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A Methodology to Assist in Contingency Planning for Protection of Nuclear Power Plants Against Land Vehicle Bombs

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ABSTRACT

This report provides a methodology which could be used by operators of licensed nuclear power reactors to address issues related to contingency planning for a land vehicle bomb, should such a threat arise.

The methodology presented in this report provides a structured framework for understanding factors to be considered in contingency planning for a land vehicle bomb including: 1) system options available to maintain a safe condition, 2) associated components and equipment, 3) preferred system options for establishing and maintaining a safe shutdown condition, and 4) contingency measures to preserve the preferred system options. Example applications of the methodology for a Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) are provided along with an example of contingency plan changes necessary for implementation of this methodology, a discussion of some contingency measures that can be used to limit land vehicle access, and a bibliography.

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PREFACE

This work was undertaken in response to contract NRC-03-87-029. It supports NRC efforts to provide technical guidance to licensees for development of contingency plans for land vehicle bombs should such a threat arise.

The NRC Lead Engineer for this task, Barry T. Mendelsohn, provided considerable input and technical direction for this report. Additionally, the report benefited from valuable technical direction given by Robert Dube of the Safeguards Branch.

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ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ADHRS	Auxiliary Decay Heat Removal System
ADS	Automatic Depressurization System
AFW	Auxiliary Feed Water
BWR	Boiling Water Reactor
CAS	Central Alarm Station
CRDHS	Control Rod Drive Hydraulic System
CST	Condensate Storage Tank
CVCS	Chemical and Volume Control System
DC	Direct Current
DG	Diesel Generator
ECCS	Emergency Core Cooling System
EDO	Emergency Duty Officer
EOD	Explosive Ordnance Disposal
EOF	Emergency Operations Facility
EOP	Emergency Operating Procedure
ESF	Essential Safeguards Features
ESW	Essential Service Water
FBI	Federal Bureau of Investigation
HPIC	High Pressure Injection Cooling
INTK	Intake Structure
LOCA	Loss of Coolant Accident
LPCI	Low Pressure Coolant Injection
NRC	Nuclear Regulatory Commission
OSP	Off Site Power
PA	Protected Area
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Assessment
psi	Pounds Per Square Inch
PWR	Pressurized Water Reactor
RB	Reactor Building
RC	Reactor Containment
RCIC	Reactor Core Isolation Cooling
RCS	Reactor Coolant System
RHR	Reactor Heat Removal
RHRSW	Residual Heat Removal Service Water
RPS	Reactor Protection System
RW	Radwaste Building
RWST	Refueling Water Storage Tank
SAIC	Science Applications International Corporation
SAS	Secondary Alarm Station
SCP	Safeguards Contingency Plan
SFP	Security Force Personnel
SL	Shift Lieutenant
SNGS	Sunshine Nuclear Generating Station
SS	Shift Supervisor
SSRS	Secondary Steam Relief Valve
STA	Shift Technical Advisor

TB	Turbine Building
TBD	To Be Determined
TNT	Trinitrotoluene
TSM	Transient Mitigation Systems
VA	Vital Area
VAA	Vital Area Analysis
VAC	Voltage Alternating Current
VDC	Voltage Direct Current

EXECUTIVE SUMMARY

The purpose of this report is to provide a methodology which could be used by operators of licensed nuclear power reactors in contingency planning for a land vehicle bomb, should such a threat arise. The security systems at nuclear power plants are designed to protect against the design basis threat specified in 10 CFR Part 73. That design basis threat does not include a land vehicle bomb.

The six step methodology presented in this report can be applied by a licensee to gain an understanding of factors to be considered in contingency planning for a possible land vehicle bomb. The methodology provides a structured framework for: 1) examining the potential vulnerability of a plant to a postulated land vehicle bomb, and 2) developing contingency planning strategies for dealing with such a possibility. The six steps are:

1. Identify system options available to establish and maintain safe shutdown (Section 2).

2. Identify buildings containing components and equipment associated with each system option (Section 3).

3. Determine "survivability envelopes" for the system options (Section 3).

4. Review site features to determine land vehicle access approach paths and distances (Section 4).

5. Identify short-range measures to limit or thwart vehicle access and protect and preserve preferred system options (Section 5).

6. Prepare plans and make advance arrangements to facilitate the short-range contingency measures in the event a land vehicle bomb threat arises (Section 5 and appendix A).

SECTION 1
INTRODUCTION

1.1 PURPOSE

The purpose of this report is to provide a methodology which could be used by operators of licensed nuclear power reactors in contingency planning for a land vehicle bomb, should such a threat arise.

1.2 NUCLEAR POWER PLANT DESIGN BASIS

The design basis for nuclear power plants includes a wide range of events that are postulated to occur. The basic minimum external loading conditions used for design of safety-related structures and certain exposed equipment are derived from USNRC Regulatory Guide 1.76 (Ref. 1), USNRC Standard Review Plan 3.3.2 (Ref. 2), and USNRC Regulatory Guide 1.91 (Ref. 3).

The security systems at nuclear power plants are designed to protect against the design basis threat specified in 10 CFR Part 73 (Ref. 4).

1.3 APPROACH

The six step methodology presented in this report can be applied by a licensee to gain an understanding of factors to be considered in contingency planning for a land vehicle bomb. The six steps are:

1. Identify system options available to establish and maintain safe shutdown (Section 2).
2. Identify buildings containing components and equipment associated with each system option (Section 3).
3. Determine "survivability envelopes" for the system options (Section 3).
4. Review site features to determine land vehicle access approach paths and distances (Section 4).
5. Identify short-range measures to limit or thwart vehicle access and protect and preserve preferred system options (Section 5).
6. Prepare plans and make advance arrangements to facilitate the short-range contingency measures in the event a land vehicle bomb threat arises (Section 5 and Appendix A).

Example applications of the methodology for a Boiling Water Reactor (BWR) and Pressurized Water Reactor (PWR) are contained in Sections 6 and 7, respectively. An example of contingency plan changes necessary for implementation of this methodology is shown at Appendix A. Appendix B provides a bibliography.

1.4 SECTION 1 REFERENCES

1. Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants," April, 1974.

2. USNRC Standard Review Plan 3.3.2, "Tornado Loadings," NUREG-0800.

3. USNRC Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Rev. 1, February 1978.

4. Code of Federal Regulations 10 CFR Part 73, "Physical Protection of Plants and Materials," U.S. Nuclear Regulatory Commission.

SECTION 2
SYSTEM OPTIONS FOR ESTABLISHING AND MAINTAINING SAFE SHUTDOWN

The first step in the planning methodology is to identify front-line and support systems that could be used to establish and maintain a safe shutdown condition in the event a land vehicle bomb threat was to arise. The output of this step is a collection of system options, each of which includes a set of systems that is capable of establishing and maintaining a safe shutdown condition.

Several techniques are available for identifying the system options. A relatively simple approach focuses on identifying potential sources of a release of radioactive material and the safety functions associated with preventing a significant release of radioactive material. This approach utilizes the plant safety functions that are identified in NUREG-0737, Supplement 1 (Ref. 1) and in NUREG/CR-2631 (Ref. 2). A more rigorous approach is to perform a detailed fault tree analysis along the lines of a Probabilistic Risk Assessment (PRA), without assigning probabilities, or Vital Area Analysis (VAA). If a PRA or VAA has already been performed for a particular plant the results can be applied to contingency planning. Other studies that may be useful in identifying systems of importance are station blackout coping analyses and Individual Plant Examinations.

Given the range of land vehicle bomb sizes being considered for contingency planning purposes, it will be postulated that a land vehicle bomb will not initiate a loss of coolant accident (LOCA) involving primary coolant system piping or interfacing piping inside the primary containment structure. This assumption should be examined on an individual plant basis because there may be instances of piping outside containment that, if breached, would result in a LOCA that cannot be isolated. By assuming that a LOCA does not occur the analysis can treat the land vehicle bomb attack as a transient initiator, and focus on protecting systems for mitigating transients. Transients of interest include, but are not limited to, loss of off-site power, loss of main steam and power conversion system, loss of heat sink, and release from radioactive waste systems.

2.1 FRONT-LINE SYSTEMS

One approach to the identification of front-line systems uses the NUREG-0737, Supplement 1 (Ref. 1) definition of the five safety functions that a plant must satisfy in all operating modes: (a) reactivity control, (b) reactor core cooling and heat removal from the primary system, (c) reactor coolant system integrity, (d) containment integrity, and (e) radioactivity release control. The specific plant systems that can be used to satisfy each function should be identified. The intent is to develop a matrix showing the primary and backup systems available to perform each safety function and to identify any opportunities for recovery actions if the primary and backup systems are disabled. Unorthodox measures for decay heat removal, such as feed and bleed (PWR) or containment flooding (BWR) can also be considered when developing the system matrix.

If the critical safety function approach is used to identify the systems of importance, some assumptions may be applicable for the purposes of contingency planning. One, it is highly unlikely that the land vehicle bomb will interfere with the plant's ability to scram the reactor. Therefore, it can be assumed that the immediate reactivity function is satisfied. Also, as long as core cooling, decay heat removal, and reactor coolant system (RCS) integrity are maintained, the functions of containment integrity and radioactivity release control will not be required. The selection of system options for safe shutdown (see Section 2.3) need not consider containment integrity and radioactivity release control.

Table 2-1 shows the typical systems available for each safety function at PWRs, plus some unorthodox measuring for decay heat removal. Table 2-2 shows BWR systems.

The safety functions required for safe shutdown are basically the same regardless of the initial operating state, therefore, it may be sufficient to look at only power operation and cold shutdown when developing a system matrix. The functional requirements for power operation are more stringent than those required for startup, hot standby, and hot shutdown, while the safety functions necessary during refueling are included in those required during cold shutdown (Ref. 2). Tables 2-1 and 2-2 reflect safety functions and systems required for power operation. If necessary, similar tables should be developed for other operating modes, if significant differences exist versus power operation.

PRA methods (Ref. 3 to 6) or VAA methods (Ref. 7 and 8) may be used to derive front -line and support system needs directly from detailed models of the nuclear power plant. If available, the results of a PRA or a VAA can be considered in contingency planning. Since the VAA is concerned with plant areas, and deterministic events, its techniques may be more applicable than the PRA to the methodology for land vehicle bombs, in which the perceived danger can be expressed in terms of areas that are affected by the explosion. Generic sabotage fault trees have been developed in VAAs for PWRs and BWRs. These trees treat reactor sabotage at a functional level, that is, they define the types of sabotage events that are of concern and the functions that are required to mitigate those events. For the purposes of the land vehicle bomb methodology, the event of interest is an induced transient, as discussed above.

Figures 2-1 and 2-2 show generic transient mitigating system fault trees for PWRs and BWRs, respectively. These trees have been expanded from the generic sabotage fault trees used in VAAs to reflect additional long-term concerns that may be applicable to the land vehicle bomb methodology. For example, the expanded trees identify the need to have a long-term source of fuel oil for the diesel generators, since most diesel day tanks have a capacity of only a few hours. These trees show only functions; the actual systems that perform these functions are plant-specific.

The trees in Figures 2-1 and 2-2 are based on two main assumptions: (a) long-term hot shutdown can be maintained, and (b) off-site power is lost. Also, these trees only reflect transient mitigation. If, for a given plant, it is decided that a land vehicle bomb could cause a LOCA, then LOCA mitigating systems must also be included. These trees may be useful as a guide to prepare a plant-specific tree that includes plant-specific assumptions and actual systems. For example, if loss of off-site power is not assumed, then several additional systems (e.g., main feedwater, steam and power conversion systems) are available. Also, plant-specific assumptions regarding the length of time that hot shutdown is maintained may eliminate the need for some long-term support systems, such as room cooling.

Table 2-1. Safety Functions and Associated Front-line Systems for a Typical PWR Plant.

SAFETY FUNCTION (from NUREG-0737, Supplement 1)	SUB-FUNCTION	PRIMARY MITIGATING SYSTEM	BACKUP MITIGATING SYSTEMS
Reactivity Control	Reactor Shutdown (Scram)	RPS and scram portion of control rod system	Boration via chemical and volume control system (CVCS)
Reactor Core Cooling and Heat Removal from the Primary System	RCS Inventory Control	Chemical and volume control (charging) system (CVCS)	High-pressure ECCS pumps
	RCS Pressure Control	Pressurizer heaters, spray and power-operated relief valves (PORVs)	Pressurizer backup heaters and safety valves (SVs)
	RCS Heat Sink	Main steam and power conversion system (via main turbine or turbine bypass system)	Auxiliary feedwater system and atmospheric steam dumps
Reactor Coolant System Integrity	RCS Pressure Control	same as above	same as above
	RCS Isolation	Automatic actuation of isolation valves	Remote-manual actuation of isolation valves
Containment Conditions	Containment Heat Removal	Containment normal cooling system	Emergency fan coolers and/or spray system
	Containment Isolation	Automatic actuation of isolation valves	Remote-manual actuation of isolation valves
	Containment Cleanup	Not required for transient mitigation	
Radioactivity Control		Normal ventilation cleanup system	ESF ventilation cleanup system

Table 2-2. Safety Functions and Associated Front-line Systems for a Typical BWR Plant.

SAFETY FUNCTION	SUB-FUNCTION	PRIMARY MITIGATING SYSTEM	BACKUP MITIGATING SYSTEMS
Reactivity Control	Reactor Shutdown (Scram)	RPS and scram portion of control rod system	Standby liquid control system
Reactor Core Cooling and Heat Removal from the Primary System	RCS Inventory Control	Main feedwater system	RCIC system injecting from CST or suppression pool HPCI system injecting from CST or suppression pool
	RCS Pressure Control	Safety/relief valves	ADS
	RCS Heat Sink	Main steam and power conversion system (via main turbine or turbine bypass system	RCIC Steam Condensing Suppression pool (short-term) Suppression pool plus RHR system operating in containment cooling mode
Reactor Coolant System Integrity	RCS Pressure Control	Same as above	Same as above
Containment Integrity	Containment Heat Removal	RHR system operating in containment cooling mode	Drywell chillers
	Containment Pressure Control	Same as above	Same as above
	Containment Isolation	Automatic actuation of isolation valves	Remote-manual actuation of isolation valves
	Containment Cleanup	Not required for transient mitigation	
Radioactivity Control		Standby gas treatment system	Normal ventilation cleanup system

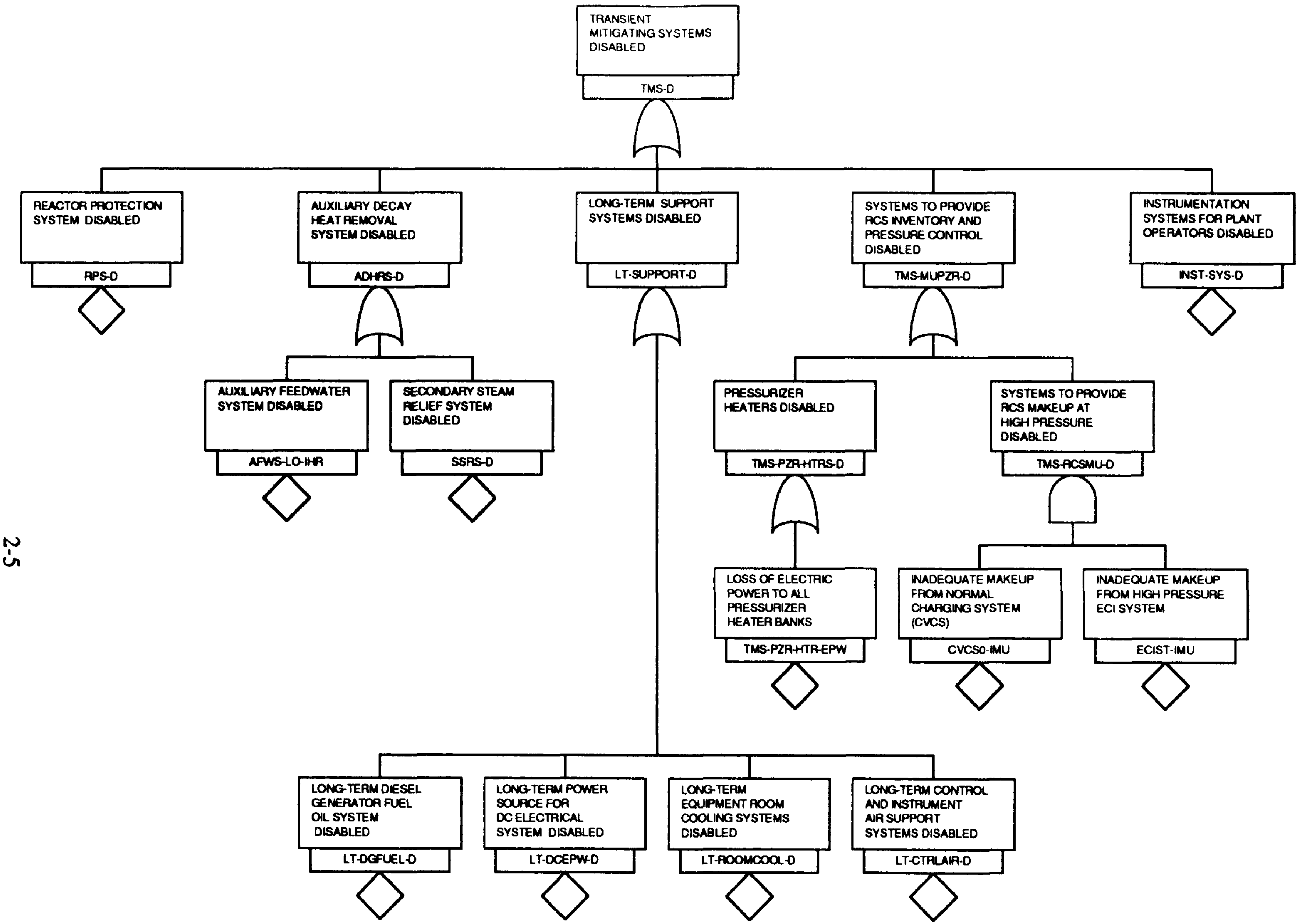


Figure 2-1. PWR Transient Mitigating System Fault Tree.

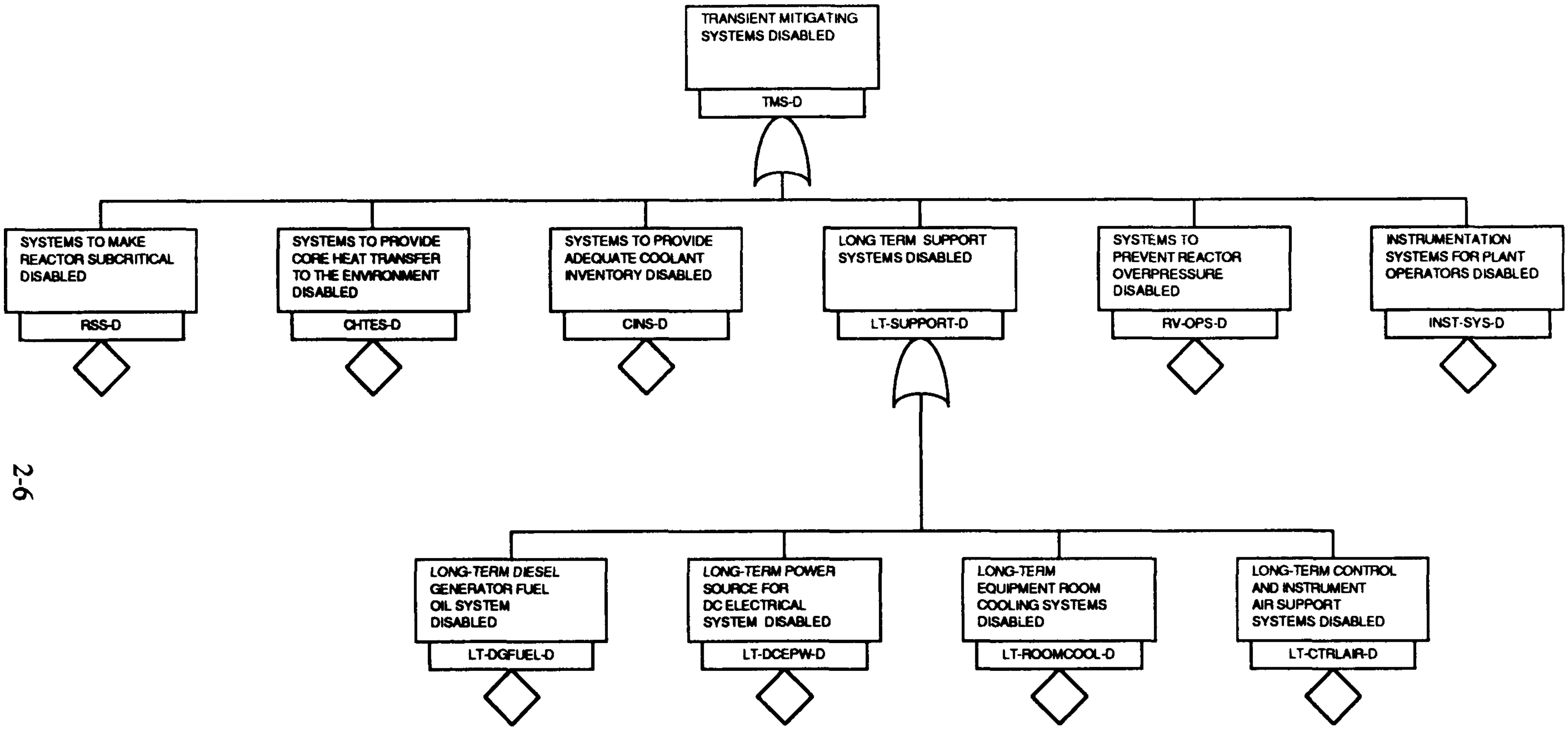


Figure 2-2. BWR Transient Mitigating System Fault Tree.

The terms in Figures 2-1 and 2-2 can be expanded to reflect site-specific failure modes for the systems and functions referenced. The expanded fault trees also point out the need to have a reliable source of instrumentation for the plant operators. This includes both instrumentation panels and electric power for those panels. The analysis should address all panels (e.g. control room, safe shutdown, local) and all power sources.

The symbols used in Figures 2-1 and 2-2 are defined in Figure 2-3.

2.2 SUPPORT SYSTEMS

Each of the front-line systems identified above require supporting systems or functions. The support functions and associated system requirements needed to permit sustained operation of the front-line systems must be defined. Examples of these support functions include, but are not limited to the following: (a) electrical motive power, (b) electrical control power, (c) pneumatic or hydraulic motive or control power, (d) actuation, (e) fuel supply, (f) lubrication, (g) equipment cooling, and (h) room cooling. System dependencies could be summarized in terms of a matrix or a system dependency diagram as used in the NUREG-1150 PRAs (Ref. 5). Figure 2-4 shows an example system dependency diagram. Note that important system dependencies also should be included in PRA or VAA models that may be available for a particular plant.

2.3 IDENTIFICATION OF AVAILABLE SYSTEM OPTIONS

Using the above front-line and support system information, a set of available system options for achieving safe shutdown can be developed. In each system option all required safety functions should be satisfied. However, it should be noted that in most cases if the core cooling and RCS integrity functions are satisfied, then the containment integrity function will not be challenged. If containment integrity is satisfied the radioactivity control function, as it relates to releases from the reactor core, will probably be satisfied. Other potential sources of release, such as spent fuel and radioactive waste systems, may also warrant consideration to determine if significant release could result from a land vehicle bomb attack. It should be noted that prior VAA studies have concluded that radioactive waste systems do not contain enough activity to cause a release in excess of 10 CFR Part 100 limits. The amount of activity present in spent fuel storage is a function of burnup and time since refueling.

Any determination of system options should be based on a consistent understanding of contingency plan success. For example, if a plant can stay in "hot" shutdown or standby for an extended period of time then this may qualify as a success. If a plant cannot stay hot for an extended period of time it would be necessary to establish cold shutdown for a success path to be achieved. Factors that go into this determination should include, but not be limited to, the capacity of available water sources, capacity of available heat sinks (e.g., period of time before suppression cooling must be established in a BWR), and battery capacity. The ability to replenish water supplies via hose connections or tank trucks, and to recharge batteries using portable diesels can be considered.

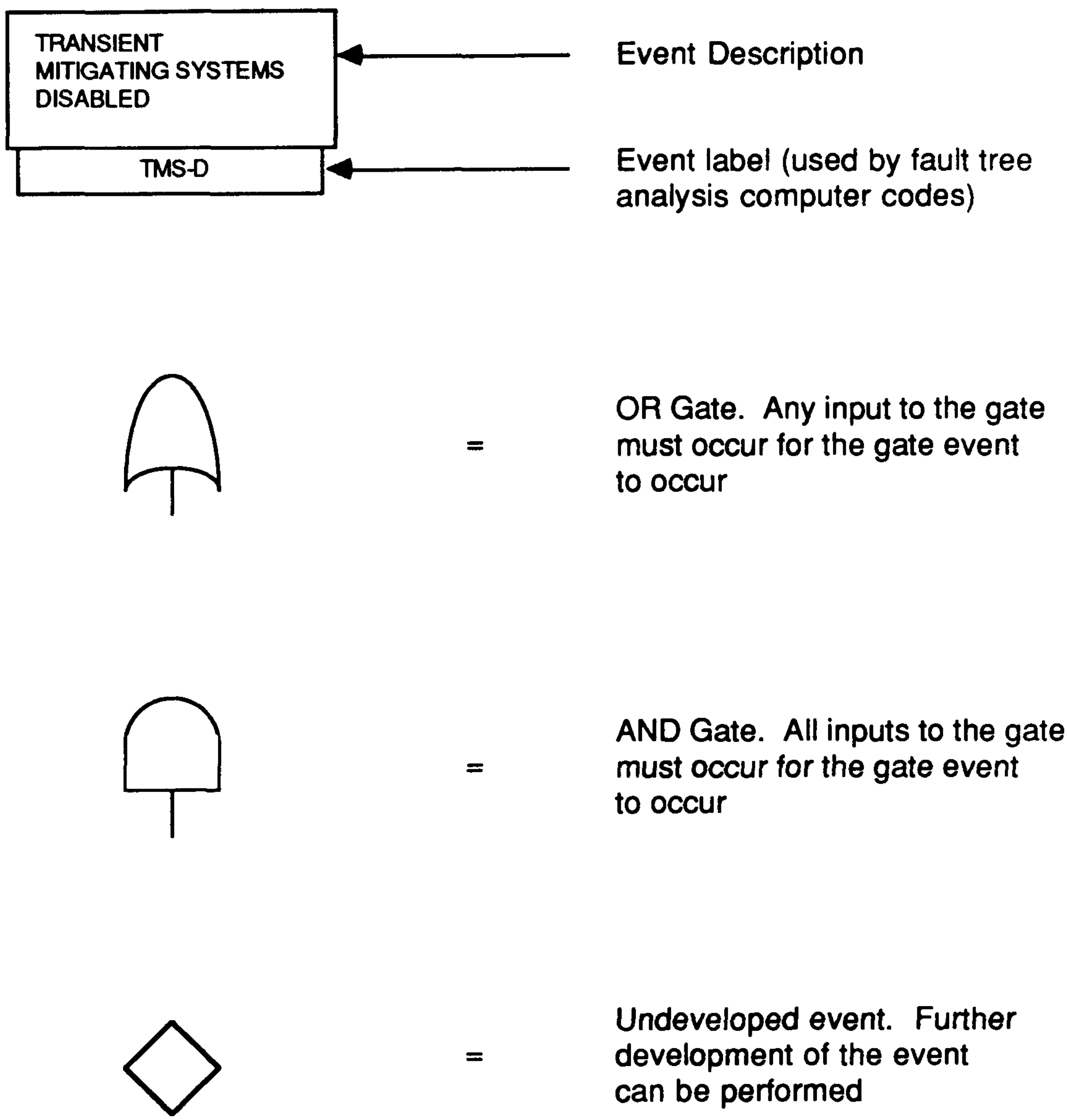
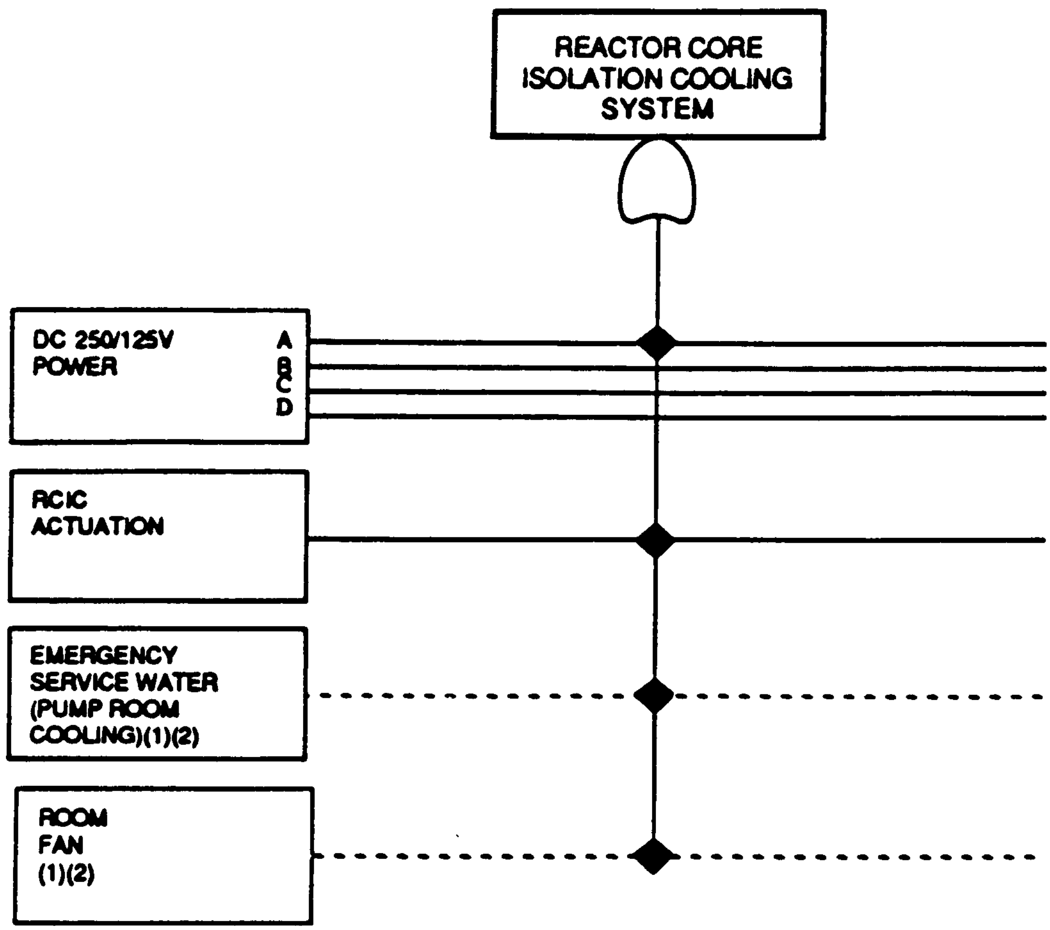


Figure 2-3. Definition of Symbols Used in Fault Trees.



Dependency Diagram Is Shown Using Failure Logic.
(1) Dependency Not Required During Short Term Operation.
(2) Room Cooling Can Also Be Performed By Opening Doors.

Figure 2-4. Example System Dependency Diagram.

After compiling the list of system options each option should be ranked based on engineering or operational considerations, such as: (a) a better quality water source is used, (b) only one AC and/or DC load group is needed, (c) depressurizing the RCS is not required. The resulting prioritized list of system options should be included in contingency procedures to familiarize the operator with the degree of flexibility available in dealing with the land vehicle bomb, should such a threat arise.

2.4 SECTION 2 REFERENCES

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SECTION 3
PROTECTING PLANT SYSTEM OPTIONS

The next two steps in the methodology is to examine the locations of essential equipment and the ability of structures to survive a bomb blast. The purpose of these steps is to characterize the system options identified in the previous step by their inherent ability to withstand effects of a threatened land vehicle bomb.

The major variables of concern in this step are the size of the explosive and the strength of the structures. Explosive size can be expressed in terms of pounds of trinitrotoluene (TNT). Structure strength can be expressed in terms of static wall capacity, as discussed in Section 3.3. Static wall capacity is the ability of a wall to resist a given loading. Based on the site's tornado and seismic zones, all safety related structures must be designed with a certain static wall capacity. For the purposes of contingency planning, the tornado or seismic zone wall capacity can be assumed, or a more detailed analysis can be performed. Such an analysis can also address the issue of tolerable damage, that is, damage that would not ordinarily be acceptable for continued plant operation, such as cracks that exceed the basis on which the structure was designed, but will still permit safe shutdown.

3.1 PLANT SURVIVAL ZONES

A survival zone is defined as an area of some radius out from each wall of a structure, such that if an explosion takes place outside of the zone the structure will not be unacceptably damaged. The radius of the survival zone area is also known as the safe standoff distance. Standoff distances can be calculated based on the blast resistance of each structure, as discussed in Section 3.3.

Survival zones should be defined for all structures containing equipment in the system options. An initial approach is to define zone boundaries based on the perimeter walls of buildings. A more detailed analysis can be performed to define survival zone boundaries based on actual structural parameters and propagation of blast effects to the interior of the building and to safety equipment contained within the building. It is recommended that outside building walls be used for an initial determination of survival zones.

3.2 LOCATION OF SYSTEMS IN RELATION TO THE DEFINED SURVIVAL ZONES

For each system option the associated survival zones should be considered. For example, one potential system option for a BWR involves use of the reactor core isolation cooling (RCIC) system for core cooling and inventory control, supported by the station batteries. The survival zones associated with this system option may be represented by the reactor building zone (which contains the RCIC piping, valves, pumps and controls) and the turbine building zone (which may contain the batteries and supporting switchgear). An additional zone for the Condensate Storage Tank can be added, but the suppression pool inside the reactor building represents an alternate water source.

The result is the conversion of the list of system options developed in Section 2 to a list of survival zones that represent the protection of available system options for safe shutdown.

3.3 BLAST LOADING ESTIMATES

A methodology for calculating standoff distance, which is defined as the minimum distance from a structure that a given magnitude of explosion will not cause damage to the structure, can be found in NUREG/CR-2462 (Ref. 1). The standoff distance is calculated with the following formula (Ref. 1):

$$R = F\mu \left(\frac{W}{P_s^2} \right)^{1/3}$$

where
R = standoff distance in feet
$F\mu$ = ductility factor
W = TNT equivalent of explosive in lbs
P_s = static wall capacity in psi

It is suggested in NUREG/CR-2462 that a ductility of 3 is most appropriate for this type of analysis.*

The major variables in this calculation are the size of the explosive and the static wall capacity of the structure. The static wall capacity can be simply assumed to be the minimum allowed for the plant's tornado zone or seismic zone. However, it should be noted that a number of conservative assumptions were made in deriving this formula. If the standoff distances determined by application of this formula can be achieved, no further calculations are necessary. If not, making more detailed calculations may be necessary. NUREG/CR-2462 contains a methodology for more realistic calculations of standoff distances. A more direct approach to determine blast effects which does not rely directly on static wall capacities is provided in the Southwest Research Institute Blast Vulnerability Guide (Ref. 2). In reality, most equipment is located within rooms in the interior of their respective buildings. Determining the blast and fragment loading on specific equipment within interior rooms requires detailed knowledge of the architectural details and therefore must be calculated on a site-by-site basis. A realistic, commercially available approach for performing calculations of blast effect using computer modeling and graphics was presented at the 29th annual INMM meeting (Ref. 3). Appendix B also provides several references pertaining to bomb/blast effects.

* For ductility = 3, the ductility factor, $F\mu = 54$.
Other ductility factors are tabulated in NUREG/CR-2462.

Once the standoff distance for each structure is calculated, the size of the survival zones is established. For the purposes of contingency planning a simplified plot plan of the site should be prepared, showing the major structures, roads, and fences. Then, the survival zones should be overlaid on the site plan. This will provide an idea of the degree of vulnerability of the structures which house essential systems. The drawing of the survival zones can take into account blast shielding by other buildings.

3.4 SURVIVAL ENVELOPES

In Section 3.2 each system option was associated with a set of survival zones. Using the standoff distances calculated above, a survival envelope can be determined for each option. Each envelope will be bounded in all directions by the maximum standoff distance of each survival zone that extends in that direction. Each envelope represents an area such that, if an explosion occurs outside, at least one system option will survive to ensure safe shutdown.

For the purposes of contingency planning the survival envelopes could be overlaid on the site plan.

3.5 SECTION 3 REFERENCES

1. Kennedy, R.P., Blejwas, T.E., and Bennett, D.E., "Capacity of Nuclear Power Plant Structures to Resist Blast Loadings," NUREG/CR-2462, Sandia National Laboratories, September 1983.

2. Whitney, M.G., Ketchum, D.E., Polcyn, M.A., "Blast Vulnerability Guide," Southwest Research Institute (prepared for the Naval Civil Engineering Laboratory), October, 1987.

3. Massa, R.J., et al.,"BombCAD - A New Tool for Bomb Defense in Nuclear Facilities," Proceedings of the 29th Annual Meeting of the Institute of Nuclear Material Management, June, 1988.

SECTION 4
SELECTION OF PREFERRED SYSTEM OPTIONS BASED ON PLANT LAYOUT

The results of the first two steps of the methodology is identification of a set of survival envelopes that facilitate the protection of systems and equipment required for safe shutdown. The system options, and hence the survival envelopes, have been ranked based on engineering and operational considerations. The third step of the methodology involves examination of the physical characteristics of the site, including existing security features, in order to choose the system option or options that can be most readily protected from attack. Then tradeoffs can be performed between the operational concerns and security concerns to choose the preferred system options.

4.1 AVENUES OF APPROACH

All credible approach paths for land vehicle bombs should be defined. Credible approaches include existing roads and off-road approaches over open terrain in the vicinity of the site. All credible approach paths should be noted on the site plan drawing along with the survival envelopes. Features of the plant that would impede vehicle travel, such as berms, recesses, buildings, and equipment, should also be identified.

4.2 RELATIONSHIP OF SURVIVAL ENVELOPES AND AREAS ACCESSIBLE TO LAND VEHICLE BOMBS

By overlaying the survival envelopes on a site plan that shows access routes and security features, information can be gained about the relative vulnerability of each system option. For example, survival envelopes that fall completely within the plant security fence may be preferable to envelopes that extend beyond the fence. Also, envelopes that are not readily accessible to vehicles have advantages over those that are more accessible.

Locations inside survival envelopes that are accessible to a land vehicle bomb, or that vehicles might be expected to reach without the installation of additional barriers, should be identified. There may be some areas on the plant site that are common to all survival envelopes and are accessible to a land vehicle bomb. These areas are important because they offer the potential for a land vehicle bomb to disable all available system options for establishing and maintaining a safe shutdown. It should be the goal of the contingency plan to preserve the integrity of at least one complete survival envelope.

The plant should identify envelopes that contain a safe shutdown option (or options) and develop contingency measures that will enhance the likelihood that these options will survive a vehicle bomb attack. It should be noted that the most preferable system option from an operational standpoint may be the more vulnerable to attack than other options. For example, options that require off-site power may have larger envelopes than options that utilize on-site emergency power. It is the intent of the methodology to identify, prior to an event, several options for dealing with recovery from or protection of the plant from the vehicle bomb, and preserving as much flexibility as possible depending on the particular circumstances. In preparing contingency measures to preserve these options consideration should be given to the relative ease in which the envelopes can be protected. Factors to consider include whether a survival envelope is entirely within the control of the security force, and whether a survival envelope encompasses existing site features in the owner-controlled area that afford some protection against vehicle bombs (i.e., structures in the owner-controlled area, site topography).

SECTION 5
CONTINGENCY MEASURES TO PRESERVE THE PREFERRED SYSTEM OPTIONS

The first four steps of the methodology result in the selection of preferred system options that take into account engineering and operational features of plant systems and the location and vulnerability of key equipment. The last two steps of the methodology involve the identification of and prearrangements for specific contingency measures that can be taken if the NRC determines that an increased state of readiness is necessary. These measures fall into three major categories: 1) measures to increase plant operational readiness, 2) changes to current plant operating mode, and 3) security measures to restrict vehicle access. These topics are discussed below.

5.1 OPERATIONAL MEASURES TO INCREASE PLANT READINESS

The plant should consider measures to increase system availability or operating flexibility. This includes alterations to normal system lineups to place them in a transient mitigation mode, curtailing plant activities that could limit system or component operability, and arrange for additional backup equipment. NUREG/CR-2585 (Ref. 1) identifies many methods for restoring key plant safety functions if the installed primary and backup systems are disabled. NUREG/CR-2585 could be used as a sourcebook for contingency planning. The following is a list of example measures that may be appropriate depending on the circumstances:

- Minimize the impact of maintenance and testing on the availability of systems that are usable in establishing and maintaining a safe shutdown condition.
  - Put back in service any equipment that has been temporarily taken out of service for maintenance or testing.
  - Postpone maintenance or testing activities that would take equipment out of service.

- Ensure that engineered safety features systems are aligned for emergency operation, if such alignment would not increase vulnerability to a LOCA caused by the land vehicle bomb.
  - Confirm that ECCS subsystems are aligned for injection.
  - Confirm that RCIC system suction and discharge valves are open (BWR).
  - Confirm that Auxiliary Feedwater System suction and discharge valves are open (PWR).

- Maximize the short-term heat sink available for absorbing decay heat load.
  - Increase condensate storage tank water level to maximum.
  - Increase suppression pool water level to maximum allowed level (BWR).
  - Reduce suppression pool temperature to the minimum allowed temperature (BWR).

- Increase water level in the upper containment pool (for suppression pool makeup) to maximum (BWR).

- Maximize the availability of ultimate heat sink systems.
  - Start emergency service water system pumps
  - Flush emergency service water system pump discharge strainers.

- Maximize the readiness of support systems.
  - Fill diesel fuel oil day tanks and long-term diesel fuel oil storage tanks to maximum.
  - Charge instrument and service air accumulators to maximum.

- Pre-position on-site emergency equipment that may be needed to support any contingency actions:

Item	Locations
Portable fans	Switchgear rooms Battery rooms Pump rooms
Portable 125 VDC generator	Battery rooms
Portable submersible pumps	Various locations TBD

- Notify pre-selected off-site vendors of the potential need for delivery of the following types of supplies and equipment:

  Portable 480 VAC generator
  Power cables
  Portable air-conditioning units
  Flexible ventilation duct work
  Fire hose
  Diesel fuel (tank truck)
  Water (tank truck)
  Bottled high-pressure gas
  Contingency barriers

5.2 MEASURES FOR LIMITING VEHICLE ACCESS

Methods for determining an appropriate standoff distance and survival envelope perimeter are described in Section 3. Once the survival envelopes have been determined and land avenues of approach analyzed, contingency procedures need to be developed and personnel trained in those procedures in order to compensate for perceived vulnerabilities. Specifically, procedures should be developed which address deployment of contingency barriers and placing security force personnel and equipment on the perimeter of the survival zone to restrict vehicle traffic into and within the site.

The primary means of limiting vehicle access is through the use of contingency barriers. The objective of a barrier is to channel, slow down, or stop a vehicle. Channeling the vehicle prevents it from leaving a prescribed route. Obstacles placed in the pathway can slow or stop the approaching vehicle, can force the driver to reveal his intentions, and can give the security force more time to react to an attempted penetration.

Arrangements can be made with off-site companies and organizations for equipment which can be used as barriers (e.g., local cement companies, constructions firms). The type of contingency barriers to be used for a particular site will depend upon the site configuration and the resources available. For example, items such as concrete pipes, 55-gallon drums, and large rocks can be moved into appropriate positions, and heavy duty equipment like bulldozers may be used as a barrier or to create ditches and berms. Additionally, preplanned purchase or construction of contingency barriers may be applicable.

In applying barriers it is useful to consider three zones: the approach zone, the impact zone, and the survival zone. The approach zone provides an area where vehicles can be slowed down for identification and search. It also provides an area where the driver's intent may be discerned. Barriers can be erected alongside the road to prevent any attempt to circumvent checkpoints and roadway barriers. At the end of the approach zone a manned checkpoint is established. Those vehicles authorized to proceed are searched here before being allowed entry into the impact zone. The impact zone is that area between the manned checkpoint and a moveable barrier capable of stopping further penetration into the survival zone (e.g., bulldozer). The survival zone (Section 3.1) is defined as an area of some radius from the wall of a structure, such that if an explosion takes place outside the zone, the structure will not be damaged.

5.3 SECTION 5 REFERENCE

1. Lobner, Peter, "Nuclear Power Plant Damage Control Measures and Design Changes for Sabotage Protection," NUREG/CR-2585, Science Applications International Corporation, May 1982.

SECTION 6
EXAMPLE APPLICATION OF THE METHODOLOGY TO THE SUNSHINE BWR PLANT

6.1 OVERVIEW OF EXAMPLE

This section illustrates how the methodology can be applied to a BWR plant. The Sunshine BWR plant is a fictitious plant that is modeled after a typical BWR/4 plant. This section documents the process of applying the methodology to the Sunshine BWR plant. The subsections are designed to follow the preceding sections of this report. For example, Section 6.2 documents the application of Section 2, the selection of system options for safe shutdown. Section 6.3 applies to Section 3. Examples of modifications to the SCP from this application are included in Appendix A.

6.2 PRINCIPAL CONTINGENCY PLANNING CONSIDERATIONS AT THE SUNSHINE BWR PLANT

Sources of radioactive material at the Sunshine BWR plant include the reactor core, the spent fuel in storage in the spent fuel pool, new fuel, and the radioactive waste system. The inventory of radioactive material available in new fuel and the radioactive waste system is insufficient to cause a significant release with consequences comparable to the 10 CFR Part 100 dose guidelines (Ref. 1). Therefore these sources are not significant concerns as land vehicle bomb targets. The inventory of radioactive material in spent fuel decays after reactor shutdown and often remains a potential source of a significant release for a period of a month or more following refueling. The reactor core is the primary concern as the source of a potential release initiated by a land vehicle bomb. The balance of this section identifies system options associated with preventing a significant release from the reactor core.

6.2.1 Front-Line Systems

This section defines the systems that need to be considered in contingency planning following a land vehicle bomb attack. Systems should be available to provide the following functions:

- Reactivity control
- Reactor core cooling and heat removal from the primary system
- Reactor coolant system integrity

If these functions cannot be provided then the following additional functions may be needed:

- Containment integrity
- Radioactivity control

Table 6-1 shows the particular systems used at the Sunshine BWR plant to satisfy these functions. The table assumes a transient occurs when the plant is in a "hot" condition, (i.e., power, startup, or hot shutdown). The primary system is listed along with a backup system.

6.2.2 Support Systems

Each of the front-line systems identified above require supporting systems or functions, such as electric power, control, and cooling. Table 6-2 identifies the types of support functions and systems available at the Sunshine BWR plant. Table 6-3 shows the relationship between the front-line systems and the support systems, effectively matching each front-line system with its required support systems.

In this example, it is assumed that station batteries can support design loads for up to 6 hours without recharging. Systems supported by DC power only may remain operable up to the point where the batteries are exhausted. Extended operation will require power from the AC system via the battery chargers, or portable emergency generators specifically intended for supporting the DC power system.

6.2.3 Preferred System Options

The following is a list of system options, ranked in order of preference. Each option assumes that the RPS operates to scram the reactor. Each option also assumes the plant will stay in an extended hot shutdown state. The RHR system must be added to each option to go to cold shutdown. Each option assumes that containment heat removal and radioactivity control are not required unless the systems for decay heat removal, inventory control, and pressure control fail to perform their functions.

System Option	Description
1	Off-site power, main feedwater system, power conversion system
2	RCIC, steam relief to suppression pool
3	RCIC and RHR operating in steam condensing mode
4	HPCI, steam relief to suppression pool
5	ADS, LPCI
6	ADS, Core Spray

Table 6-1. Safety Functions and Associated Front-line Systems for the Sunshine BWR Plant.

SAFETY FUNCTION	SUB-FUNCTION	PRIMARY MITIGATING SYSTEM	BACKUP MITIGATING SYSTEMS
Reactivity Control	Reactor Shutdown (Scram)	RPS and scram portion of control rod system	Standby liquid control system
Reactor Core Cooling and Heat Removal from the Primary System	RCS Inventory Control	Main feedwater system	RCIC system injecting from CST or suppression pool HPCI system injecting from CST or suppression pool
	RCS Pressure Control	Safety/relief valves	ADS
	RCS Heat Sink	Main steam and power (via main turbine or turbine bypass system)	RCIC Steam Condensing (short-term) Suppression pool Suppression pool plus RHR system operating in containment cooling mode
Reactor Coolant System Integrity	RCS Pressure Control	Same as above	Same as above
Containment Integrity	Containment Heat Removal	RHR system operating in containment cooling mode	Drywell chillers
	Containment Pressure Control	Same as above	Same as above
	Containment Isolation	Automatic actuation of isolation valves	Remote-manual actuation of isolation valves
	Containment Cleanup	Not required for transient mitigation	
Radioactivity Control		Standby gas treatment system	Normal ventilation cleanup system

Table 6-2. Support Functions and Systems for the Sunshine BWR Plant.

SAFETY FUNCTION	SUB-FUNCTION	PRIMARY MITIGATING SYSTEM	BACKUP MITIGATING SYSTEM
AC Power	Motive Power	4160/480 VAC system supplied from offsite power (OSP)	4160/480 VAC system suppled from diesel generators
	Instrument and Control Power	120 VAC system supplied via inverters from 125/250 VDC System	120 VAC system supplied from 480 VAC System
DC Power		125/250 VDC system supplied via battery chargers from 4160/480 VAC System	125/250 VDC system supplied from station batteries
Essential Equipment Cooling	Diesel Cooling	Essential Service Water System operating open-loop	ESW system operating closed-loop with emergency cooling tower
	Pump Cooling	Same as above	Same as above
	Equipment Room Cooling	Same as above	Same as above
Decay Heat Removal (RHR Heat Exchanger Cooling)	RHR Service Water Service operating open-loop	RHRSW System operting closed-loop with emergency cooling tower	Rig spool piece to supply via ESW System
System Actuation	Automatic actuation logic	System-level manual actuation (i.e., actuate RCIC, ADS, etc.)	Component-level manual actuation (i.e., actuate individual pump or valve remotely or locally
Pneumatic Power	Diesel starting	Air start accumulators	Air compressors to recharge accumulators
	Valve power	Service air system	Dedicated accumulators
	Instrument air	Same as above	

Table 6-3 System Dependency Matrix for Front Line Systems at the Sunshine BWR Plant

FRONT-LINE SYSTEMS	REQUIRED SUPPORT SYSTEMS														
	AC Div A	AC Div B	DC Div 1	DC Div 2	ESW A	ESW B	RHRSW A	RHRSW B	Auto Act.	Manual Act.	Diesel Fuel Oil A	Diesel Fuel Oil B	Pneum. System	Room Fan Cooler Units	REMARKS
RPS (Normal Scram)															No Dependencies to Scram
RPS (Backup Scram)			X	X					X						
SLCS	X									X					
RCIC (Short-term)			X						X						
RCIC (Long-term)			X		X				X					X	ESW for Room Cooling
HPCI (Short-term)				X					X						
HPCI (Long-term)				X		X			X					X	ESW for Room Cooling
RHR A/C (Inject)	X		X		X				X					X	
RHR A/C (Cooling)	X		X		X		X			X				X	
RHR B/D (Inject)		X		X		X			X					X	
RHR B/D (Cooling)		X		X		X		X		X				X	
Core Spray	X		X		X				X					X	
ADS			X	X					X				X		Either DC Train
AC Division A (From Offsite Power)			X											X	
AC Division A (From Diesel)			X		X				X		X		X	X	
AC Division B (From Offsite Power)				X										X	
AC Division B (From Diesel)				X		X			X			X	X	X	
DC Division 1 (From Battery)															6 Hour Life with Design Loads
DC Division 1 (From AC)	X														
DC Division 2 (From Battery)															6 Hour Life with Design Loads
DC Division 2 (From AC)		X													
ESW A	X		X						X						
ESW B		X		X					X						
RHRSW A	X		X							X					
RHRSW B		X		X						X					
Diesel Fuel Oil A	X		X						X						AC and DC Transfer Pumps
Diesel Fuel Oil B		X		X					X						AC and DC Transfer Pumps
Service Air System	X		X												Non-safety System
Pneumatic Accumulators															No Dependencies if Charged
Room Fan Coolers A	X		X												
Room Fan Coolers B		X		X											

6.3 PROTECTING SYSTEM OPTIONS AT THE SUNSHINE BWR PLANT

This section examines the locations of essential equipment and the ability of structures to survive a land vehicle bomb blast. For a given structure to be affected there must be a direct line of sight between the explosion and a wall of the structure, (i.e., where grouped fairly close together, one building is assumed to shield another building from the direct effects of the blast.). Figure 6-1 shows a simplified plot plan for the site.

6.3.1 Plant Survival Zones

A survival zone is defined as an area of some radius out from each wall of a structure, such that if an explosion takes place outside of the zone the structure will not be damaged. The radius of the survival zone area is also known as the safe standoff distance. Standoff distances will be calculated in Section 6.3.3, based on the blast resistance of each structure.

Survival zones have been established for the following major structures - reactor building (RB), turbine building (TB), diesel generator building (DG), condensate storage tank (CST), and intake structure (INTK). A survival zone has not been established for the switchyard because a large area of the plant as well as off-site areas are associated with off-site power.

6.3.2 Location of Essential Equipment

For each system option identified in Section 6.2 the applicable survival zones are identified. Clearly the reactor building is important to all strategies because it contains the RCS and its interfaces with core cooling systems. Therefore, the CST zone is omitted from RCIC and HPCI options because the suppression pool can be used as a water source. The turbine building is required in all strategies because the control room, emergency switchgear rooms, and battery rooms are located inside. In system option 2 utilizing the RCIC system, the control room can be replaced by the remote shutdown panel inside the radwaste building. However, since the RCIC requires the Division A battery the turbine building is still important to option 2. Therefore, the radwaste building is omitted from option 2.

Most of the equipment associated with the RCIC and ECCS, particularly the pumps, is below grade and therefore is assumed to be protected. However, some piping and power control cable runs are at grade level in the reactor building, making these systems vulnerable to an explosion within the reactor building's survival zone.

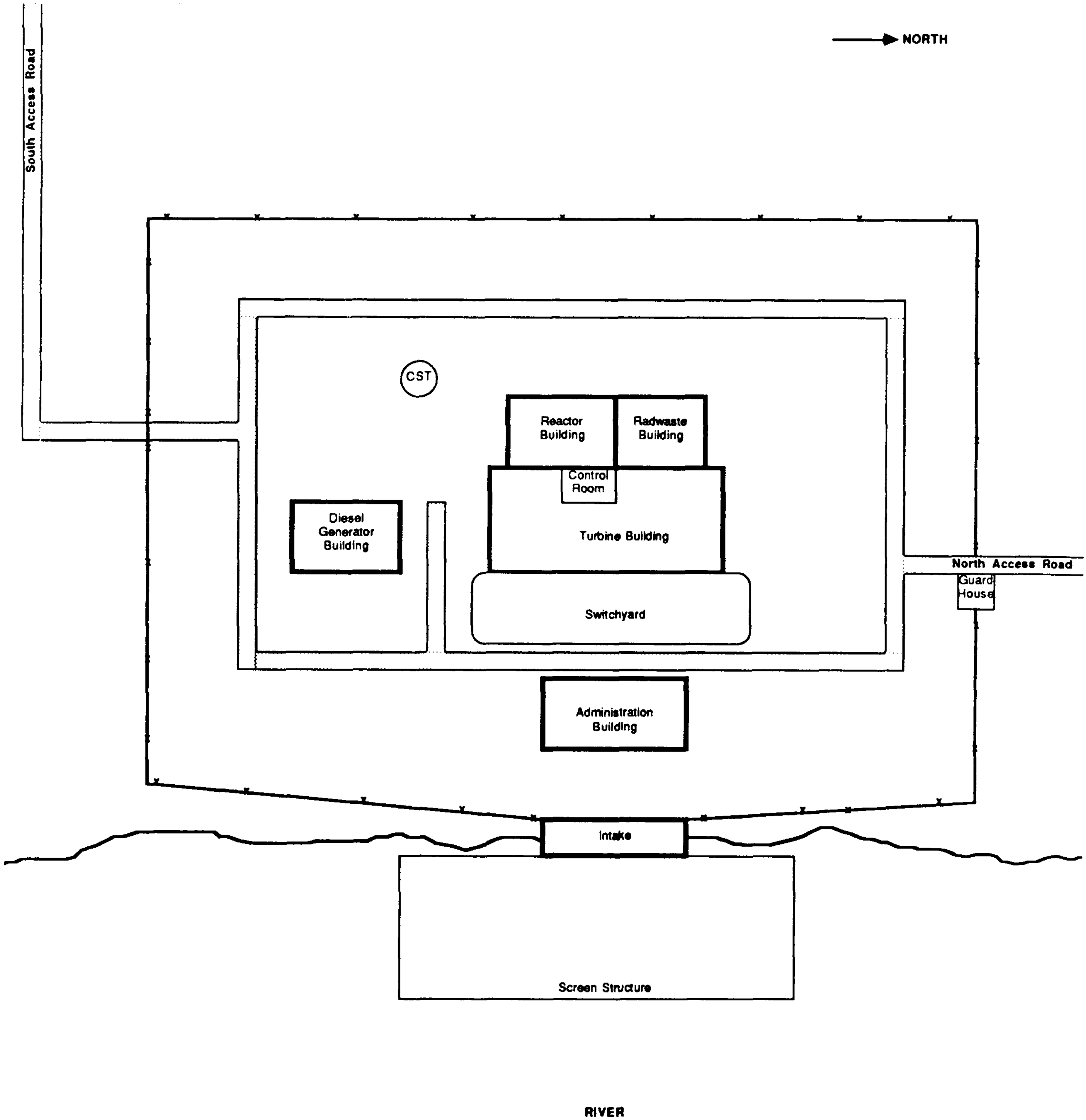


Figure 6-1. Simplified Plot Plan of Sunshine BWR Plant

The following is a list of survival zones required for each system option. Both front-line and support systems are considered.

System Option	Survival Zones
1	RB, TB, off-site power (OSP)
2	RB, TB
3	RB, TB, DG, INTK
4	RB, TB
5	RB, TB, DG, INTK
6	RB, TB, DG, INTK

6.3.3 Blast Loading of Structures

Since the Sunshine plant is located in Tornado Zone I, all structures are built, as a minimum to withstand a static overpressure of 3.0 psi. NUREG/CR-2462 (Ref. 2) provides guidance for calculating static overpressure for more sturdy structures. The reactor building, with 24 inch thick concrete walls and a maximum wall span of 26 feet, has a static wall capacity of 4.5 psi. The diesel generator building, with 24 inch thick walls and a span of 19 feet, has a static wall capacity of 7.5 psi. All other structures are assumed to be designed for the 3.0 psi tornado requirement.

The standoff distance for each structure is calculated with the following formula:

$$R = F\mu \left(\frac{W}{P_s^2} \right)^{1/3}$$

where
R = standoff distance in feet
$F\mu$ = ductility factor
W = TNT equivalent of explosive in lbs
P_s = static wall capacity in psi

Reference 2 suggests a ductility of 3 is most appropriate for this analysis.*

Figure 6-2 shows an example standoff distance for each structure overlaid on the simplified plot plan. The curves were drawn assuming shielding by other buildings.

* For ductility = 3, the ductility factor, $F\mu = 54$.
Other ductility factors are tabulated in NUREG/CR-2462.

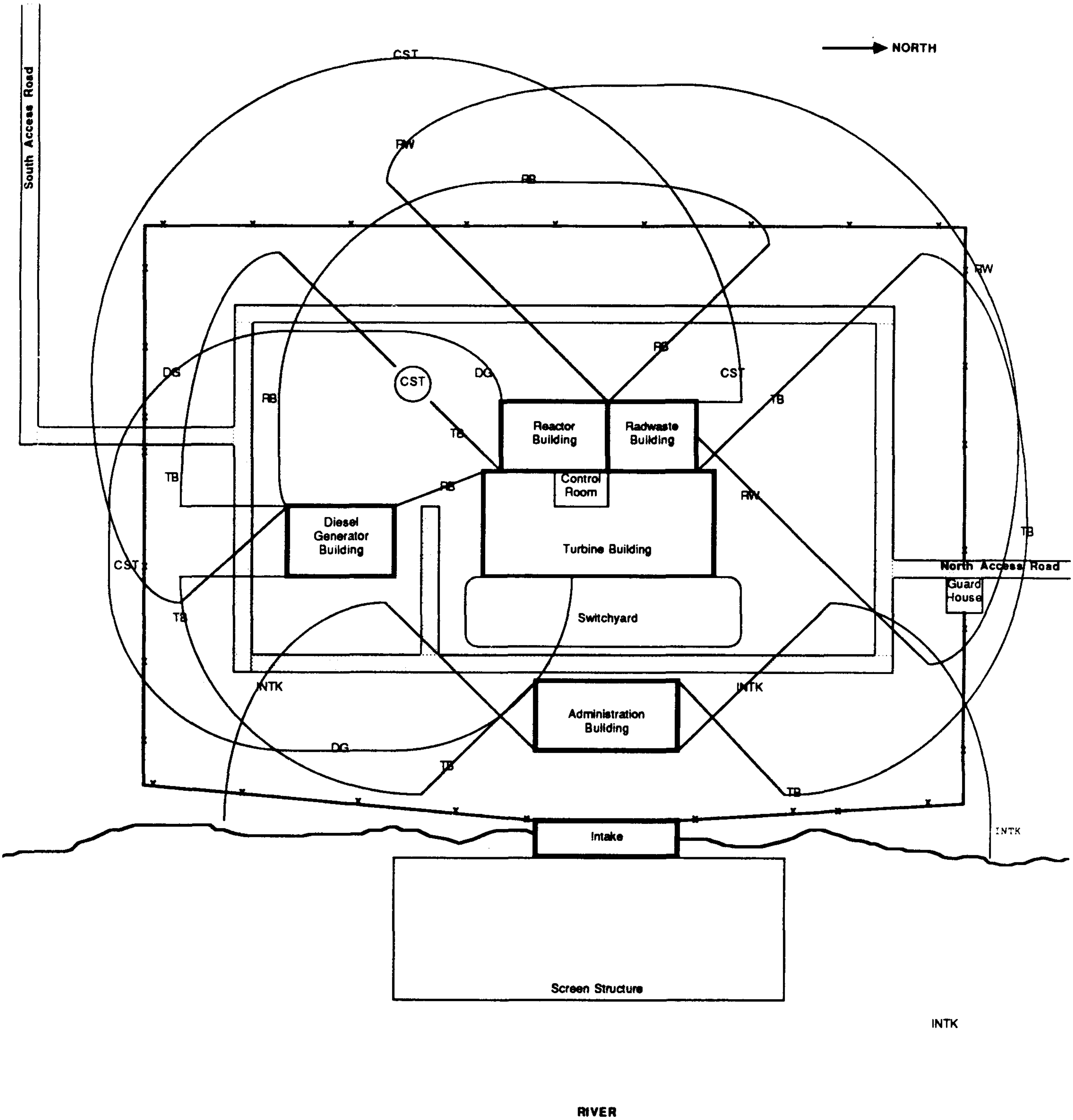


Figure 6-2. Survival Zones for Sunshine Plant Structures

6.3.4 Survival Envelopes

Given the survival zones required for each system option, and the standoff distance for each zone, a set of envelopes has been developed which represent the overall survival zone for each system option. Figure 6-3 shows the survival envelopes overlaid on the simplified plot plan.

6.4 SELECTION OF PREFERRED SYSTEM OPTIONS BASED ON PLANT LAYOUT AT THE SUNSHINE BWR PLANT

6.4.1 Avenues of Approach

The Sunshine BWR plant site has two access roads, the main road from the north and an auxiliary access road from the south. The plant is bordered on the west by hills and on the east by the river, so the two access roads are the only credible approach paths for land vehicles.

6.4.2 Relationship of Survival Envelopes and Areas Accessible to land Vehicle Bombs

Figure 6-3 shows that all of the system options share a common minimum survival envelope, with options 3, 5, and 6 having a more extensive envelope. Therefore, the contingency plan will be designed to protect the minimum survival envelope. This will ensure that a viable system option will be available to achieve a safe shutdown.

The smallest survival envelopes are for system options 2 (RCIC) and 4 (HPCI). These options require protection of only the reactor and turbine buildings. Other survival envelopes also contain these buildings, so options 2 and 4 represent the minimum area for protection.

From an operational standpoint, option 2 is preferred over all options except the use of normal systems that rely on off-site power. If a potential bomb attack should leave off-site power available, then option 1 would be preferred.

The survival envelopes depicted in Figure 6-3 reflect the approach of establishing survival zones based on exterior walls of buildings. In reality, most equipment is located within rooms in the interior of their respective buildings. To determine the blast effects on an interior wall it can be conservatively assumed that if the blast occurs within the standoff distance of the first wall the second wall will see the blast as if the first wall were not present. If the strength of the interior wall is such that its standoff distance is inside the standoff distance of the exterior wall (taking into account the distance between the two walls) then the survival envelopes can be drawn relative to the interior wall, resulting in smaller envelopes.

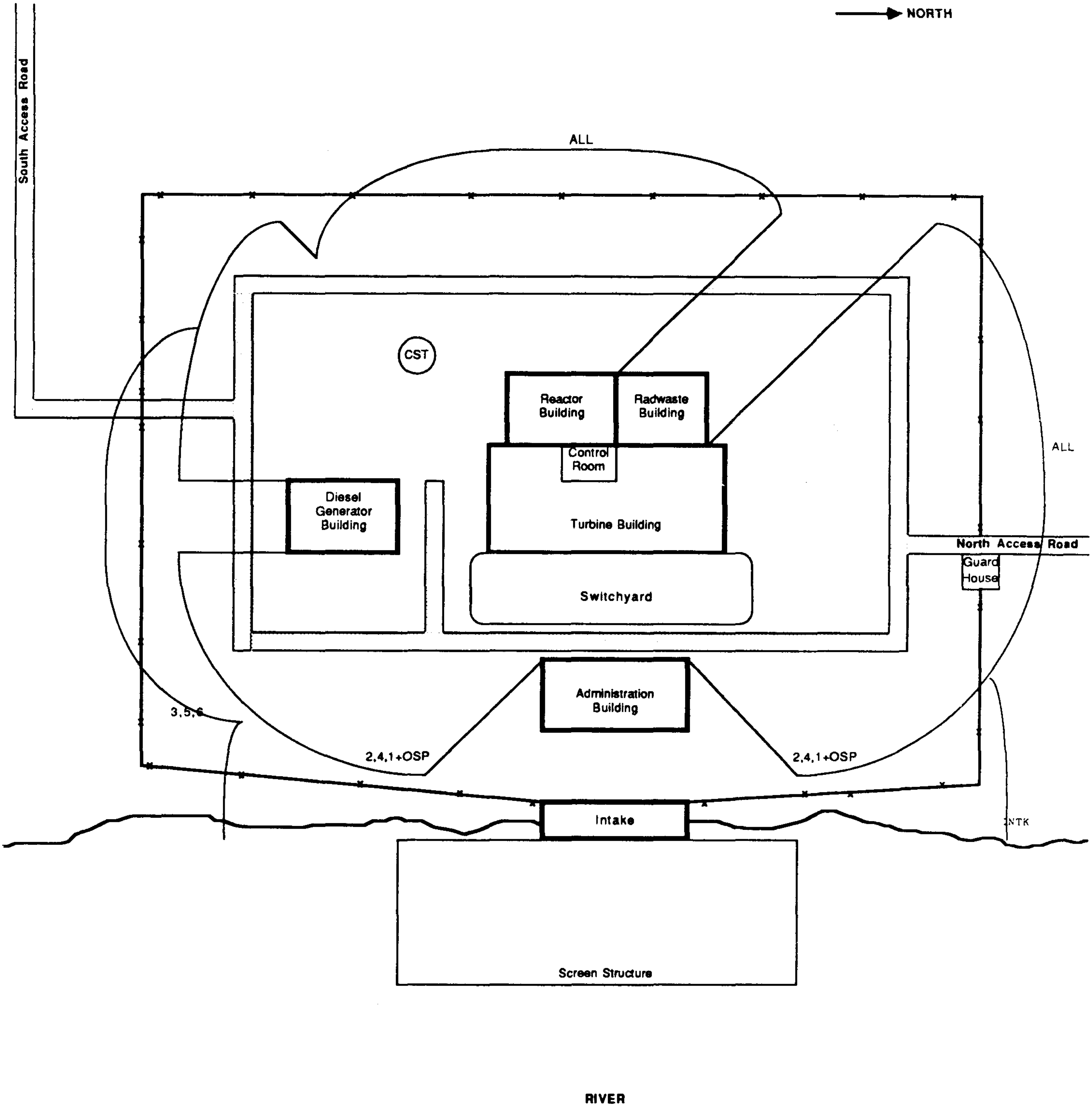


Figure 6-3. Survival Envelopes for Sunshine Plant

Using this approach, the survival envelopes for options 2 (RCIC) and 4 (HPCI) can be made smaller than those shown in Figure 6-3. The RCIC and HPCI pump rooms are both below grade in the reactor building, and are assumed to be protected. The most vulnerable portion of these systems is piping that rises through pipe chases to grade level then enters the drywell. The RCIC pipe chase is in the southeast corner of the reactor building and the HPCI pipe chase is in the southwest corner of the reactor building, as shown in Figure 6-4. Both pipe chases are enclosed by 2 foot thick concrete walls with a static wall capacity of 4.5 psi, the same as the exterior walls of the reactor building. The walls of the pipe chases are no closer than 30 feet from an exterior wall, therefore, the portions of survival envelopes 2 and 4 that face the reactor building can be brought in 30 feet. This assumes that the interior wall sees the blast as if the exterior wall did not exist.

The turbine building survival zone is relevant because the control room, switchgear rooms, and battery rooms are all inside the turbine building. All of these rooms are in a vertical row, with the switchgear and battery rooms below the control room. These rooms are enclosed by concrete walls with a static wall capacity of 3.0 psi, the same as the exterior walls of the turbine building. The interior walls are no closer than 50 feet from an exterior wall, therefore, the portions of the survival envelopes that face the turbine building can be brought in 50 feet.

6.5 CONTINGENCY MEASURE TO PRESERVE THE PREFERRED SYSTEM OPTIONS AT THE SUNSHINE BWR PLANT

If appropriate to the alert notification the plant and security staff should increase plant readiness. Examples of measures that could be implemented are presented in this section.

6.5.1 Increase Plant Readiness

Consistent with the requirements in the Sunshine plant Technical Specifications, the following measures can be taken:

- Minimize the impact of maintenance and testing on the availability of systems that are usable in establishing and maintaining a safe shutdown condition.
  - Put back in service any equipment that has been temporarily taken out of service for maintenance or testing.
  - Postpone maintenance or testing activities that would take equipment out of service.

- Ensure that engineered safety features systems are aligned for emergency operation.
  - Confirm that ECCS subsystems are aligned for injection.
  - Confirm that RCIC system suction and discharge valves are open.

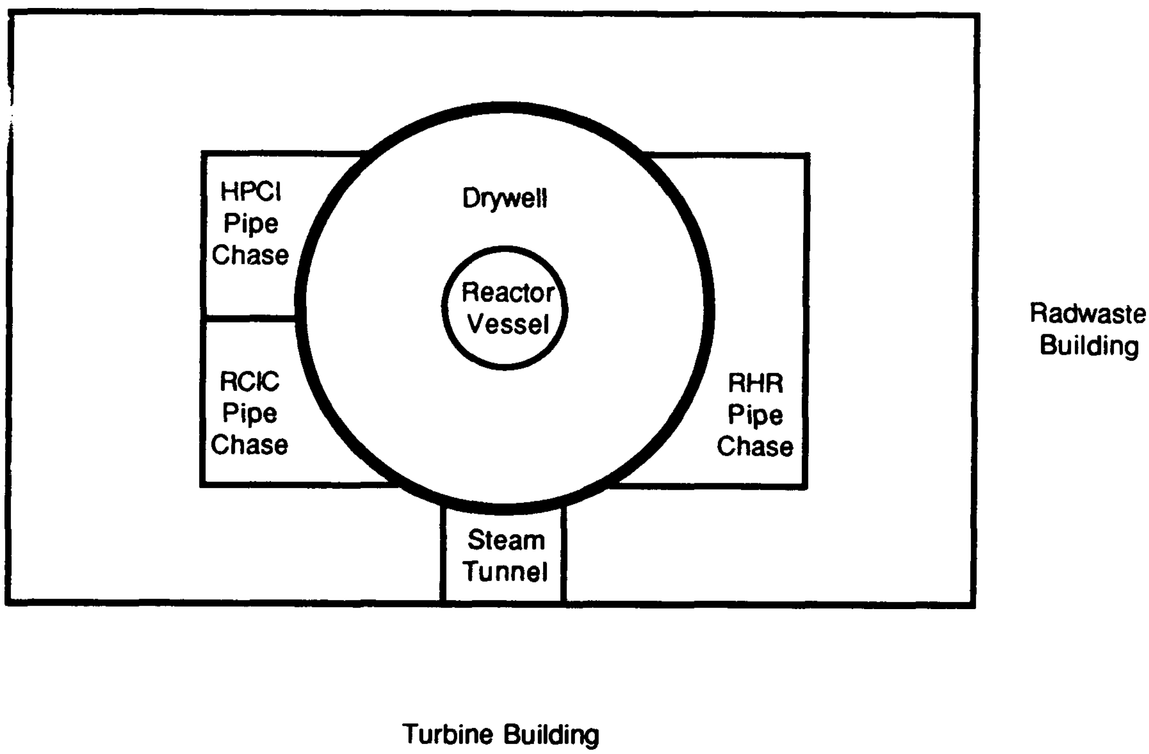


Figure 6-4. Layout of Reactor Building at Grade Level.

- Maximize the short-term heat sink available for absorbing decay heat load.
  - Increase condensate storage tank water level to maximum.
  - Increase suppression pool water level to maximum allowed level.
  - Reduce suppression pool temperature to the minimum allowed temperature.
  - Increase water level in the upper containment pool (for suppression pool makeup) to maximum.

- Maximize the availability of ultimate heat sink systems.
  - Start emergency service water system pumps
  - Flush emergency service water system pump discharge strainers

- Maximize the readiness of support systems.
  - Fill diesel fuel oil day tanks and long-term diesel fuel oil storage tanks to maximum.
  - Charge instrument and service air accumulators to maximum.

- Pre-position on-site emergency equipment.

Item	Locations
Portable fans	Switchgear rooms Battery rooms Pump rooms
Portable 125 VDC generator	Battery rooms
Portable submersible pumps	(TBD)

- Notify pre-selected off-site vendors of the potential need for delivery of the following supplies and equipment:

Item	Vendor	Phone
Portable 480 VAC generator	(TBD)	(TBD)
Power cables	(TBD)	(TBD)
Portable air-conditioning units	(TBD)	(TBD)
Flexible ventilation ductwork	(TBD)	(TBD)
Fire hose	(TBD)	(TBD)
Diesel fuel (tank truck)	(TBD)	(TBD)
Water (tank truck)	(TBD)	(TBD)
Bottled high-pressure gas	(TBD)	(TBD)
Contingency barriers	(TBD)	(TBD)

6.5.2 Measures for Limiting Vehicle Access

The main areas of concern are the regions south and west of the reactor building, and north and southeast of the turbine building, in which all survival envelopes overlap. To reduce the amount of traffic entering the site, the south gate will be closed and locked and a temporary barrier to traffic will be placed outside the gate. All traffic will be required to use the north gate, and a temporary barrier designed to slow the speed of vehicles approaching the gate will be set up 50 feet outside the gate. The barriers will be created from 55-gallon drums filled with sand. Armed security personnel will be posted at both barriers. All traffic entering the plant will be searched for explosives.

6.6 SECTION 6 REFERENCES

1. 10 CFR Part 100.

2. Kennedy, R.P., Blejwas, T.E., and Bennett, D.E., "Capacity of Nuclear Power Plant Structures to Resist Blast Loadings," NUREG/CR-2462, Sandia National Laboratories, September 1983.

SECTION 7
EXAMPLE APPLICATION OF THE METHODOLOGY TO THE MOONGLOW PWR PLANT

7.1 OVERVIEW OF EXAMPLE

This section illustrates how the methodology can be applied to a PWR plant. The Moonglow PWR plant is a fictitious plant that is modeled after a typical Westinghouse 4-loop, 2-unit plant. This section documents the process of applying the methodology to the Moonglow PWR plant. The subsections are designed to follow the preceding sections of this report. For example, Section 7.2 documents the application of Section 2, the selection of system options for safe shutdown. Section 7.3 applies to Section 3.

7.2 PRINCIPAL CONTINGENCY PLANNING CONSIDERATIONS AT THE MOONGLOW PWR PLANT

Sources of radioactive material at the Moonglow PWR plant include the reactor core, the spent fuel in storage in the spent fuel pool, new fuel, and the radioactive waste system. The inventory of radioactive material available in new fuel and the radioactive waste system is insufficient to cause a significant release with consequences comparable to the 10 CFR Part 100 dose guidelines (Ref. 1). Therefore these sources are not significant concerns as land vehicle bomb targets. The inventory of radioactive material in spent fuel decays after reactor shutdown and often remains a potential source of a significant release for a period of a month or more following refueling. The reactor core is the primary concern as the source of a potential release initiated by a land vehicle bomb. The balance of this section identifies system options associated with preventing a significant release from the reactor core.

7.2.1 Front-Line Systems

This section defines the systems that must be considered in contingency planning for a land vehicle bomb alert. A Vital Area Analysis has been performed for Moonglow 1 and 2. The VAA fault tree identifies the following systems that are required for transient mitigation:

- Reactor Protection System for initiating a reactor scram
- Main steam and power conversion system or auxiliary feedwater system and secondary steam relief system for decay heat removal
- Charging system for RCS makeup and reactor coolant pump seal cooling
- Pressurizer heaters for RCS pressure control
- Instrumentation systems to support the information needs of the control room operators.

These systems, along with their support systems, provide the capability to maintain each unit in an extended hot shutdown condition. The following brief descriptions of these systems focusing on the requirements for successful operation as identified in the VAA are provided.

The main steam and power conversion system, following reactor shutdown, transfers heat to the ultimate heat sink via the condenser and the circulating water system. The system requires off-site power in order to operate.

The Auxiliary Feedwater (AFW) System consists of two motor-driven pumps, designated A and B, and one turbine-driven pump, designated C. Any one pump can provide a sufficient flow of makeup water to at least two of four steam generators to provide adequate decay heat transfer to the atmosphere via the secondary steam relief system. Motor-driven pump A is powered by AC train A. Motor-driven pump B is powered by AC train B. Turbine-driven pump C is powered by steam from steam lines B and C, but requires DC power from DC train A to open and control the turbine control valves. Water sources for the AFW pumps are either the condensate storage tank (CST) or the Essential Service Water (ESW) system. Pump cooling is provided locally. Pump room cooling can be accomplished by propping open the doors, if necessary.

The charging system, part of the Chemical and Volume Control System (CVCS), consists of two centrifugal charging pumps, designated A and B, and one positive displacement charging pump, designated C. Any one pump can provide sufficient RCS makeup and reactor coolant seal cooling. Pump A is powered by AC train A, pump B is powered by AC train B, and pump C is powered by non-1E bus X. Centrifugal charging pump cooling is required and is provided by the ESW system, which also provides pump room cooling. Water sources for the charging pumps are the two boric acid tanks or the refueling water storage tank (RWST).

Pressurizer heaters are powered by non-1E AC power. They can be connected to Class 1E 480 volt AC buses A and B during emergencies. One bank of pressurizer heaters, powered by either bus A or B, can provide sufficient RCS pressure control.

There are two trains of 120 volt AC instrumentation power, designated A and B. Train A is required when "A" components are used, train B is required when "B" components are used. Each 120 volt AC bus can be powered by either the 480 volt AC bus or the 125 volt DC bus of the same train.

7.2.2 Support Systems

The above front-line system descriptions refer to various required supporting systems or functions, namely AC power, DC power, and ESW. The following brief descriptions of these systems focusing on the requirements for successful operation as identified in the VAA are provided.

AC power can be provided by off-site power, or by two diesel generators, A and B. The diesel generators require fuel, cooling, lubrication, ventilation, high pressure air for starting, and DC power for starting and control. Seven day fuel supplies are stored in underground tanks and are therefore considered protected from land vehicle bombs. Diesel cooling is provided by the respective train of the ESW system. Lubrication is provided by a dedicated system for each diesel. Ventilation is provided by ductwork to the roof of the diesel wing of the auxiliary building. Starting air is provided by a storage accumulator for each diesel.

DC power is provided by batteries. The batteries have a rated capacity of two hours with full loads, but with load shedding their capacity can be extended to approximately four hours for support of AFW and instrumentation. If the event lasts more than four hours the batteries will require recharging, normally from the respective AC train through a battery charger.

The ESW system consists of two independent trains, A and B, each with one pump. A cross-tie is provided between the two trains. The ESW system operates in a closed loop, taking suction from and discharging to the cooling tower basin. Each train can cool all of the heat loads of the same train. In this analysis the heat loads of interest are the charging pumps and room coolers and the diesel generators. The ESW system also cools the containment fan coolers, if necessary. Either ESW train can also provide water to the suction of the AFW pumps. ESW pumps A and B are powered by AC trains A and B, respectively.

7.2.3 Preferred System Options

A set of ten system options, applicable to each unit, is shown in Table 7-1. These options are listed in order of operational preference. For example, it is undesirable to inject raw water from the ESW system into the steam generators, so the CST is the preferred water source for the AFW system. It should be noted, however, that options utilizing the diesel generators require the ESW system for diesel cooling, so the ESW system will also be available as an AFW water source.

Certain assumptions have gone into Table 7-1. First, since all AFW pumps are in the same area of the auxiliary building, for the purposes of this analysis no effort has been made to differentiate between the pumps. The same is true for the charging pumps, except that as long as off-site power is available the positive displacement pump is preferred because it does not require ESW cooling. Also, it is expected that pumps of the same electrical load group (e.g., AFW A, charging A, ESW A) will be utilized together.

Table 7-1. System Options for Safe Shutdown at the Moonglow PWR Plant.

SYSTEM	1	2	3	4	5	6	7	8	9	10
REACTOR PROTECTION SYSTEM	X	X	X	X	X	X	X	X	X	X
STEAM & POWER CONVERSION SYSTEM	X	X								
AUXILIARY FEEDWATER SYSTEM			X	X	X	X	X	X	X	X
CST FOR AFW			X	X			X	X		
ESW FOR AFW					X	X			X	X
CHARGING SYSTEM	X	X	X	X	X	X	X	X	X	X
BORIC ACID TANKS FOR CHARGING	X		X		X		X		X	
RWST FOR CHARGING		X		X		X		X		X
OFFSITE POWER	X	X	X	X	X	X				
EMERGENCY DIESEL GENERATORS							X	X	X	X
ESSENTIAL SERVICE WATER SYSTEM					X	X	X	X	X	X

7.3 PROTECTING SYSTEM OPTIONS AT THE MOONGLOW PWR PLANT

This section examines the locations of essential equipment and the ability of structures to survive a land vehicle bomb blast. For a given structure to be affected there must be a direct line of sight between the explosion and a wall of the structure, (i.e., one building is assumed to shield another building from the effects of the blast.). Figure 7-1 shows a simplified plot plan for the site.

7.3.1 Plant Survival Zones

A survival zone is defined as an area of some radius out from each wall of a structure, such that if an explosion takes place outside of the zone the structure will not be damaged. The radius of the survival zone area is also known as the safe standoff distance. Standoff distances will be calculated in Section 7.3.3, based on the blast resistance of each structure.

Survival zones have been established for the following areas:

- Unit 1 reactor containment (RC1)
- Unit 1 diesel generator area, containing the diesel generators and switchgear, in the southwest corner of the auxiliary building (DG1)
- Unit 1 CVCS area, containing the charging pumps and boric acid tanks, in the northwest corner of the auxiliary building (CVCS1)
- Unit 1 refueling water storage tank (RWST1)
- Unit 1 condensate storage tank (CST1)
- Unit 1 turbine building, containing the steam and power conversion system (TB1)
- Unit 2 reactor containment (RC2)
- Unit 2 diesel generator area, containing the diesel generators and switchgear, in the southeast corner of the auxiliary building (DG2)
- Unit 2 CVCS area, containing the charging pumps and boric acid tanks, in the northeast corner of the auxiliary building (CVCS2)
- Unit 2 refueling water storage tank (RWST2)
- Unit 2 condensate storage tank (CST2)
- Unit 2 turbine building, containing the steam and power conversion system (TB2)
- Common ESW pumphouse (ESW).

Survival zones have not been established for the control room and the AFW pump areas because they are far enough removed from exterior walls to be considered protected from land vehicle bombs. A survival zone has not been established for the switchyard because a large area of the plant as well as off-site areas are associated with off-site power.

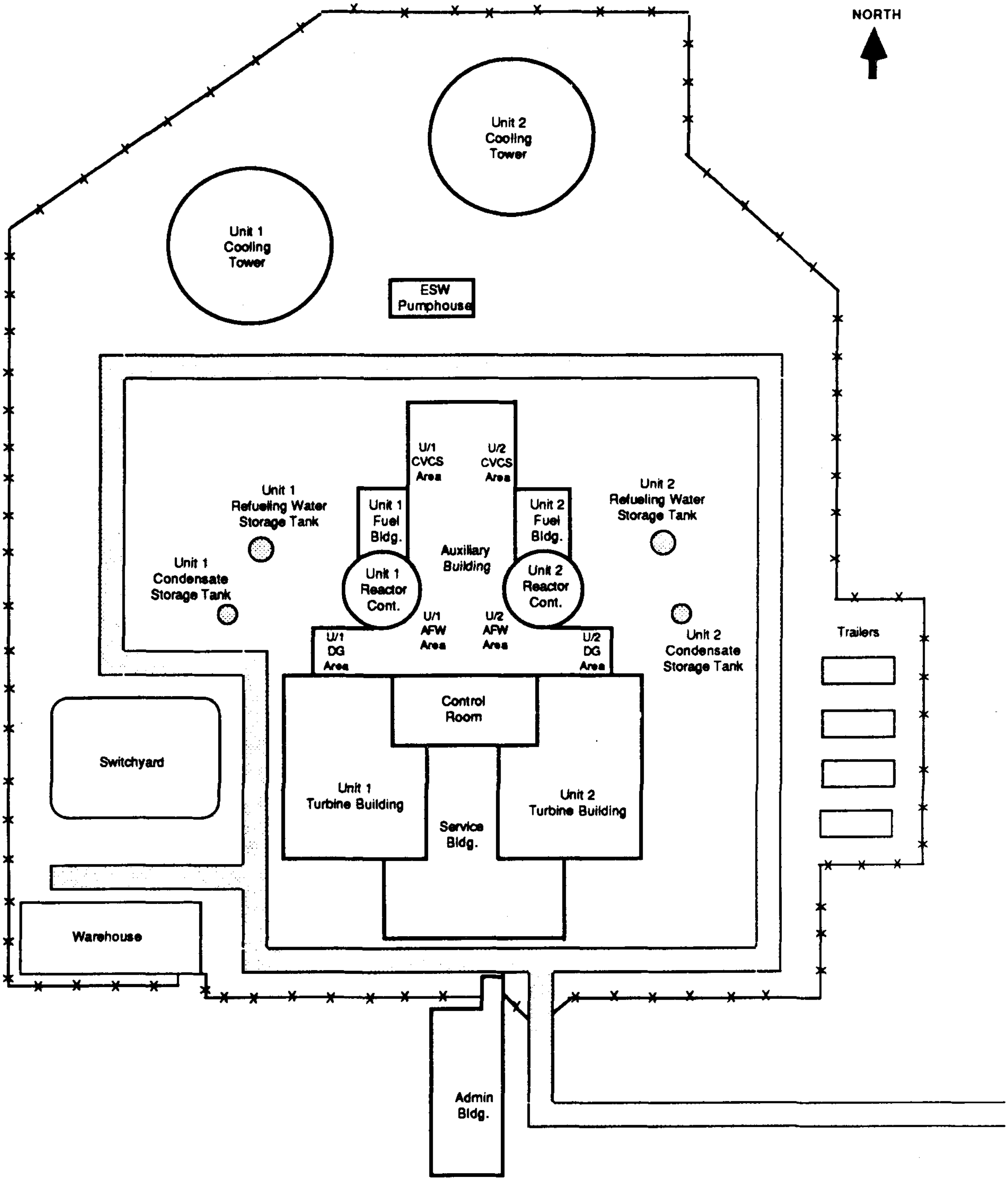


Figure 7-1. Simplified Plot Plan of Moonglow PWR Plant

7.3.2 Location of Essential Equipment

For each system option identified in Section 7.2 the applicable survival zones are identified. Clearly the reactor containment is important to all strategies because it contains the RCS and its interfaces with core cooling systems. Also, the diesel generator area is required in all strategies, including off-site power strategies, because it contains the class 1E switchgear.

The following is a list of survival zones required for each system option for Unit 1. A similar list can be compiled for Unit 2.

System Option	Survival Zones
1	RC1, TB1, CVCS1, DG1, OSP (off-site power)
2	RC1, TB1, CVCS1, RWST1, DG1, OSP
3	RC1, CST1, CVCS1, DG1, OSP
4	RC1, CST1, CVCS1, RWST1, DG1, OSP
5	RC1, ESW, CVCS1, DG1, OSP
6	RC1, ESW, CVCS1, RWST1, DG1, OSP
7	RC1, CST1, CVCS1, DG1, ESW
8	RC1, CST1, CVCS1, RWST1, DG1, ESW
9	RC1, ESW, CVCS1, DG1
10	RC1, ESW, CVCS1, RWST1, DG1

7.3.3 Blast Loading of Structures

Since the Moonglow plant is located in Tornado Zone I, all structures are built, as a minimum, to withstand a static overpressure of 3.0 psi. NUREG/CR-2462 (Ref. 2) provides guidance for calculating static overpressure for more sturdy structures. The auxiliary building and ESW pumphouse, with 24-inch thick concrete walls and a maximum wall span of 26 feet, each have a static wall capacity of 4.5 psi. The reactor containment, with 48-inch thick walls, has a static wall capacity of 12.0 psi. All other structures are assumed to be designed for the 3.0 psi tornado requirement.

The standoff distance for each structure is calculated with the following formula:

$$R = F\mu \left(\frac{W}{P_s^2} \right)^{1/3}$$

where
R = standoff distance in feet
$F\mu$ = ductility factor
W = TNT equivalent of explosive in lbs
P_s = static wall capacity in psi

Reference 2 suggests a ductility of 3 is most appropriate for this analysis.*

Figure 7-2 shows the standoff distance for each structure overlaid on the simplified plot plan. The curves were drawn assuming shielding by other buildings.

7.3.4 Survival Envelopes

Given the survival zones required for each system option, and the standoff distance for each zone, a set of envelopes has been developed which represent the overall survival zone for each system option. Figure 7-3 shows the survival envelopes overlaid on the simplified plot plan.

7.4 SELECTION OF PREFERRED SYSTEM OPTIONS BASED ON PLANT LAYOUT AT THE MOONGLOW PWR PLANT

7.4.1 Avenues of Approach

The Moonglow PWR plant site has one access road, entering the plant from the south. The plant is surrounded by generally flat terrain, so off-road approach may be credible. The nearest navigable waterway is the Moonglow River, approximately one-half mile away to the north.

* For ductility = 3, the ductility factor, $F\mu = 54$.
Other ductility factors are tabulated in NUREG/CR-2462.

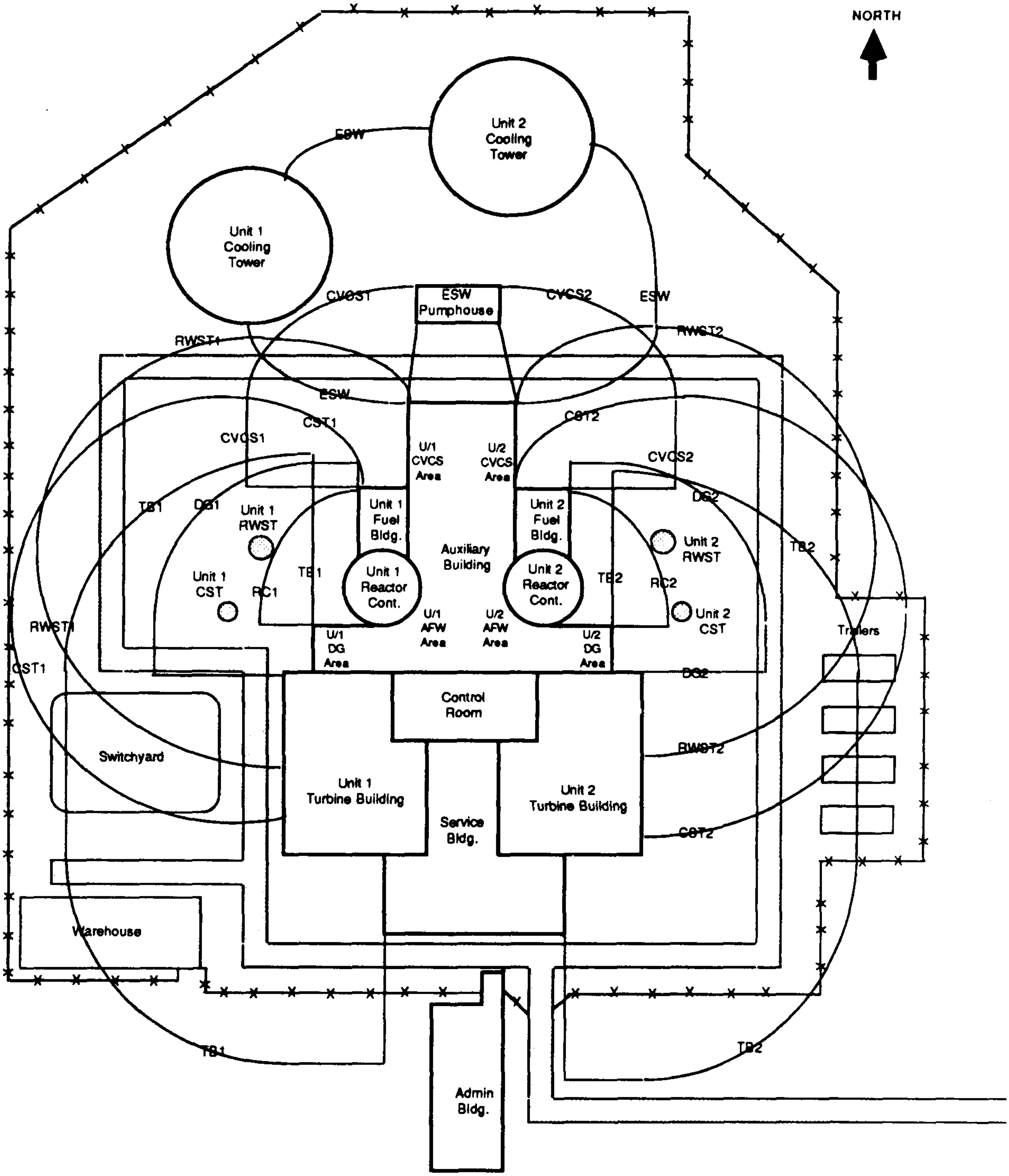
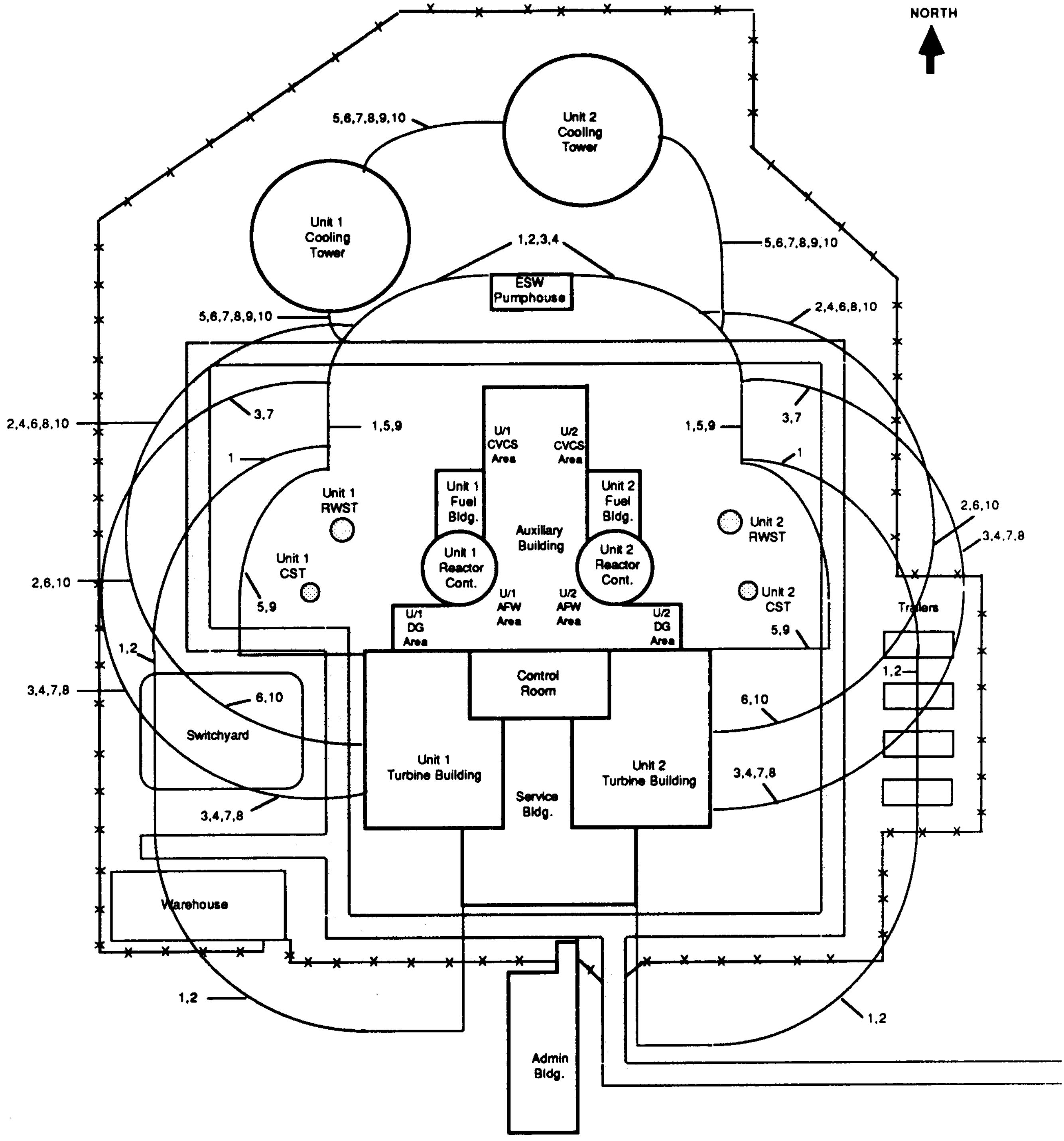


Figure 7-2. Survival Zones for Moonglow Plant Structures



Note: Envelopes 1 through 6 also require offsite power.

Figure 7-3. Survival Envelopes for Moonglow Plant

7.4.2 Relationship of Survival Envelopes and Areas Accessible to Land Vehicle Bombs

Figure 7-3 shows the survival envelopes for each system option. The envelopes were developed by combining all survival zones in a particular system option. Figure 7-3 shows the survival envelopes overlaid on the site plot plan.

The survival envelopes for options 1 through 6 also include areas associated with off-site power. Therefore, these options may be accessible to land vehicle bombs. Of the other options, which utilize the emergency diesel generators, the envelopes for options 7, 8, and 10 extend slightly outside the security fence in the area north of the trailers. However, this area can only be accessed by off-road vehicles.

Due to the potential difficulty in protecting off-site power, system options 7 through 10 are preferred over options 1 through 6. From an operational standpoint, using the CST as an AFW water source is preferred to using the ESW system, therefore options 7 and 8 are preferred over options 9 and 10. Option 7 is preferred over option 8 because the boric acid tanks are preferred over the RWST as a water source for the charging pumps.

It should be noted that option 9 involves the survival envelope with the smallest area.

7.5 CONTINGENCY MEASURES TO PRESERVE THE PREFERRED SYSTEM OPTIONS AT THE MOONGLOW PWRPLANT

If appropriate to the alert notification the plant and security staff should increase plant readiness. Examples of measures that could be implemented are presented in this section.

7.5.1 Increase Plant Readiness

Consistent with the requirements in the Moonglow Plant Technical Specifications, the following measures will be taken:

- Minimize the impact of maintenance and testing on the availability of systems that are usable in establishing and maintaining a safe shutdown condition.
    - Put back in service any equipment that has been temporarily taken out of service for maintenance or testing.
    - Postpone maintenance or testing activities that would take equipment out of service.

- Ensure that engineered safety features systems are aligned for emergency operation.
    - Confirm that ECCS subsystems are aligned for injection.
    - Isolate non-emergency portions of the CVCS.

- Increase CST, RWST, and boric acid tank levels to maximum.

- Maximize the availability of ultimate heat sink systems.
  - Start emergency service water system pumps
  - Flush emergency service water system pump discharge strainers.

- Maximize the readiness of support systems.
  - Fill diesel fuel oil day tanks and long-term diesel fuel oil storage tanks to maximum.
  - Charge instrument and service air accumulators to maximum.

- Pre-position on-site emergency equipment.

Item	Locations
Portable fans	Switchgear rooms Battery rooms Pump rooms
Portable 125 VDC generator	Battery rooms
Portable submersible pumps	(TBD)

- Notify pre-selected off-site vendors of the potential need for delivery of the following supplies and equipment:

Item	Vendor	Phone
Portable 480 VAC generator	(TBD)	(TBD)
Power cables	(TBD)	(TBD)
Portable air-conditioning units	(TBD)	(TBD)
Flexible ventilation ductwork	(TBD)	(TBD)
Fire hose	(TBD)	(TBD)
Diesel fuel (tank truck)	(TBD)	(TBD)
Water (tank truck)	(TBD)	(TBD)
Bottled high-pressure gas	(TBD)	(TBD)
Contingency barriers	(TBD)	(TBD)

7.5.2 Measures for Limiting Vehicle Access

For the preferred system options 7 through 10, the survival envelopes are almost entirely within the security fence. It will be necessary to prohibit access to the off-road area north of the trailers on the east side of the site. Also, a temporary barrier will be set up near the main gate in order to reduce the speed of traffic entering the site. All traffic entering the plant will be searched for explosives.

Within the fence the main areas of concern are north of the turbine buildings. Temporary barriers will be set up to limit vehicle access into these areas.

7.6 SECTION 7 REFERENCES

1. 10 CFR Part 100.

2. Kennedy, R.P., Blejwas, T.E., and Bennett, D.E., "Capacity of Nuclear Power Plant Structures to Resist Blast Loadings," NUREG/CR-2462, Sandia National Laboratories, September 1983.

APPENDIX A

SAMPLE MODIFICATIONS TO A SAFEGUARDS CONTINGENCY PLAN

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APPENDIX A
SAMPLE MODIFICATIONS TO A SAFEGUARDS CONTINGENCY PLAN

A.1 PURPOSE

The purpose of this appendix is to provide the reader with examples of modifications to a hypothetical Safeguards Contingency Plan (SCP) that would be appropriate for addressing a land vehicle bomb, should such a threat arise.

A.2 BACKGROUND AND SCOPE

Operators of nuclear power plants are required by 10 CFR Part 73, Appendix C, to develop safeguards contingency plans which deal with the perceived danger to licensee personnel and property from radiological sabotage and overt attacks. Events 1 through 13 listed below are typically found in existing SCPs. Event 14 could be added to cope with a land vehicle bomb alert and Event 9 can be modified to cope with the detonation of a land vehicle bomb.

1. Loss or Degradation of Physical Security Systems Hostage Situation.
2. Loss of Security Computer Power.
3. Loss or Degradation of Communication Systems.
4. Loss or Degradation of Security Force.
5. Threat Against the Station.
6. Discovery of Intruders or Attack.
7. Internal Disturbance.
8. Hostage Situation.
9. Fire, Explosion or Other Catastrophe.
10. Discovery of Sabotage Devices or Evidence of Sabotage.
11. Civil Disturbance.
12. Security Alert.
13. Tamper Alarm Annunciation.
14. Land Vehicle Bomb Alert.

An SCP identifies the actions of a station's security force members, emergency, and managerial personnel. Also identified, is the assistance to be provided by the Local Law Enforcement Agencies (LLEA), the State Police, and Federal Agencies. The sequential actions of an SCP event may contain branch points to direct execution of actions outlined in other procedures (e.g., the procedure for another SCP event or a procedure from the emergency plan).

This appendix contains example responsibility matrices and the implementing procedures for Events 9 and 14.

A.3 RESPONSIBILITY MATRICES

The responsibility matrices for Event 9 and Event 14 are contained in Table A-1 and A-2 respectively. These matrices tie together the functions being performed by the plant operational elements that could be directly involved in a land vehicle bomb alert.

Table A-1 Responsibility Matrix for Event 9: Fire, Explosion, or Other Catastrophe

INDICATIONS		PERSON RESPONSIBLE	SUMMARY OF ACTIONS
Fire, explosion, or other catastrophe. CAS/SAS *notified by observer.*	1	CAS/SAS	Notify Shift Supervisor (SS) and Shift Lieutenant (SL).
	2	Shift Lieutenant	Dispatch Security Force Personnel (SFP) to scene.
	3	SFP	Determine location and make preliminary damage assessment report to SL.
	4	Shift Lieutenant	Inform SS of location and preliminary assessment of damage.
	5	SS	Classify event and notify NRC and other appropiate agencies. Implement assembly and accountability. Evacuate if appropriate.
	6	Shift Lieutenant	If directed by SS, initiate site evacuation procedures.
	7	SS	Direct implementation of Event 10 (Security Alert) or Event 12 (Evidence of Sabotage) as appropriate.
	8	Shift Lieutenant	Implement Event 10 (Security Alert) or Event 12 (Evidence of Sabotage), as directed by SS.
	9	CAS/SAS	Assist SS with notifications as directed.
	10	SS*	Open TSC and EOF, as appropriate. Consult With the Shift Technical Advisor (STA) for engineering decisions and mitigation strategies.
	11	Shift Lieutenant	Direct SFP to establish traffic control points.
	12	SFP	Establish traffic control points.
	13	SS	Direct implementation of emergency procedures, as appropriate.
	14	Shift Lieutenant	Implement emergency procedures as directed by SS.
	15	SS	Obtain off-site emergency vehicle support.
	16	Shift Lieutenant	If possible, direct SFP to deploy to protect vital areas.
	17	SFP	Deploy to protect vital areas.
	18	Shift Lieutenant	Direct SFP to establish off-site assembly point. Recall off duty SFPs.
	19	SFP	Establish off-site assembly point as directed by SS.
	20	Shift Lieutenant	Direct SFP to restrict plant access to emergency vehicles and expedite them.
	21	SFP	Expedite entry of emergency vehicles and stop all other incoming traffic. Keep one lane open only for emergency vehicles.
	22	CAS/SAS	Assist Shift Lieutenant with personnel accountability.
	23	Shift Lieutenant	Keep SS informed on accountability status.
EVENT TERMINATED	24	SS	Enter recovery phase. Notify NRC of resolution of event. Inform Shift Lieutenant of status.
	25	Shift Lieutenant	File security incident report.

*SS may assume position of Emergency Coordinator and some responsibilities may shift to the TSC or EOF, IAW emergency plans.

Table A-2 Responsibility Matrix for Event 14: Land Vehicle Bomb Threat

INDICATIONS		PERSON RESPONSIBLE	SUMMARY OF ACTIONS
Information received or evidence noted of bomb threat. CAS/SAS notified by observer. THREAT IS CREDIBLE	1	CAS/SAS	Notify Shift Supervisor (SS) and Shift Lieutenant.
	2	SS	Evaluate threat and consult with Shift Lieutenant regarding threat credibilty. Classify event and notify NRC and other appropriate agencies.
	3	Shift Lieutenant	Notify LLEA, FBI, and EOD as directed by SS.
	4	SS	Place plant in safe mode.
	5	Shift Lieutenant	Contact offsite companies for continency barrier material. Direct SFP to deploy contingency barriers and protect survival zones
	6	SS	Implement assembly and accountabilty, as necessary.
	7	SFP	Set up check points, establish barriers, and stop and search all incoming vehicles.
	8	SS	Evacuate all but essential personnel.
	9	Shift Lieutenant	Initiate personnel accountability and other emergency procedures as directed by SS. Direct SFP to deploy to protect the PA and vital areas.
	10	SFP	Deploy and increase patrol of PA and vital areas.
	11	Shift Lieutenant	Direct SFP to establish off-site assembly point.
	12	SFP	Establish offsite assembly point and traffic control as directed by Shift Lieutenant.
	13	Shift Lieutenant	Recall off duty SFP.
	14	SS	Obtain offsite emergency support.
	15	Shift Lieutenant	Direct SFP to restrict entry to plant to emergency vehicles and expedite their entry.
	16	SFP	Expedite entry of emergency vehicles and stop all other incoming traffic. Keep one lane open only for emergency vehicles.
	17	Shift Lieutenant	Establish personnel accountability.
	18	CAS/SAS	Assist Shift Lieutenant with personnel accountability.
	19	Shift Lieutenant	Keep SS informed of accountability progress. Execute Event 9 if device is detonated.
	20	SFP	Assist fire, medical, LLEA, and EOD units as they respond. Expedite and escort entry of emergency vehicles and stop all other incoming traffic.
	21	SS	Enter recovery phase.
	22	Shift Lieutenant	File security incident report.

*SS may assume position of Emergency Coordinator and some responsibilities may shift to the TSC or EOF, IAW emergency plans.

A.4 IMPLEMENTING PROCEDURES

The implementing procedures for Event 9 and Event 14 follow as paragraphs A.4.1 and A.4.2, respectively, for the hypothetical Sunshine Nuclear Generating Station (SNGS).

A.4.1 Event 9: Fire, Explosion, or Other Catastrophe.

I. PURPOSE

This procedure is designed to provide an orderly, effective means of coping with potential and actual threats to the plant that may occur as a result of fire, explosion, or other condition that may necessitate site evacuation.

II. DISCUSSION

This procedure applies to all SNGS Personnel. A fire, explosion, or other catastrophic event may threaten public safety and plant integrity. Therefore, to prevent or minimize adverse consequences, timely and proper implementation is critical.

A. Preparation

The SNGS Safeguards Contingency Plan and Emergency Plan includes provisions to respond to catastrophic events on a timely, effective, and organized manner. The plans identify on-site and off-site response resources, establish clear cut levels of authority, and define the decisions and actions necessary to achieve the following objectives.

1. Assess the event for reactor plant and security implications.
2. Implement procedures to place the plant in a safe mode of operation.
3. Implement procedures to minimize security vulnerability.
4. Notify off-site agencies in accordance with the SNGS Emergency Plan.
5. Assemble and account for all station personnel.
6. Evacuate non-essential personnel, if deemed appropriate.
7. Resolve the situation and implement recovery procedures.

B. Evacuation

When it is determined that lives or health of plant personnel are threatened, evacuation may be necessary. The objectives of a successful evacuation are to:

1. Assemble and account for all station personnel.
2. Conduct safe and timely removal of non-essential station personnel.
3. Maintain station security.

C. Command and Control

The SNGS Emergency Operations Facility (EOF) is designated as the control centers for response activities under this procedure. The Shift Supervisor (SS), or the Emergency Coordinator (EC) if an emergency is declared in accordance with the SNGS Emergency Plan, is responsible for implementation of this procedure and overall coordination of SNGS activities during this event. Reports to or requests for assistance from local, state and Federal agencies shall be directed and controlled by the SS/EC. The SS/EC shall determine the level of off-site assistance necessary from off-site agencies (Federal, state and local) an implement requests for assistance in accordance with existing Letters of Agreements, SNGS Emergency Plan and governmental guidelines.

III. REFERENCES

A. Sunshine Nuclear Generating Station Security Plan.

B. Sunshine Nuclear Generating Station Safeguards Contingency Plan.

C. Sunshine Nuclear Generating Station Emergency Plan and Procedures.

D. 10 CFR Part 73.55; 10 CFR Part 73; Appendix C.

IV. EVENT DEFINITION

A fire, explosion or other catastrophe is a disruptive, destructive emergency which may have been accidental or intentionally caused to divert attention and response resources in order to gain access to protected and vital areas to commit sabotage. Effective response must therefore include provisions to ensure that the capability to identify and respond to concurrent contingency events is maintained.

V. RESPONSIBILITIES

A. Station Personnel are responsible for immediate and complete reporting of all relevant information regarding a fire, explosion, or other catastrophe to the Shift Supervisor (normally accomplished through the CAS/SAS).

B. Shift Supervisor (SS) is responsible for operating the plant in a safe and secure manner. He/she shall take overall charge of station activities under this procedure. If an event is declared in accordance with the SNGS Emergency Plan, the SS shall assume the position of Emergency Coordinator (EC) and carry out all duties and responsibilities as defined in the Emergency Plan until formally relieved by authorized emergency response personnel.

C. Shift Lieutenant (SL), under the direction of the SS/EC, is responsible for coordination of the security operations, including armed response (as appropriate), conducting orderly assemble and accountability procedures, conducting safe evacuation of station personnel to designated evacuation sites, maintaining station integrity and implementing any directives required by the SS/EC.

D. Central and Secondary Alarm Stations (CAS/SAS), under the direction of the security Shift Lieutenant, are responsible for directing initial security response, controlling plant access, and assisting in station accountability, assembly and evacuation efforts.

E. Operations Personnel, under the direction of the SS, are responsible for implementing reactor plant procedures and actions to ensue a safe and stable reactor plant mode of operation.

F. Security Force Personnel (SFP), under the direction of the SL, are responsible for controlling access during emergencies, assisting off-site response personnel, maintaining station integrity, assisting with site evacuation and implementing directives of the SL.

VI. PROCEDURES

A. Shift Lieutenant

1. Dispatch SFP to location and make a preliminary damage assessment being particularly alert for evidence of intruders, sabotage, or other unusual or suspicious conditions. Receive situation reports.
2. Notify and consult with the SS to evaluate the situation, extent of damage, areas affected, potential for concurrent threat to plant safety/security, and necessity for evacuation.
3. If the event may be or is known to be security-related, or has created a security vulnerability, direct execution of Event 10 (Evidence of Sabotage) or Event 12 (Security Alert), as appropriate.
4. If directed, notify LLEA, State Police, and Federal agencies in accordance with SNGS Letters of Agreement and governmental guidelines.
5. If directed, order and facilitate evacuation of non-essential personnel and those in areas threatened or affected by the event. Account for all personnel in accordance with Emergency Plan Procedure EOP-3, Personnel Accountability, and EOP-4 Site Evacuation.
6. Direct the establishment of traffic control points in parking lots and access roads, have all incoming traffic (except emergency response vehicles) stopped, and keep one lane of the access road open to expedite emergency vehicles.
7. Direct that access to the station be permitted only to off-site assistance personnel, and that the entry of off-site emergency response personnel be facilitated and escorted to the designated area.
8. Call in additional SFP for traffic control and apply compensatory measures to maintain an adequate level of plant security.

9. When the event is determined to be resolved, no continuing security threat exists, and the SS/EC has entered the recovery phase.
   a. Insure all non-essential off-site assistance personnel have left the station protected zones.
   b. If directed by SS/EC insure agencies contacted are appraised of the event situation/resolution.
   c. Insure orderly transition to normal security operations.
   d. File Security Incident/Violation Reports, as necessary.

B. <u>Shift Supervisor</u>

1. Receive all available information regarding the event, consult with Operations personnel and the SL to assess extent of damage, areas affected, and potential threat to plant safety.
2. Implement EOP-1, Event Classification and Notification Procedures in accordance with the SNGS Emergency Plan/Contingency Event Reporting Procedure. Provide frequent updates.
3. Direct Operations personnel to place the reactor plant in safe and stable mode of operation. Implement other actions to provide maximum safety and reliability of reactor plants systems and components, as appropriate.
   a. Secure maintenance, repair, or testing activities and return systems/components to operational status.
   b. Verify Engineered Safety Features are operational and properly aligned.
   c. Insure adequate water supplies for decay heat removal.
   d. Maximize readiness of station support systems.
   e. As allowed by procedures and technical specifications, insure maximum reliability and flexibility of reactor plant and support systems, e.g., system cross connections operational, spool pieces installed, power supplies in most reliable alignment.
   f. Pre-position emergency personnel and equipment.
   g. Notify pre-selected vendors of potential need for supplies and equipment.
4. If appropriate, direct Operations personnel to assist SFP investigating the cause of a fire or explosion, and to determine whether it may have been security-related.
5. If necessary, direct the SL to evacuate non-essential personnel and those in areas threatened or affected by the event, in accordance with Emergency Procedures EOP-3 and EOP-4.
6. If the event is reported to have possibly been security-related, implement Event 10 (Evidence of Sabotage) or Event 12 (Security Alert) procedures
7. Open the TSC or EOF as appropriate and consult with the Shift Technical Advisor for engineering decisions and mitigation strategies.
8. When the event is resolved, no continuing security threat exists, and it is agreed between all appropriate agencies, then enter the recovery phase and return to normal operating conditions.

D. Central and Secondary Alarm Stations (CAS/SAS)

CAS:

1. Direct initial security force response until relieved by the SL.
2. Assist with assemble, accountability and evacuation.
3. Facilitate plant access by off-site emergency response personnel.
4. Control plant access to prohibit unauthorized entry and allow rapid entry of response teams and emergency personnel.
5. Implement SL directives.

SAS:

1. If required, implement CAS procedures.
2. Implement SL directives.

E. Security Force Personnel

1. SFP assigned to parking lots, access road:

    a. Establish traffic control points.
    b. Stop all incoming traffic except LLEA, fire-fighting, and medical vehicles.
    c. Ensure one lane of the access road is kept open at all times.
    d. Establish an assembly point for evacuees.

2. SFP assigned to admit emergency response personnel:

    a. Keep the gate clear of all obstructions and vehicles.
    b. Admit only emergency response vehicles.
    c. Record for each entering vehicle the agency involved, number of persons, and license plate number.

3. Protected Area Portal Officers:

    As directed, upgrade access controls and admit no visitors without specific approval.

4. Others:

    Implement actions as directed to maintain site security in the event of concurrent threats, and to assist off-site assistance personnel.

A.4.2 Event 14: Land Vehicle Bomb Alert

I. PURPOSE

This procedure is designed to provide an orderly and effective means of responding to a land vehicle bomb alert, should such a threat arise.

II. DISCUSSION

This procedure applies to all SNGS personnel. It is to be used in conjunction with other SCP and Emergency Plan procedures. This implementing procedures outlines those actions that should be taken by plant personnel should a land vehicle bomb alert be received up until such time as a land vehicle bomb attack occurs. Once a fire, explosion, or other catastrophic activity occurs then the procedure for Event 9 is implemented.

III. REFERENCES

A. Sunshine Nuclear Generating Station Security Plan.

B. Sunshine Nuclear Generating Station Safeguards Contingency Plan.

C. Sunshine Nuclear Generating Station Emergency Plan and Procedures.

D. 10 CFR 73.55; 10 CFR 73; Appendix C.

IV. EVENT DEFINITIONS

A land vehicle bomb alert occurs when information is received by the station that an explosive laden vehicle may attempt to penetrate the Protected Area or otherwise impact plant operations.

V. RESPONSIBILITIES

A. Station Personnel are responsible for immediate and complete reporting of all relevant information regarding a fire, explosion, or other catastrophe to the Shift Supervisor.

B. Shift Supervisor (SS) is responsible for operating the plant in a safe and secure manner. He shall take overall charge of station activities under this procedure. He shall assume the position of Emergency Coordinator (EC) if an emergency is declared in accordance with the SNGS Emergency Plan and carry out all duties and responsibilities as defined in the SNGS Emergency Plan and Implementing procedures until formally relieved by authorized emergency response personnel.

C. Shift Lieutenant (SL), under the direction of the SS/EC, is responsible for coordination of the security operations, including armed response (as appropriate), conducting orderly assemble and accountability procedures, conducting safe evacuation of station personnel to designated evacuation sites, maintaining station integrity and implementing any directives required by the SS/EC.

D. Central and Secondary Alarm Stations (CAS/SAS), under the direction of the security Shift Lieutenant, are responsible for directing initial security response, controlling plant access, and assisting in station accountability, assembly and evacuation efforts.

E. Operations Personnel, under the direction of the SS, are responsible for implementing reactor plant procedures and actions to ensue a safe and stable reactor plant mode of operation.

F. Security Force Personnel (SFP), under the direction of the SL, are responsible for controlling access during emergencies, assisting off-site response personnel, maintaining station integrity, assisting with site evacuation and implementing directives of the SL.

VI. PROCEDURES

A. Station Personnel

1. Receive threat information, either by telephone, in person or by letter/note. (Threats could be received by any employee of SNGS.)
    a. Document all information received.
    b. Attempt to determine specifics of the threat:
        - Time of attack.
        - Type and quantity of explosives.
        - Type of vehicle to be used.
        - Caller's name and where the call is made from.
        - Caller's voice characteristics.
        - Background noise to help in identifying the call origination location.
2. Notify the SS with all information.

B. Shift Supervisor/Emergency Coordinator

1. Receive all information, consult with SL and others as necessary to assess the land vehicle bomb alert.
2. Implement EOP-1, Event Classification and Notification Procedures, in accordance with the SNGS Emergency Plan/Contingency Event Reporting Procedure. Provide frequent updates. Request assistance from off-site agencies, as necessary, in accordance with Letters of Agreement, SNGS Emergency Plan and governmental guidelines.
3. Direct Operations personnel to place the reactor plant in safe and stable mode of operation. Implement other actions to provide maximum safety and reliability of reactor plant systems and components, as appropriate.

a. Secure maintenance, repair, or testing activities and return systems/components to operational status.
b. Verify Engineered Safety Features are operational and properly aligned.
c. Insure adequate water supplies for decay heat removal.
d. Maximize readiness of station support systems.
e. As allowed by procedures and technical specifications insure maximum reliability and flexibility of reactor plant and support systems, e.g., system cross connections, operational, spool pieces installed, power supplies in most reliable alignment.
f. Pre-position emergency personnel and equipment.
g. Notify pre-selected vendors of potential need for supplies and equipment.

4. If determined necessary to protect station personnel, implement assembly and accountability. Consider evacuation of non-essential personnel.
5. Implement Security Alert (Event 12) procedures.
6. If required, direct SL to open EOF, insuring available for safe occupancy, and to obtain emergency vehicle support escort.
7. When the event is resolved, no continuing security threat exists, and it is agreed between all appropriate agencies, then enter the recovery phase and return to normal operating conditions.

C. Shift Lieutenant

1. Assist SS with evaluation of threat.
2. If directed, notify LLEA, State Police, and Federal agencies in accordance with SNGS Letters of Agreement, SNGS Emergency Plan and governmental guidelines. Coordinate efforts between assisting off-site agencies and station personnel.
3. Contact off-site companies for delivery of contingency barriers and related materials.
4. Direct SFP to deploy contingency barriers to prevent unauthorized vehicle access.
5. If directed, implement Security Alert (Event 12) procedures.
6. Direct SFP to establish checkpoint(s) and a safe distance perimeter. Restrict access to emergency vehicles only.
7. If directed, implement assembly and accountability procedures.
8. If directed, implement evacuation of non-essential personnel procedures.
9. Implement Fire, Explosion, or Other Catastrophe (Event 9) procedure if a device is detonated.
10. When the event is determined to be resolved, no continuing security threat exists, and the SS/EC has entered the recovery phase:

    a. Insure all non-essential off-site assistance personnel have left the station projected zones.
    b. If directed by SS/EC insure agencies contacted are appraised of the event situation/resolution.
    c. Insure orderly transition to normal security operations.
    d. File Security Incident/Violation Reports, as necessary.

D. Central and Secondary Alarm Stations (CAS/SAS)

CAS:

1. Direct initial security force response until relieved by the SL.
2. Assist with assemble, accountability and evacuation.
3. Facilitate plant access by off-site emergency response personnel.
4. Control plant access to prohibit unauthorized entry and allow rapid entry of response teams and emergency personnel.
5. Implement SL directives.

SAS:

1. If required, implement CAS procedures.
2. Implement Shift Lieutenant directives.

E. Security Force Personnel

1. Erect contingency barriers and establish checkpoints.
2. Stop and search all incoming vehicles.
3. Position security forces and patrols in predesignated defensive positions.
4. Integrate site security force action with LLEA for traffic control and other related activities.
5. Establish an assembly point for evacuees.

APPENDIX B

TOPICAL BIBLIOGRAPHY OF SAFEGUARDS REFERENCES

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APPENDIX B
TOPICAL BIBLIOGRAPHY OF SAFEGUARDS REFERENCES

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