Area Map

1.4 Reactor Description

The NTR, located in Building 105, is a heterogeneous enriched-uranium graphite-moderated and -reflected light-water-cooled thermal reactor. The reactor is a variable level neutron source used in the research, development, analytical and commercial programs of GEH and its customers. The NTR is primarily engaged in neutron radiography non-destructive material imaging. Per the General Electric Nuclear Test Reactor Safety Analysis Report Section 1.1, the NTR is licensed to operate at power levels not in excess of 100 kW (thermal).

GETR and related structures are located in the 200 Area. VBWR and EVESR and related structures are located in the 300 Area. These facilities are not occupied. Only relatively minor activities associated with inspection and maintenance of the deactivated facilities are currently performed. No fuel assemblies from these reactors remain on-site. Radiation and contamination levels in all of the SAFSTOR facilities are significantly reduced since shut-down several decades ago and well below values typical of operating research & test reactors.

Those and other areas regulated under separate licenses at VNC that contain radioactive material are illustrated Figure 1-2.

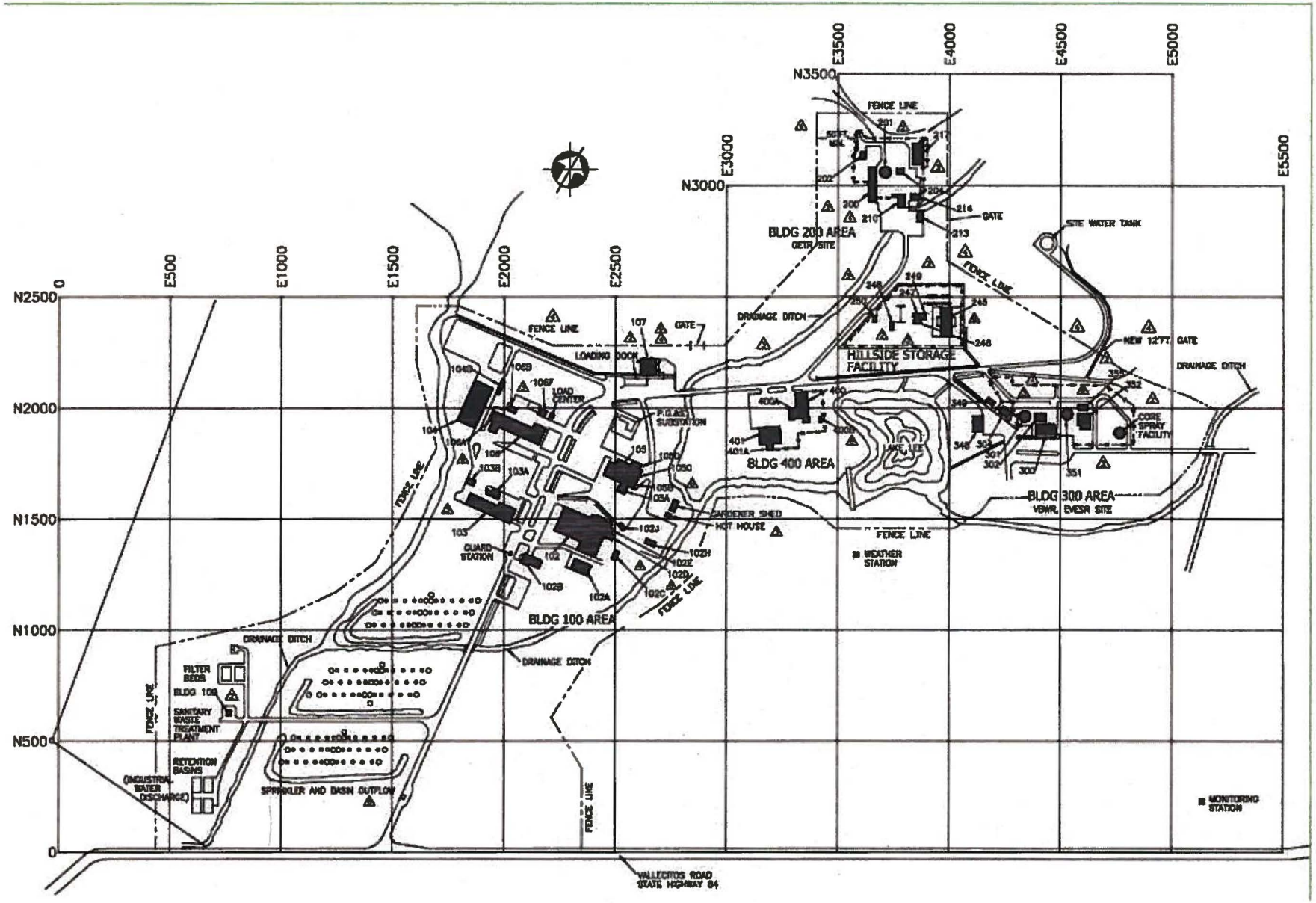

Figure 1-2 – VNC Site Layout

2 DEFINITIONS

Planning Standard (& ANSI/ANS-15.16 Section 3.2 & NUREG-0849 Section 2.0)

Terms unique to the reactor facility or that have a special meaning when used in the plan shall be defined in the plan.

Assessment Actions – Those actions taken during or after an emergency to obtain and process information necessary to make decisions to implement corrective, protective and recovery actions.

Corrective Actions – Those actions taken to arrest and terminate an emergency.

Direct – Directing involves obtaining data and recommendations, processing this input, and then ensuring the performance of one or more actions or activities such as additional assessment, protective or corrective actions. The performance of actions or activities is generally through responsible intermediaries.

Emergency Action Level (EAL) – A pre-determined, site-specific, observable threshold for an initiating condition that, when met or exceeded, result in actions such as (a) establishing emergency classes and (b) initiating appropriate emergency measures.

Emergency Classification Level (ECL) – One of a set of names or titles established by the US Nuclear Regulatory Commission (NRC) for grouping off-normal events or conditions according to (1) potential or actual effects or consequences, and (2) resulting onsite and offsite response actions. The emergency classification levels, in ascending order of severity, are:

- Unusual Event (UE)
- Alert
- Site Area Emergency (SAE)
- General Emergency (GE)

Emergency Control Center (ECC) – The primary base of VNC emergency operations during a declared event to facilitate the management and coordination of overall emergency response.

Emergency Planning Zone (EPZ) – Area for which off-site emergency planning is performed to assure that prompt and effective actions can be taken to protect the public in the event of an accident. The EPZ size is dependent on reactor power level and the distance beyond the site boundary at which the protective action guides could be exceeded.

Refer to Section 6 for the VNC facility specific EPZs.

Fire – Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

Holding Statement – A statement reviewed and approved for accuracy prior to issuance, that provides prepared information to distribute in response to rumors or inquiries from news or social media outlets, community officials, regulatory agencies, or other interested parties.

Off-Normal Condition – A situation or event, other than those addressed by site personnel on a routine basis, which are evaluated for emergency plan entry by the Emergency Director.

Off-Site – The geographical area that is beyond the site boundary.

On-Site – The geographical area that is within the site boundary.

Operations Boundary – The area within the site boundary such as the reactor building (or the nearest physical personnel barrier in cases where the reactor building is not a principal physical personnel barrier) where GEH has direct authority over all activities. The area within this boundary shall have prearranged evacuation procedures known to personnel frequenting the area.

Refer to Section 6 for the site specific reactor facility operational boundaries.

Protective Actions – Those actions taken to mitigate the consequences of an emergency.

Recovery Actions – Those actions taken after an emergency to restore the area to the pre-emergency condition.

Site Boundary – The site boundary is a boundary that does not necessarily have restrictive barriers and surrounds the operations boundary wherein GEH may directly initiate emergency activities. The area within the site boundary may be frequented by people unacquainted with the reactor operations.

For purposes of this plan, the site boundary is the GEH property fence designated as the Vallecitos Nuclear Center.

3 ORGANIZATION AND RESPONSIBILITIES

Planning Standard (ANSI/ANS-15.16 Section 3.3 & NUREG-0849 Section 3.0)

Responsibility for planning and implementing all emergency measures within the site boundary rests with the owner/operator of the reactor facility. The plan shall describe the emergency organization that would be activated to cope with radiological emergencies that includes the on-site emergency organization and any augmentation from off-site groups. Persons or groups that will fill positions in the emergency organization should be identified by their normal everyday title.

3.1 VNC Emergency Response Organization (ERO)

VNC emergency preparedness response adapts the normal site organization into an ERO that is activated upon declaration of an emergency classification level. The VNC ERO is shown below.

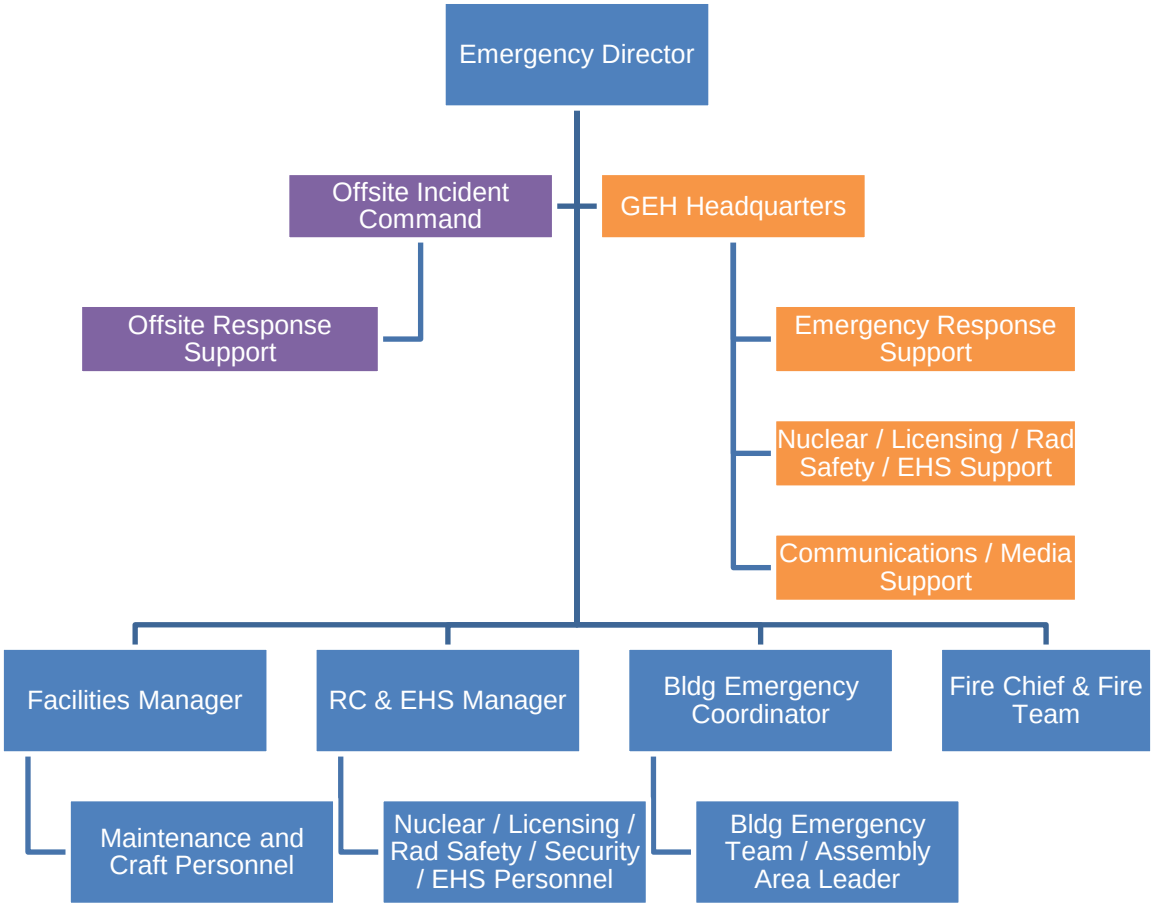

Figure 3-1 – VNC Emergency Response Organization and Support Interface

An off-normal condition is initially evaluated by the Emergency Director. An Emergency Director is present on site whenever the reactor (NTR) is operational or entries into EVESR, GETR, or VBWR are in progress. Otherwise, the Emergency Director may be offsite.

When the Emergency Director is on site, they are typically made aware of an off-normal condition [[
]]. When the Emergency Director is not on site they will be contacted by [[
]]. [[
]]

Following evaluation of the event, the Emergency Director will determine whether an emergency declaration is warranted, staff the appropriate ERO positions and notify Federal and State agencies.

Responsibilities and authority of members of the ERO, management, and support specialists include those listed below. Additional responsibilities and duties may be assigned in implementing procedures.

3.1.1 Emergency Director

As part of overall command and control of the event, the Emergency Director coordinates the collection and evaluation of information from the event location, prioritizes response and mitigating activities of dispatched personnel, and manages the Emergency Control Center (ECC) and ERO in order to provide continuous assessment of the situation regarding the magnitude of the emergency, projected consequences, and effectiveness of the response measures taken.

Specifically, the Emergency Director has the overall responsibility and authority for VNC emergency response activities, including:

- Classifying and declaring emergencies
- Designating a location for the ECC, [[ ]]
- Ensuring notification of the VNC ERO and augmenting as necessary
- Ensuring notification of the appropriate offsite agencies
- Mobilizing corporate and other support resources as necessary
- Coordinating response activities (including off-site assistance if requested) to mitigate the consequences of the event
- Directing on-site protective actions to prevent or minimize personnel hazard and injury
- Authorizing reentry into facilities or areas that may have been evacuated during the emergency
- Authorizing volunteer emergency workers to incur radiation exposures in excess of normal occupational limits
- Escalating the emergency classification level or terminating the event

These responsibilities can only be delegated to other personnel qualified as an Emergency Director.

The Emergency Director is also responsible for providing holding statement information about the emergency to the corporate communications and public relations function for release to the news media and the public.

3.1.2 [[ ]]

[[

]]

[[

]]

3.1.3 [[ ]]

[[

]] [[

]] This includes dose assessments and recommendation of on-site protective actions as appropriate.

3.1.4 [[ ]]

[[ ]] repair/damage control teams associated with accident mitigation. The [[ ]] assesses the personnel resources and technical skill levels required to mitigate the emergency situation and requests augmentation of the ERO staff as appropriate.

3.1.4.1 [[ ]]

[[

]] to emergencies during normal working hours and may be called in during off-hours to assist in emergencies.

3.1.5 [[

]]

[[ ]] is responsible for supporting assessment of the emergency and directing assessment, corrective, and protective activities concerning criticality safety and radiation protection.

3.1.6 [[ ]]

[[ ]] who will respond to an emergency during normal working hours, communicate conditions and take local corrective and protective actions. If needed, the BET may be called in during off-hours. The BET includes personnel trained to perform emergency response activities which may include first aid, radiation monitoring, and equipment operation and maintenance particular to their facility.

3.1.6.1 [[ ]]

[[
]]They are responsible for communicating with the BEC and for accounting for all personnel who work in the evacuated area.

3.1.7 [[ ]]

[[ ]] when onsite and may be called in during off-hours. They are [[
]]

[[
]] Fires which have progressed or threaten to progress to the interior structural fire stage or during off-hours will be handled by off-site assistance.

3.2 Off-Site Agencies

Federal, state and local agency response assistance is not anticipated since no radiological event at VNC is capable of reaching a level requiring protection of the public (local source term resulting in a release of radioactivity is not sufficient to result in exposure which exceed EPA PAG levels beyond the site boundary).

Offsite agencies are notified of declared emergencies as described in Section 7.

3.2.1 Federal Agencies

Control, responsibility and interface of federal organizations is governed by the National Response Framework (NRF) and the Nuclear/Radiological Incident Annex to the NRF when they are notified of an event at a nuclear research or test reactor facility.

The NRC acts as the lead federal agency with regard to technical matters during a nuclear incident including radiological assistance. The NRC maintains an Incident Response Plan (IRP). The IRP objectives are to provide for protection of the public health and safety, property, and the environment, from the effects of radiological incidents that may occur at licensed facilities. The objectives of the agency plan set forth the organizational and management concepts and responsibilities needed to assure that NRC has an effective emergency response program.

Department of Homeland Security (DHS) may provide leadership capabilities in the event there are incidents related to security.

3.2.2 State Agencies

The California Office of Emergency Services (OES) is the state authority for coordination of all state response. Cal OES is also the primary state response agency that coordinates the state's response to requests for assistance from local jurisdictions.

If an event is of significant magnitude to require establishment of a near site Incident Command Post (ICP), it will be established through Cal OES and the Emergency Director will communicate with and potentially provide a liaison to the ICP to assist in coordinating response efforts.

3.3 Off-Site Support Organizations

Certain supporting services that may be needed during or after a radiological emergency are available from local off-site organizations. These services are described below.

3.3.1 First Aid Assistance

First aid assistance is available through the Alameda County Office of Emergency Services dispatcher (911). Typically, local fire Emergency Medical Service (EMS) units are sent to respond for first aid related issues. However, other trained personal, such as from local law enforcement, may be dispatched for first aid service as determined by the county dispatch process.

A written agreement is maintained with local emergency medical services for assistance that would be requested to come on-site.

3.3.2 Medical Treatment Facilities

Access to local area medical facilities and professional care for radiation-exposed or contaminated individuals requiring medical treatment is provided through written agreement with a private professional organization.

3.3.3 Ambulance Service

Ambulance service is available through the Alameda County Office of Emergency Services dispatcher (911). If the nature of the emergency or injury warrants, 911 is called and injured personnel are transported via ambulance to one of several local area medical facilities.

A written agreement is maintained with a local private ambulance service company regarding transport of injured or ill personnel to an offsite medical treatment facility, who may be contaminated.

3.3.4 Firefighting Assistance

When needed, a request for firefighting assistance will be made through the Alameda County Office of Emergency Services dispatcher (911).

Assistance for VNC is provided by the participants in the California Fire Service and Rescue Emergency Mutual Aid Plan. Typically, the primary response will be from Alameda County Fire Services. If additional assistance beyond the county capability is needed, personnel and equipment are requested through the California Department of Forestry & Fire Protection (CDF).

A written agreement is maintained with local fire services for assistance that would be requested to come on-site.

3.3.5 Police Assistance

Police assistance is available for law enforcement activities and off-site traffic and/or crowd control from county and state law enforcement agencies with jurisdiction over the areas and roadway surrounding VNC.

A written agreement is maintained with local law enforcement for assistance that would be requested to come on-site.

4 EMERGENCY CLASSIFICATION SYSTEM

Planning Standard (ANSI/ANS-15.16 Section 3.4 & NUREG-0849 Section 4.0)

The emergency plan shall describe several classes of emergency situations covering the spectrum of emergency conditions that involve the alerting or activating of progressively larger segments of the emergency organization. To provide for improved communications between the licensee or owner/operator and federal, state, and local agencies and organizations, the most severe accidents are standardized in four classes of emergency conditions that group the accidents according to the severity of off-site radiological consequences. Each emergency plan shall include only those standard classes appropriate for dealing with accident consequences determined to be credible for the specific facility.

Each class of emergency should be associated with particular emergency action levels and with particular immediate actions to provide appropriate graded response.

This plan is based on the classification system described in ANSI/ANS-15.16-2015. Events are standardized in four classes of emergency conditions which group them according to the severity of off-site radiological consequences. These classes in order of increasing severity are:

- Unusual Event
- Alert
- Site Area Emergency
- General Emergency

All four classes are included in this section of the emergency plan for completeness even though credible radiological accident consequences for NTR are covered by the first two classes.

4.1 Unusual Event

Unusual Events may be initiated by either man-made events or natural phenomena that can be recognized as creating a significant hazard potential that was previously nonexistent. There is usually time available to take precautionary and corrective steps to prevent the escalation of the accident or to mitigate the consequences should it occur. No releases of radioactive material requiring off-site responses are expected.

Although the situation may not have caused damage to the reactor, it may warrant an immediate shutdown of the reactor or interruption of nonessential routine functions.

The ED ERO position will be activated, with other ERO positions potentially notified to increase the state of readiness as warranted by the circumstances.

Actions taken in response to this emergency class are:

1. Notify State and NRC of Unusual Event emergency declaration per Section 7.1.2
2. Augment ERO resources if needed
3. Assess and respond

4. Escalate to a more severe class, if appropriate
   or
   Terminate the emergency with verbal summary to offsite authorities

4.2 Alert

Events leading to an Alert would be of such radiological significance as to require notification of the GE and off-site emergency organizations and their response as appropriate for the specific emergency situation. Under this class, it is unlikely that off-site response or monitoring would be necessary. Reactor shutdown is a highly probable response action. Protective evacuations or isolation of certain areas within the operations boundary or within the site boundary may be necessary.

Actions taken in response to this emergency class are:

1. Notify State and NRC of Alert emergency declaration per Section 7.1.2
2. Augment ERO resources and staff the ECC
3. Dispatch on-site monitoring teams
4. Assess and respond
5. Make staff available for consultation with NRC and State on a periodic basis
6. Escalate to a more severe class, if appropriate
   or
   Terminate the emergency with verbal summary to offsite authorities

4.3 Site Area Emergency

A site area emergency may be initiated when events such as major damage of fuel or cladding and actual or imminent failure of other physical barriers containing fission products in reactor fuel or fueled experiments have occurred, and projected off-site radiological consequences exceed action levels in section 5.0. Monitoring at the site boundary should be conducted to assess the need for off-site protective actions. Protective measures on-site may be necessary.

The results of NTR Safety Analysis Report (SAR) Section 13 accident analyses show that there are no credible events that could cause fuel melt or a significant release of fission products from the fuel. Even if catastrophic non-mechanistic failure of the NTR facilities is assumed, there are no potential consequences more severe than those associated with the accidents analyzed in SAR Chapter 13.

SAR Section 13.5.3.1 provides radiological consequence analysis of accidental explosions. Assuming a 1% release and stable atmospheric conditions (inversion), maximum site boundary doses are less than 20 mRem to the thyroid and 1 mRem to the whole body under this combination of circumstances.

SAR Table 13-3 provides dose summaries for site boundary exposure to the NTR Design Basis Accident (DBA), which is an experiment accident event. Total Body 2 hour submersion dose is 4.54E-3 Rem (4.5 mRem) and CDE Thyroid is 1.61E-1 Rem (161 mRem).

The limiting EAL exposure threshold is for 1 hour. [[

]]

4.4 General Emergency

A general emergency may be initiated by accidents that result in an uncontrolled release of radioactive material into the air, water, or ground to the extent that protective actions off-site may be necessary. This class of accident is not credible for most research reactors. Therefore, most research reactors would not include this class as part of their emergency plans.

Refer to the technical basis in Section 4.3, Site Area Emergency, documenting that the NTR radiological source term is insufficient to meet the level of Site Area Emergency or General Emergency classification levels.

5 EMERGENCY ACTION LEVELS

Planning Standard (ANSI/ANS-15.16 Section 3.5 & NUREG-0849 Section 5.0)

Because of the wide diversity of research reactors (power level, engineered safety features, site environment, etc.), those conditions that might initiate or signal a radiological incident having particular off-site consequences will vary widely among facilities. Action levels should be established in terms of effluent monitors or other plant parameters from which the dose rates and radiological effluent releases at the site boundary can be projected.

To establish effluent action levels, facilities that have meteorological information available may base the action levels on actual meteorological conditions; otherwise, the criteria to be used for downwind concentration should be taken from ANSI/ANS-15.7-1977; R1986 (withdrawn), "Research Reactor Site Evaluation," Sec. 4, "Criteria for Downwind Concentration" [3]. Each emergency plan shall establish EALs appropriate for the specific facility and consistent with Table 1.

The emergency plan shall include EALs to initiate protective actions for members of the general public and facility staff on-site.

5.1 Unusual Event

ANSI/ANS-15.16 Table 1 Initiating Condition	VNC Emergency Action Level(s)
Abnormal Radiological Conditions	
Actual or projected radiological effluent at the site boundary that is calculated (or measured) to result in either of the following conditions, both of which are based on an exposure of 24 hours or less: (1) A deep dose equivalent of 0.15 mSv (15 mrem) **OR** (2) A committed effective dose equivalent of 0.15mSv (15 mrem) based on the following considerations: • 100 EC X 24 hours = 2.4 $X10^3$ EC-hour ~0.15 mSv (15 mrem) (for radionuclides other than noble gases) • 50 EC X 24 hours = 1.2 $X10^3$ EC-hour ~0.15 mSv [15 mrem] (for noble gases)	**RU1** Actual or projected dose at the site boundary: • ≥ 15 mrem DDE over a 24-hour period • ≥ 15 mrem CEDE over a 24-hour period **RU2** Actual or projected dose rates at the site boundary: • ≥ 4 mrem/hr DDE • ≥ 20 mrem CDE thyroid for 1 hour of inhalation **RU3** Radiological effluent level (µCi/cc) meet any of the following: • ≥ 2.4E-8 NTR Noble Gas Stack Monitor • ≥ 2.4E-5 NTR Particulate Stack Monitor • ≥ 2.4E-1 from any reactor facility effluent Noble Gas sample • ≥ 4.7E-3 from any reactor facility effluent Halogen sample • ≥ 2.4E-7 from any reactor facility effluent α Particulate sample • ≥ 2.4E-5 from any reactor facility effluent β Particulate sample

ANSI/ANS-15.16 Table 1 Initiating Condition	VNC Emergency Action Level(s)
Security Conditions	
Credible security threat affecting the reactor facility	**SU1** Credible security threat affecting a reactor facility
Receipt of bomb threat affecting the reactor facility	**SU2** Credible bomb threat affecting a reactor facility
Hazardous Conditions	
Report or observation of a severe natural phenomenon affecting the reactor site	**HU1** Report or observation of any of the following severe natural phenomenon affecting the NTR: • Tornado strike within the site boundary • > 75 mph winds for > 1 minute • NTR Seismic Alarm and felt by onsite personnel
Fire within the reactor facility not extinguished within 15 minutes	**HU2** Fire within a reactor facility not extinguished within 15 minutes of detection

5.1.1 RU1 Technical Basis

The RU1 threshold values are directly related to the ANSI/ANS-15.16-2015 initiating condition values.

For the purpose of event declaration, direct measurement by survey instrument adjusted for exposure period is considered equivalent to an isotopic sample and analysis (where the determination of actual DDE and CEDE would not be timely).

5.1.2 RU2 Technical Basis

Per ANSI/ANS-15.16, if the exposure time is < 24 hours, the EC multiplier can be increased proportionately, provided that the values of 2.4×10^3 and 1.2×10^3 EC-hour are used to declare an Unusual Event; the proportional increases are 5 for an alert and 25 for a site area emergency.

Using this relationship, the RU2 threshold values are one fifth the RA2 threshold values.

Direct measurement by survey instrument is considered equivalent for purposed of event declaration as isotopic sample and analysis to determine actual DDE would not be timely.

CDE thyroid is determined by portable air sample and gross count adjustment for I-131 source term assumptions.

5.1.3 RU3 Technical Basis

Per ANSI/ANS-15.16, it is expected that licensees will determine the relationship of the EAL dose levels at the site boundary to instrumentation readings and/or safety analysis accident conditions for their specific facilities.

NTR Vent Stack Noble Gas Monitor instrument range is 2E-11 to 2E-04

NTR Vent Stack Particulate Monitor instrument range is 1E-07 to 1E+01

Refer to Appendix 3 for the calculations supporting the threshold values for RU3.

5.1.4 SU1 Technical Basis

Per ANSI/ANS-15.16, the situation that may lead to an emergency class described in the subsections of NUREG-0849, Sec. 4.0 may be referenced as EALs appropriate to the emergency class.

Per NUREG-0849, situations that may lead to this class include: (1) threats to or breaches of security such as bomb threats or civil disturbances directed toward the reactor.

- The SU1 security threat threshold is based on the ANSI/ANS-15.16-2015 initiating condition wording.
- A civil disturbance alone would not meet the definition of an unusual event as conditions for this description could be as low as a single protester staging at the entrance to the site access road. However, a civil disturbance level consistent with the Unusual Event definition would be a credible security threat and declared per SU1.

5.1.5 SU2 Technical Basis

Per ANSI/ANS-15.16, the situation that may lead to an emergency class described in the subsections of NUREG-0849, Sec. 4.0 may be referenced as EALs appropriate to the emergency class.

Per NUREG-0849, situations that may lead to this class include: (1) threats to or breaches of security such as bomb threats or civil disturbances directed toward the reactor.

- The SU2 bomb threat threshold is based on the ANSI/ANS-15.16-2015 initiating condition wording clarified that the it be a credible threat for consistency with the SU1 security threat wording.

5.1.6 HU1 Technical Basis

Per ANSI/ANS-15.16, the situation that may lead to an emergency class described in the subsections of NUREG-0849, Section 4.0 may be referenced as EALs appropriate to the emergency class.

Per NUREG-0849, situations that may lead to this class include: (2) natural phenomena, such as tornados in the immediate vicinity of the reactor, hurricanes, or earthquakes felt in the facility.

- Tornado in the immediate vicinity of the reactor is defined as a tornado strike within the site boundary. Tornado EF rating is not a consideration as EF-0 winds are projected as 65 – 85 mph, which meets the intent of the initiating condition. Strike means that the tornado touched down.

- Hurricanes have not historically been experienced at VNC. A threshold of sustained winds > 75 mph measured on site will be used to meet the intent of the initiating condition. Sustained means a period of at least 1 minute.
- The combination of NTR Seismic Alarm and felt by personnel considered equivalent to an earthquake of Magnitude 4 at the site. Richter Scale Magnitude 4 earthquakes correlate to a level IV Modified Mercalli Scale identified as being felt indoors by many, by few outside, where dishes and windows rattle.

5.1.7 HU2 Technical Basis

Per ANSI/ANS-15.16, the situation that may lead to an emergency class described in the subsections of NUREG-0849, Section 4.0 may be referenced as EALs appropriate to the emergency class.

Per NUREG-0849, situations that may lead to this class include: (3) facility emergencies, such as prolonged fires, fuel damage indicated by high coolant fission product activity, or high offgas activity.

- The HU2 fire threshold is related to the ANSI/ANS-15.16-2015 initiating condition wording with the additional specification that the 15 minute time period begins when the fire is detected (by fire alarm or direct observation).
- Coolant activity at VNC is monitored on a monthly basis and is not suitable as an EAL threshold.
- Thresholds for abnormal radiological conditions, which include high gaseous activity are provided in the RUx series EALs.

5.2 Alert

ANSI/ANS-15.16 Table 1	VNC Emergency Action Levels
Abnormal Radiological Conditions	
Actual or projected radiological effluent at the site boundary that is calculated (or measured) to result in either of the following conditions, both of which are based on an exposure of 24 hours or less: (1) A deep dose equivalent of 0.75 mSv (75 mrem) **OR** (2) A committed effective dose equivalent of 0.75mSv (75 mrem) based on the following considerations: • 500 EC X 24 hours = 1.2 $X10^4$ EC-hour ~0.75 mSv (75 mrem) (for radionuclides other than noble gases) • 250 EC X 24 hours = 6.0 $X10^3$ EC-hour ~0.75 mSv [75 mrem] (for noble gases)	**RA1** Actual or projected dose at the site boundary: • ≥ 75 mrem TEDE over a 24-hour period • ≥ 75 mrem CEDE over a 24-hour period **RA2** Actual or projected dose rates at the site boundary: • ≥ 20 mrem/hr TEDE • ≥ 100 mrem CDE thyroid for 1 hour of inhalation **RA3** Radiological effluent level (µCi/cc) meet any of the following: • ≥ 1.2E-7 NTR Noble Gas Stack Monitor • ≥ 1.2E-4 NTR Particulate Stack Monitor • ≥ 1.2E-0 from any reactor facility effluent Noble Gas sample • ≥ 2.4E-2 from any reactor facility effluent Halogen sample • ≥ 1.2E-6 from any reactor facility effluent α Particulate sample • ≥ 1.2E-4 from any reactor facility effluent β Particulate sample
Actual or projected radiation levels at the site boundary of 0.2 mSv/hour deep dose equivalent (20 mrem/hour) for 1 hour or 1.0 mSv (100 mrem) to the thyroid (committed dose equivalent)	
Security Conditions	
Security breach affecting the reactor facility	**SA1** Security breach affecting a reactor facility

5.2.1 RA1 Technical Basis

The RA1 threshold values are directly related to the ANSI/ANS-15.16-2015 initiating condition values.

For the purpose of event declaration, direct measurement by survey instrument adjusted for exposure period is considered equivalent to an isotopic sample and analysis (where the determination of actual DDE and CEDE would not be timely).

5.2.2 RA2 Technical Basis

The RA2 threshold values are directly related to the ANSI/ANS-15.16-2015 initiating condition values.

For the purpose of event declaration, direct measurement by survey instrument adjusted for exposure period is considered equivalent to an isotopic sample and analysis (where the determination of actual DDE would not be timely).

CDE thyroid is determined by portable air sample and gross count adjustment for I-131 source term assumptions.

5.2.3 RA3 Technical Basis

Per ANSI/ANS-15.16, it is expected that licensees will determine the relationship of the EAL dose levels at the site boundary to instrumentation readings and/or safety analysis accident conditions for their specific facilities.

NTR Vent Stack Noble Gas Monitor instrument range is 2E-11 to 2E-04

NTR Vent Stack Particulate Monitor instrument range is 1E-07 to 1E+01

Refer to Appendix 3 for the calculations supporting the threshold values for RA3.

5.2.4 SA1 Technical Basis

The SA1 security breach threshold is based on the ANSI/ANS-15.16-2015 initiating condition wording and includes physical attacks and verification of bomb placement or sabotage directly affecting a reactor facility.

6 EMERGENCY PLANNING ZONEs (EPZs)

Planning Standard (ANSI/ANS-15.16 Section 3.6 & NUREG-0849 Section 6.0)

As part of emergency planning, the reactor licensee or owner/operator of a facility that identifies radiological emergencies that result in off-site plume exposures exceeding 10 mSv deep dose (1 rem whole body) or 50 mSv (5 rem) thyroid shall identify an EPZ.

The postulated radioactive releases from credible accidents provide the basis for determining the need for an EPZ. The EPZ size depends on the distance at which the protective actions are calculated to be warranted. As an alternative to performing such calculations, the EPZ sizes in Table 2 may be adopted according to the power level. Table 2 is based upon highly conservative dose calculations that are generically applicable to research reactors.

6.1 NTR EPZ

Per the NTR Safety Analysis Report Section 1.1, the NTR is licensed to operate at power levels not in excess of 100 kW (thermal).

Thus, based upon ANSI/ANS-15.16-2015 Section 3.6 and Table 2, the applicable EPZ for NTR is the operations boundary for the reactor facility.

The NTR operations boundary is established as [[ ]].

6.2 GETR, VBWR, and EVESR EPZs

The other three reactor facilities are in a defueled SAFSTOR status with the spent fuel no longer remaining on site.

Since the emergency planning requirements for these facilities are deferred to this VNC Regulatory Guide 2.6 emergency plan, their EPZ is based on the same specification as the NTR.

GETR, VBWR, and EVESR operations boundaries are established as their respective reactor containment enclosure.

7 EMERGENCY RESPONSE

Planning Standard (ANSI/ANS-15.16 Section 3.7 & NUREG-0849 Section 7.0)

Emergency response measures shall be identified for each emergency. These response measures should be related to the emergency class and action levels that specify what measures are to be implemented.

7.1 Activation of Emergency Organizations

Site Emergency Procedures (SEPs) are established for notification and mobilization of emergency response personnel.

7.1.1 Notification of Onsite Personnel and Mobilization of the ERO

Notification of onsite personnel occurs each time an emergency classification level is declared by the Emergency Director (initial event declaration and any escalation) via [[

]]. Provisions are made to alert personnel in high noise areas and outbuildings as applicable.

Notification and mobilization of the VNC ERO is described in section 3.1.

7.1.2 [[ ]]

[[ ]] is declared or upgraded, initial notifications are made to continually [[ ]].

[[

]]

1. State Agencies (Cal OES)

   Cal OES is notified [[ ]] of an event declaration (initial or an escalation).

2. Nuclear Regulatory Commission (NRC)

   The NRC is notified immediately after notification of Cal OES [[ ]] declaration (initial or an escalation).

7.1.3 [[ ]]

[[
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- [[ ]]
- [[ ]]

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7.2 Assessment Actions

7.2.1 Plant Parameters and Corresponding Emergency Classification

Recognizable EAL thresholds have been developed in accordance with Regulatory Guide 2.6 and the NRC endorsed methodology in ANSI/ANS-15.16-2015 (refer to section 5).

EAL technical bases document the VNC site specific indications and parameters used to determine the thresholds that correlate to a particular emergency classification level (refer to section 5).

7.2.2 Onsite Accident Assessment Capabilities

On-site capabilities and resources are available to provide information for accident assessment throughout the course of an event. Data will be obtained from in-place radiation monitors, portable instrumentation, and from observation and measurement by specific emergency teams.

Radiological instrumentation readings and sampling are used to project dose rates at the Site Boundary, and to determine the integrated dose received for events involving a release of radioactivity. Site emergency procedures address calculating accumulated or projected dose.

7.3 Corrective Actions

VNC has strategies for mitigation of designated emergencies (such as radiological, fire, security threat, and other hazards) and has equipment available to be used in those strategies/mitigative actions.

The Emergency Director is responsible for assessing the need for and directing mitigation activities such as deactivation of process systems or restoration of disabled equipment needed to mitigate the consequences of an emergency. Additional assistance may be provided by other ERO positions upon arrival or via remote communications.

7.4 Protective Actions

Preventive measures are implemented, to the extent practical, to prevent exposure of on-site personnel to radiological hazards; and in the event that prevention techniques fail, protective measures are in place to minimize the effects of such emergencies.

Protective measures are taken by ERO personnel and any support organization personnel called to the site. Initial actions to protect non-emergency team personnel may involve evacuation from facilities followed by search for and rescue of missing persons, medical treatment, decontamination, and other actions judged appropriate by the Emergency Director dependent on existing conditions.

7.4.1 Personnel Evacuation from Immediate Area

Personnel may be evacuated from an area affected by an emergency or moved to areas controlled for safety purposes. The evacuation is initiated by [[
]].

Typically, personnel evacuate their facility by following established routes to a pre-designated assembly area, which is posted in each facility. Alternate routes and/or alternate assembly areas may be determined and directed by the Building Emergency Coordinator if travel to or conditions at the designated assembly area are hazardous. The Building Emergency Teams will assist in the orderly evacuation of facilities. Additional instructions may be relayed by the Emergency Director [[
]].

The Assembly Area Leader from the Building Emergency Team will conduct personnel accountability at the assembly area to determine whether there are missing employees; security personnel will identify visitors that were expected to be at that location. Reports of missing persons are relayed to the Emergency Director for appropriate search and rescue action.

7.4.2 Contamination Control Measures

In response to an emergency involving a potential release of radioactive material, it is assumed that a release has occurred. The ERO establishes access controls to the area (such as rope/tape barriers, building access points, postings, control point watches, periodic announcements, etc.), determines whether radioactive contamination is present by survey, and takes appropriate steps to limit personnel exposure to and the spread of radioactive contamination. Area contamination information is provided to the Emergency Director and tracked by the ERO.

Emergency workers are protected from contamination by protective clothing available in emergency supply lockers. In order to protect emergency workers in areas of radioactive airborne contamination, self-contained breathing apparatuses (SCBA) or filtered respirators are available for use as appropriate.

Contaminated individuals are treated and decontaminated in isolated areas.

7.4.3 Personnel Decontamination/First Aid

Individuals are surveyed and then decontaminated as necessary. If an individual is contaminated and injured, the order of decontamination/first aid administration is dependent on the severity of the contamination and injury. The criteria for deciding the order is that which is least detrimental to the overall health of the individual.

7.4.4 Emergency Exposure Control and Guidelines

Identification and control of radiation areas is performed the same as described in Section 7.4.2 for radioactive contamination. Measures and criteria for radiation, high radiation and locked high radiation areas encountered during a declared emergency are established the same as those used during normal operations as much as possible.

Direct exposures of emergency workers are monitored by remote area monitoring (RAM) devices, portable survey instruments, and by the individuals' own personal monitoring devices (such as electronic dosimeters). A supply of electronic dosimeters that can be set to alarm for dose and dose rate values are maintained on site for emergency worker use. Personnel exposure information is provided to the Emergency Director and tracked by the ERO.

Emergency exposure guidelines for emergency workers, consistent with EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, U.S. Environmental Protection Agency, May 1992, Table 2-2, "Guidance on Dose Limits for Workers Performing Emergency Services," have been established as follows:

TEDE Limit (Rem)[a]	**Activity**
5	All activities during the emergency.
10	Protecting valuable property when lower dose is not practicable.
25	Lifesaving or protection of large populations when lower dose is not practical.
Greater Than 25	Lifesaving or protection of large populations, only if individuals receiving exposure are volunteers, and fully aware of risks involved.

a Sum of external effective dose equivalent and committed effective dose equivalent to nonpregnant adults from exposure and intake during an emergency situation. Workers performing services during emergencies should limit dose to the lens of the eye to three times the listed value and doses to any other organ (including skin and. body extremities) to ten times the listed value. These limits apply to all doses from an incident, except those received in unrestricted areas as members of the public during the intermediate phase of the incident.

8 EMERGENCY FACILITIES AND EQUIPMENT

Planning Standard (ANSI/ANS-15.16 Section 3.8 & NUREG-0849 Section 8.0)

The emergency plan should briefly describe the emergency facilities, types of equipment and their location.

8.1 Emergency Control Center (ECC)

During an emergency [[

]].

[[

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8.2 Assessment Facilities

The reactor facilities are monitored by area radiation monitors (ARMs) and effluent radiation (stack) monitors as required by their technical specifications. Radiation monitors with remote readouts permit continuous assessment in some areas.

Other monitoring devices are utilized to identify off-normal conditions, such as smoke detectors, criticality, fire and flood alarms, and onsite and offsite seismic and meteorological indicators. Several of these devices activate alarms locally and/[[ ]] for immediate response and assessment.

Portable survey and personnel monitoring instruments are maintained throughout the site and are available for use during an emergency. Sampling equipment and counting laboratories are available on site for specific radionuclide identification and analysis.

Company vehicles are available for use by emergency response personnel. Communication from the area experiencing the emergency is possible using the [[

]].

8.3 First Aid and Medical Facilities

The site contains numerous areas where radioactive materials are used. Consequently, there are numerous areas where contaminated injured individuals may be relocated for first aid administration and decontamination. On site company vehicles are available for transportation.

First aid supplies, stretchers and industrial showers are located around the site.

GEH will provide a radiation monitor to assist in the control and cleanup of contamination of ambulance and offsite medical facilities used when treating contaminated injured personal transported from the site as necessary.

8.4 [[ ]]

8.4.1 [[ ]]

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8.4.2 [[ ]]

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8.4.3 [[ ]]

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8.4.4 [[ ]]

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8.4.5 [[ ]]

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8.4.6 [[ ]]

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8.5 Contingency Planning

Procedures include instructions for consideration in case the emergency renders the ECC or equipment employed during the response unusable. The VNC site contains several facilities that can be designated response locations should the ECC be unavailable. First-aid, personnel protective clothing, radiological, fire-fighting, etc. equipment and resources are maintained throughout the site such that access restrictions to a particular area would not likely result in the inability to perform necessary response activities.

Mutual aid agreements between offsite support agencies provides assurance that fire, medical and law enforcement resources would be available when called upon.

9 RECOVERY

Planning Standard (ANSI/ANS-15.16 Section 3.9 & NUREG-0849 Section 9.0)

This element of the emergency plan should describe the criteria for restoring the reactor facility to a safe status including reentry into the reactor building or portions of the facility that-may have been evacuated because of the accident. The operations to recover from most severe accidents will.be complex and depend on the actual conditions at the facility. It is not practicable to plan detailed recovery actions for all conceivable situations.

9.1 Reentry

During an emergency, immediate actions are directed toward limiting the consequences of the accident to afford maximum protection to personnel onsite. Once corrective measures have been taken and effective control of the facility has been reestablished, a more methodical approach to reentry is taken. Reentry into two separate categories:

- Reentry during the emergency phase of an accident is performed to save a life, control a release of radioactive material, prevent further damage to or restore equipment. If necessary, this category of reentry may be performed using emergency exposure limits. Briefings, rather than written procedures, may be used when making these reentries.

  All reentry activities conducted during the emergency are authorized by the Emergency Director and coordinated by Incident Command.

- Reentry during the recovery phase of an accident is performed using normal occupational exposure limits. Either normal procedures or procedures developed specifically for each reentry are used to control post-emergency activities.

  Reentry activities during the recovery phase are authorized by a Recovery Director or the VNC Manager, and coordinated by the recovery personnel directing and performing the reentry.

9.2 Recovery

During a declared emergency, a point will be reached when the facility will be restored to a stable condition. The Emergency Director will determine when there is no longer a need to keep the ERO activated and the site can return to a normal organization for control.

The extent and nature of the corrective and protective measures and the extent of facility recovery will depend on the remaining conditions, if any, and the status of site areas and equipment. The general goals for recovery are:

- An orderly evaluation of the cause and effect of the event and the implementing of actions to prevent recurrence of the incident.
- A planned approach for maintaining the facility in a stable condition by obtaining the appropriate manpower, materials, and equipment needed to accomplish that end.

- An evaluation of the emergency radiation exposure records for all on-site emergency response personnel involved in the incident.
- A planned approach to ensure that further radiation exposures and contamination control are restored under 10 CFR 20 requirements and are in keeping with the ALARA program.

Procedures have been developed for the systematic transition from the declared state of emergency to recovery and termination.

10 MAINTAINING EMERGENCY PREPAREDNESS

Planning Standard (ANSI/ANS-15.16 Section 3.10 & NUREG-0849 Section 10.0)

The emergency plan shall describe the elements necessary for maintaining an acceptable state of emergency preparedness. A description shall be provided of how the effectiveness of the emergency plan will be maintained, including training, review, and update of the emergency plan and associated implementing procedures along with maintenance and inventory of equipment and supplies that would be used in emergencies. Frequent coordination with emergency support organizations should also be maintained to ensure the necessary training and the efficient use of their capabilities.

10.1 Training and Drills

10.1.1 Training

ERO personnel receive the appropriate level of site access, radiological, communications systems, facility evacuation, and position specific training. The training for ERO personnel is primarily developed from the position specific responsibilities and tasks as defined in this plan and the site emergency procedures.

Emergency response and other personnel in the following categories receive knowledge and/or performance based training initially and annual retraining thereafter:

1. Emergency Directors

   This position receives training to maintain proficiency on the topics listed below:

   - Event Classification / Emergency Action Levels
   - Event Notification and Communications
   - Accident Assessment and Mitigation
   - Protective Actions / Emergency Exposure Control

2. Accident Assessment Personnel

   Accident assessment activities are performed by Emergency Directors, Facilities Managers (as applicable), and GEH operations, radiological, security and maintenance managers as a function of their areas of expertise and ERO roles.

3. Radiological Monitoring and Analysis Teams

   Radiological monitoring personnel will receive training for the actions they will be expected to perform during an emergency as part of their training. The following general topics will be included in the training:

   - Equipment and Equipment Checks
   - Emergency Communications
   - Radiological Release Surveys and Sampling

- Emergency Exposure Control

4. First Aid and Rescue Personnel

   A number of site employees are trained in first aid.

   Basic search and rescue activities may be performed by ERO personnel as part of event response.

5. Medical Support Personnel

   VNC does not maintain medical support personnel, such as a site nurse on staff.

6. Police, Security, Ambulance and Fire-Fighting and Other Personnel

   a) Training of site security personnel is controlled by the VNC Security Plan.

   b) Building Emergency Team members receive initial training and annual reviews in respiratory protection, radiological protection, first aid, fire protection and emergency support as appropriate for their assigned responsibilities.

   c) The Site Fire Chief is responsible for fire protection training of designated personnel assigned to the site fire team, which is controlled outside this emergency plan as defined by the site fire protection program.

   d) Training is offered to the offsite support organizations that may be called upon to provide assistance in the event of an emergency (i.e., local law enforcement, fire-fighting, rescue, medical services, ambulance).

      The training made available is designed to acquaint the participants with the special characteristics of VNC (e.g. potential radiation and radiological contamination areas), notification procedures, and their expected roles. Organizations that must enter the site also receive instructions as to the identity (by position and title) of those VNC persons who will control their support activities.

   e) Badged site personnel who are not part of the ERO are instructed in reporting and responding to alarms.

10.1.2 Conduct of Drills

Drills are conducted annually to provide supervised instruction, training and practice opportunities for ERO members and are executed as realistically as is reasonably possible.

Written scenarios, prepared in advance, govern the conduct of annual drill and include the following as applicable:

- General Information – A section containing the scope of the scenario, time period, place(s), and participating organizations.
- Timeline – A section containing the time schedule of initiating events.

- Messages – A section for plant data, injects, messages, and symptomology cards.
- Onsite Radiological Data – A section for area radiation maps and display system snapshots, if warranted by the scenario events.
- Objectives – A section containing a table of performance objectives expected to be demonstrated during the scenario.
- Participant/Controller/Evaluator/Observer Instructions – as applicable to the drill.

Smaller response proficiency drills, such as evacuation drills, may be performed in addition to the larger scope annual drill in each occupied building at VNC.

At least every two years, a drill shall be offered that contains provisions for coordination with off-site emergency personnel and should test, at a minimum, the communication links and notification procedures with those off-site agencies and support organizations.

10.1.3 Critique of Drills

Following the observation of drills, a critique is conducted to evaluate areas such as personnel performance, response procedure processes, and facility and equipment adequacy and identify issues. Specifically, the critique is performed as soon as possible following the conclusion of a drill using preselected performance objectives that are evaluated against measurable demonstration criteria.

A written critique report is prepared a drill to document whether the objectives were successfully demonstrated. Failed or degraded performance objectives are entered into the corrective action program (CAP). Failed or degraded demonstration criteria, improvement items and recommendations are dispositioned within the report and may be entered into the CAP.

10.2 Plan Review and Update

10.2.1 Responsibility for the Plan

The Manager, VNC is the senior GEH employee on site with overall authority for site operations. This authority includes the responsibility for overall emergency preparedness activities at VNC.

The Manager, RC & EHS, is responsible for administering the program by coordinating and planning radiological emergency preparedness, updating the emergency plan, and coordinating plans with other appropriate organizations.

10.2.2 Review and Update

The Emergency Plan will be reviewed to be current on a biennial basis, and updated if necessary. Any changes due to regulatory revisions, issues identified by drills and exercises, or other updates will be incorporated into the Emergency Plan.

Agreements with supporting organizations will be reviewed on a biennial basis, and updated if necessary. Changes to agreements may be coordinated with the biennial review of the Emergency Plan.

Emergency plan implementing and administrative procedures are reviewed biennially or when revised as needed.

Changes will be processed in accordance with 10 CFR 50.54(q) requirements and distributed per site procedures.

10.3 Maintenance and Inventory of Emergency Equipment, Instrumentation, and Supplies

In addition to supplies of normal use equipment and instruments, emergency kits are maintained at VNC. Annual inventories and quarterly surveillances are performed to verify supplies and kit contents, and inspect and operationally check emergency use equipment/instruments. The inventories will utilize the corrective action program to document follow-up action items that correct any deficiencies discovered. Sufficient reserves of instruments and equipment are maintained to replace those removed from emergency kits or lockers for calibration or repair.

Requirements to operationally check emergency equipment and instruments prior to use, if needed, are contained in site procedures.

Requirements to calibrate emergency equipment and instruments are specified in site procedures.

Portable radiation monitoring instruments are calibrated upon initial acquisition, after major maintenance and at least annually. Radiation Protection is responsible for the maintenance and storage of radiological equipment and instruments.

Appendix 1 – Regulatory and Developmental References

1. 10 CFR 20, Standards for Protection Against Radiation
2. 10 CFR 50.54, Conditions of Licenses
3. 10 CFR 50 Appendix E, Emergency Planning and Preparedness for Production and Utilization Facilities
4. Regulatory Guide 2.6, Emergency Planning for Research and Test Reactors, Revision 2
5. ANSI/ANS-15.16-2015, Emergency Planning for Research Reactors
6. NUREG-0849, Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors, October 1983
7. EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, October 1991
8. General Electric Nuclear Test Reactor Safety Analysis Report, June 2000
9. NRC Letter SNM-960 Amendment 5, 12/20/90
10. GEH Memo, Evaluation that a VNC Radiological Emergency Plan is not Required for Radioactive Material Authorized by the State of California, 03/08/18

Appendix 2 – Emergency Plan Implementing Procedures

[Response and administrative procedures that implement this plan will be developed and listed in this appendix following approval.]

Appendix 3 – EAL Technical Bases for Effluent Releases

Method: 10 CFR 20 effluent concentration limits, representative of a 50 mrem/yr dose, are adjusted to an equivalent concentration limit for the EAL site boundary threshold value in mr/hr. The site boundary EAL concentration limit is back-calculated to an effluent stack release rate using the limiting SAR X/Q dispersion factor and stack flow rate.

		10 CFR 20 Concentration Limit (µCi/cc)	RU3 Site Boundary Release Concentration (µCi/cc)	RU3 NTR Stack Release Rate (µCi/sec)	RU3 NTR Stack Release Concentration (µCi/cc)
10 CFR 20 Unknown		1.00E-15	7.01E-13	2.02E-02	2.37E-08
Noble Gas*	Ar-41	1.00E-08	7.01E-06	2.02E+05	2.37E-01
Halogen*	I-131	2.00E-10	1.40E-07	4.03E+03	4.74E-03
Alpha Particulate*	Np-237	1.00E-14	7.01E-12	2.02E-01	2.37E-07
Beta-Gamma Particulate*		1.00E-12	7.01E-10	2.02E+01	2.37E-05

		10 CFR 20 Concentration Limit (µCi/cc)	RA3 Site Boundary Release Concentration (µCi/cc)	RA3 NTR Stack Release Rate (µCi/sec)	RA3 NTR Stack Release Concentration (µCi/cc)
10 CFR 20 Unknown		1.00E-15	3.51E-12	1.01E-01	1.19E-07
Noble Gas*	Ar-41	1.00E-08	3.51E-05	1.01E+06	1.19E+00
Halogen*	I-131	2.00E-10	7.01E-07	2.02E+04	2.37E-02
Alpha Particulate*	Np-237	1.00E-14	3.51E-11	1.01E+00	1.19E-06
Beta-Gamma Particulate*		1.00E-12	3.51E-09	1.01E+02	1.19E-04

Calculation Constants

10 CFR 20 Effluent Concentration Dose Basis (mrem/yr):	50
10 CFR 20 Effluent Concentration Dose Basis (mrem/hr):	5.70E-03
EAL RU3 Limit (mr/hr):	4
EAL RA3 Limit (mr/hr):	20
Limiting X/Q* (sec/cc):	3.48E-11
NTR Bldg 105 Stack Flow Rate* (cfm):	1800
Conversion Factor (cc/sec per cfm):	471.95
NTR Bldg 105 Stack Flow Rate (cc/sec):	8.50E+05

* Values taken from NTR SAR Section 6.4