ROCHESTER GAS AND ELECTRIC CORPORATION

GINNA STATION

SUMMARY DESCRIPTION OF COMPLIANCE

WITH 10CFR73 AMENDMENT

PROTECTION AGAINST MALEVOLENT

USE OF VEHICLES AT NUCLEAR

POWER PLANTS

REVISION 2

JULY, 1997

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1.0 INTRODUCTION

The Nuclear Regulatory Commission (NRC) has amended 10 CFR Part 73, "Physical Protection of Plant and Materials" to include the use of a four-wheel drive land vehicle by adversaries for transport of personnel or a land vehicle bomb to the proximity of vital areas. The amendment is a result of the February 1993 incidents at Three Mile Island Nuclear Station and the World Trade Center. The amendments require the installation of vehicle control measures, including vehicle barrier systems (VBS), to protect against the use of vehicles to gain unauthorized proximity to vital areas, and also protect vital equipment from damage from a design basis explosion (DBX) at the point of vehicle denial. These two threats are considered separately.

This document constitutes Rochester Gas and Electric Corporation's submittal of a summary description of vehicle control measures and results of the DBX comparison for the Ginna Nuclear Station as required by the amended rule.

The primary objectives of this rule are to protect vital components from the effects of the blast of the design basis explosion and to prevent intrusion into the vital area by the Design Basis Vehicle. The specifics regarding the Design Basis Vehicle and Design Basis Explosive were provided in Regulatory Guide 5.68. Since a four-wheel drive vehicle is being considered, the entire site perimeter must be protected by either a VBS or natural barriers such as lakes, cliffs or woodlands.

Since Ginna Station is located on the shore of Lake Ontario, the entire northern perimeter is naturally protected. Additionally, a portion of the perimeter southeast of the plant is protected by a natural embankment. The physical modifications required to protect the remainder of the site perimeter are:

- a cable bollard system along the east perimeter between the existing fence and the Manor House;

- concrete jersey barriers along the southern perimeter of the plant;

- vehicle crash gates at the main access point west of the Security Building and at the Receiving Dock;

- two cable bollard systems parallel to the inner fence along the west perimeter.

Evaluations of the effects of the DBX on vital structures have confirmed that the proposed vehicle control measures will ensure that safe shutdown capability is maintained.

2.0 METHODOLOGY

The basic approach taken and the criteria followed are described in this section. The criteria were developed from guidance provided by the NRC through various workshops (Ref. 6.7, 6.8) and publications including NUREG/CR-6190 and NUREG/CR-4250.

2.1 Initial Assessment and VBS Conceptual Design

An initial assessment of the site layout and traffic patterns was made to determine the most practical location for the VBS. This included the following:

- Identify approach paths for the intruder vehicle and determine to what extent speed reduction measures can be used to advantage.
- Assess capabilities of structures which form part of the VBS perimeter to stop the Design Basis Vehicle.
- Consider effect of VBS location on Security operations.

2.2 Safe Shutdown Equipment Identification and Structural Evaluations for DBX

Safe shutdown equipment was identified and locations determined by buildings or specific coordinates for vital components not housed in buildings. Screening and blast evaluations were performed for structures and components to assess the adequacy of the standoff distance provided. The consequences of potentially failed building components on safe shutdown components was evaluated.

Conservative safe standoff distances are determined using the screening criteria provided in NUREG/CR-6190 Volume 1 (Ref. 6.1), including the March 1997 errata (Ref. 6.9), for typical components and reinforced concrete structures, or the FACEDAP computer code in cases where screening criteria are not applicable. The FACEDAP code specifies a level of protection provided by the structure. Per NRC guidelines, a medium level of protection is required.

Based on the guidance provided, the following criteria were used for the safe shutdown evaluation.

1. All structures and equipment, regardless of construction, are adequately protected if the standoff distance is greater than or equal to 360 feet.

2. Hardened equipment can be assumed to survive the blast with no further analysis if it is located greater than 180 feet from the blast. Hardened equipment includes pumps, motors and seismically designed equipment.

3. A large water-filled tank will survive the blast if it is located greater than 100 feet from the blast. Exposed equipment attaching to it must meet the 180 foot requirement.

4. All vital structures located below grade may be assumed to survive the DBX. Additionally, the effects of ground shock are not a concern for vital equipment located in below-grade vital areas.

5. Loss of off-site power is the only design basis event which occurs concurrent with a bomb event.

6. Single failure is not postulated concurrent with the event, therefore, redundancy does not have to be maintained.

7. A fire is not assumed concurrent with the event so fire protection equipment does not directly require protection.

8. Potential flooding due to damaged equipment, including fire protection, is to be considered.

9. Damage to radioactive items such as shipment barrels of contaminated rags is acceptable. Thus, the Contaminated Storage Building, Radwaste Storage Building and Low Level Radwaste Storage Facility are not considered vital structures.

10. NRC guidance indicated underground items are not a concern if they are not visibly identified.

11. Credit can be taken for manual actions and compensatory measures provided there is appropriate time and necessary procedures are in place. The consequences of personnel losses due to the blast do not require consideration.

12. Only one bomb is assumed to explode.

The systems and components required for safe shutdown due to a 10 CFR Part 73 design basis explosion are based on the Appendix R safe shutdown methodology. The Appendix R methodology is used based on guidance from the NRC. The Ginna 10 CFR 50, Appendix R Safe Shutdown Analysis (Ref. 6.2), documents the fire protection safe shutdown methodology and identifies the required systems and components. Due to inherent differences between the effects of a fire and those of a blast, further considerations were necessary to apply the Appendix R approach to evaluation of the DBX. These differences are noted below.

Appendix R	Blast
Fire limited to 1 fire area	More than 1 area may be affected.
Valves, piping, wrapped cable, etc. assumed OK	Those components may be damaged by overpressure or missiles
Fire can affect below grade equipment	All below grade equipment assumed OK for blast (flooding must be considered)

Evaluation of blast effects will only address flooding or water damage caused by failed tanks or piping. Flooding or water damage due to inadvertent actuation of fire suppression systems was previously addressed by Rochester Gas and Electric.

2.3 Final Design of Vehicle Barrier System

The VBS will be designed by performing the following steps.

Adjust location of the VBS as necessary to ensure adequate safe standoff distances are provided and the total perimeter is protected.

Determine kinetic energy requirements along the entire site perimeter. Select barriers and/or speed control measures to satisfy the kinetic energy requirements.

3.0 DESIGN BASIS EXPLOSION EVALUATIONS

The intensity of the blast pressures and impulses exerted on a particular structure are dependent on the standoff distance of the structure from the blast source and its orientation with respect to the direction of the blast wave. The location and orientation of vital structures at Ginna allowed several structures to screen out or be addressed by comparison to other structures. Some structures required evaluation using the FACEDAP computer code.

Based primarily on review of the Ginna 10 CFR 50 Appendix R Safe Shutdown Analysis, the following structures contain safe shutdown components.

1. Containment
2. Auxiliary Building
3. Control Building
4. Diesel Generator Building
5. Standby Auxiliary Feedwater Building
6. Cable Tunnel
7. Intermediate Building
8. Service Building
9. East Facade Structure
10. Screenhouse

Screening analyses were performed for the following structures.

Screenhouse
Diesel Generator Building
Containment
Cable Tunnel
Intermediate Building
Service Building

The only safe shutdown equipment located in the Service Building are the Condensate Storage Tanks (CSTs). Because completely diverse and independent means are available to perform the CST's function of providing a source of water to the suction of the auxiliary feedwater pumps (i.e., the Service Water System), no additional analysis was performed relative to its capability to resist the DBX.

FACEDAP evaluations were performed for the Control Building, Auxiliary Building and the Standby Auxiliary Feedwater Building. The Facade evaluation was made by comparison to the Auxiliary Building evaluation.

3.1 Screenhouse

The Screenhouse is a steel frame structure enclosed by metal siding. It houses the Service Water pumps, 480V AC switchgear buses 17 and 18 and safety-related piping and circuits.

The closest possible location of the DBX is at the northwest corner of the proposed VBS. The distance at this location is greater than the 360 feet specified in Reference 6.1; thus all vital equipment in the Screenhouse is protected.

3.2 Diesel Generator Building

The Diesel Generator Building consists of reinforced concrete walls and a reinforced concrete roof. It houses the two emergency diesel generators along with various safety-related circuits. Due to its location and lower profile, it is shielded to the south and southeast by the Turbine and Condensate Demineralizer Buildings. Thus, the closest possible location of the DBX is due east and is in excess of the 360 feet specified in Reference 6.1. All vital equipment in the Diesel Generator Building is protected.

3.3 Containment

The Containment is a reinforced concrete cylindrical shell with a domed roof. The wall is a minimum 3'-6" thick and the dome is 2'-6" thick. Concrete compressive strength is 5000 psi. The walls are prestressed vertically and reinforced circumferentially. The dome is reinforced to act as a hemispherical membrane. Reinforcement yield strength is 40,000 psi.

The NUREG screening criteria do not specifically apply to the Containment structure due to its shape and reinforcing steel strength (60,000 psi). However, certain factors can be considered which allow the Containment to be "evaluated" without detailed analysis.

- Assume the Containment is equivalent to a 30" thick two-way slab with minimum reinforcement. This is conservative since the Containment is heavily reinforced and its cylindrical shape in inherently stronger that a flat slab. Per Reference 6.1, a standoff distance of 54 feet is adequate. Further assume (again, conservatively), that the required standoff distance is inversely proportional to the static strength of the structure and that the strength is directly proportional to the reinforcement yield strength. In this case, the minimum required standoff distance would be increased to:

  SD = 54 feet x (60/40) = 81 feet

The closest possible location of the DBX is due south of Containment at a distance well in excess of the 81 feet evaluated.

All vital equipment within Containment is protected.

3.4 Cable Tunnel

The Cable Tunnel is a reinforced concrete structure which runs between the Auxiliary Building and the Control Building. It contains power feeds and control circuits for various safety-related components. The entire length of the Cable Tunnel is located below grade except along its northern face at the Intermediate Building and Turbine Building. Land vehicle access to this area is prohibited (see Attachment I). Thus, the Cable Tunnel is unaffected by the DBX and all vital components within are protected.

3.5 Intermediate Building

The Intermediate Building is an L-shaped structure constructed of steel framing and enclosed by masonry walls. For Appendix R purposes, and thus the purpose of this effort, this building is divided into the Intermediate Building North (IBN) and the Intermediate Building South (IBS). The IBS houses no vital equipment. The IBN contains the Turbine Driven and two Motor Driven Auxiliary Feedwater Pumps, Main Steam system piping, safety valves and PORVs, various safety-related circuits and process monitoring instrumentation. The closest possible location of the DBX is south perimeter at a distance greater than 360 feet. Thus, all vital equipment is protected.

3.6 Service Building

As noted in Section 3.0, completely independent and diverse means of providing a water source to the Auxiliary Feedwater Pumps is provided by the Service Water System. Thus, no additional analysis of the capability of the Condensate Storage Tanks or the Service Building to withstand the effects of the DBX is required.

3.7 Standby Auxiliary Feedwater Building

The Standby Auxiliary Feedwater Building is a reinforced concrete structure approximately 47 feet by 28 feet by 25 feet in height. .The walls and roof act as two-way slabs and are a minimum of 2'-0" thick. Concrete compressive strength is 3000 psi and reinforcing steel yield strength is 60,000 psi.

This structure houses the Standby Auxiliary Feedwater Pumps along with a portion of the Service Water system which delivers Auxiliary Feedwater to the Steam Generators.

Since the concrete strength is less than that used in the development of the NUREG screening criteria (4000 psi), the building was analyzed using the FACEDAP code. The result of the FACEDAP analysis, which assumed the blast to be placed at 100 feet, shows no damage to the structure which corresponds to a high level of protection. This is much less than the distance between the building and the VBS. Additionally, there is an access structure adjacent to the west side of the Standby Auxiliary Feedwater Building. It consists of light framing and siding and it was assumed that, in the event of a DBX, this structure would collapse. In this case, pressure leakage into the Standby Auxiliary Feedwater Building would occur through the doorway at the access structure. From Reference 6.1, the required standoff distance to prevent excessive internal pressure is:

$$SD = (A/V + .07007)/.001776$$

Considering the area of the doorway and the volume of the Standby Auxiliary Feedwater Building, this required standoff distance is much less than the distance between the building and VBS .

Since internal pressure buildup is not a problem and the high level of protection for the overall structure exceeds the medium level of protection requirement, the vital equipment within is protected.

Also, as noted in Section 3.5 above, redundant and diverse means of providing auxiliary feedwater to maintain safe shutdown capability in the event of a DBX is also provided in the Intermediate Building.

3.8 Auxiliary Building

Above grade, the Auxiliary Building is essentially a steel frame structure with some concrete bearing walls along the perimeter. Below grade, it is entirely constructed of reinforced concrete. Basically rectangular in shape, the building measure approximately 214 feet by 75 feet and has two distinct roof heights at 40 feet and 56 feet above grade. The building is enclosed by short masonry walls and corrugated metal siding above. Vital equipment located on the operating level (i.e., above grade) includes: Spent Fuel Pool; Refueling Water Storage Tank; Component Cooling Water pumps, heat exchangers and associated piping; Service Water piping, and Emergency Power System components 480V AC Bus 14, MCC 1C and DC distribution panel 1A (ABDP1A). The FACEDAP code was used to analyze the Auxiliary Building. Several analyses were performed to investigate the structural framing, siding, girts and masonry walls.

The analyses were performed at a distance less than that between the auxiliary building and the VBS. At that distance, the siding and masonry walls are calculated to fail, exposing equipment on the operating floor to direct blast effects. All equipment required to operate to effect safe shutdown is provided in alternate locations. Train B of the Emergency Power System is available through Bus 16 and MCC 1D. DC control power is supplied through the Auxiliary Building DC distribution panel 1B. These components are located on the Auxiliary Building Mezzanine level which is located below grade and is separated from the operating floor by a minimum 1'-6" thick slab.

The structure was also evaluated at a distance less than that between itself and the VBS located to the southeast of the building (where the Jersey Barriers are staked on soil). The effects of the DBX on the building were less severe than that of the south location because the building is loaded with the reflective components of the pressure pulse of the blast and receives only minor damage.

The remaining vital components are unaffected by blast pressure since they are located further from the DBX than required by the NUREG screening criteria. They are, however, susceptible to potential missile damage from the failed masonry block. The CCW pumps are located approximately 20 feet beyond the south masonry wall. Assuming that the blocks damage the pumps and the CCW system is damaged, decay heat removal for safe shutdown is accomplished by water-solid steam generator operation. This procedure was previously approved by the NRC (Ref. 6.3).

The RWST and Service Water piping need to maintain their structural integrity to prevent flooding effects. These items will not be damaged by blast-resultant missiles, such as masonry blocks, due to their location and their relatively large size compared to the block. The consequences of failed blocks which potentially may fall into the Spent Fuel Pool are bounded by the analyses described in Section 9.1.2.7 of Reference 6.4. The blocks are not of a sufficient size to create the possibility of fuel damage which could cause a release in excess of 10 CFR 100 limits.

Finally, the analysis shows that the structure provides a medium level of protection with the DBX located at a standoff distance well within the location of the VBS. Thus, the overall structure is maintained and no failed building components, other than those discussed above, need to be considered.

3.9 Control Building

The Control Building includes the Battery Rooms, the Air Handling Room, the Relay Room and the Control Room. The Battery Rooms and Air Handling Room are located below grade and are, therefore, protected from the blast. The Relay Room contains power feeds and control circuits for various vital components. Similarly, the Control Room houses control circuits for all safety-related components. The south and east faces of the Relay Room and Control Room are exposed to the DBX. The south face is a 20" thick concrete wall. Although it is reinforced similarly in both directions, it is essentially two vertical spans between grade elevation 271'-0" and the Control Room floor at elevation 289'-6" and between the Control Room floor and roof at elevation 309'-10". The Control Room roof is also a 20" thick one-way reinforced concrete slab. The Relay Room east face is protected by concrete walls and a concrete roof at elevation 289'-6". The minimum wall thickness is 15" and the wall spans vertically from grade to the roof. The roof is 12" thick and spans north/south over W 10 X 45 beams. Since these components act as one-way slabs and the concrete strength (3000 psi) and steel strength (40,000 psi) are less than that used in the NUREG screening criteria, the FACEDAP code was used. The evaluation performed with the DBX at its closest position, shows that the Control Building provides a medium level of protection, the Control Building envelope will remain intact, and thus, all vital components within are protected.

3.10 Facade Structure

The Facade Structure consists of steel framing supporting girts and corrugated metal siding. East of Containment, the Facade provides support for a portion of the Main Steam and Feedwater piping from the B steam generator to the Intermediate Building.

The Facade girts are adequate by comparison to the Auxiliary Building as detailed below.

	Auxiliary Building	Facade Structure
Siding	.040 Shadowall	.040 Shadowall and Ribwall
Girt and Spacing	C12 x 20.7 on 7' centers	C12 x 20.7 on 7' centers
Maximum girt span	32'-4"	32'-4"
Standoff distance	>200 feet	>240 feet

The Facade columns are slightly smaller than those along the south face of the Auxiliary Building. However, their loaded widths are the same the span between lateral supports is less, the columns carry essentially no load from grade elevation 271'-0" to approximately 294'-0" since no siding exists there and they are located at a distance greater than the Auxiliary Building (which yields a lower blast pressure). Therefore, the Facade columns are adequate by comparison to the Auxiliary Building.

Direct blast effects on the piping can be ignored since the standoff distance provided is greater than that required by Reference 6.1. Since the Facade structure maintains its integrity, the Main Steam and Feedwater piping would not be damaged.

4.0 VEHICLE BARRIER SYSTEM DESIGN

4.1 General Criteria

The VBS is designed to prevent intrusion of the design basis vehicle into an area by stopping the forward motion of the vehicle. Furthermore, the VBS is located and designed so as to provide adequate standoff distance from exposed vital equipment and structures housing vital equipment necessary to achieve safe shutdown under the postulated DBX. The safe shutdown analysis performed determined that the VBS may be located at the existing Protected Area (PA) fence.

NUREG/CR-6190, Vol. 2 (Ref. 6.5) provides guidance for VBS design. Definitions of the design basis vehicle (DBV) specifies parameters such as weight, speed, payload and kinetic energy are safeguards information. However, the fact that the DBV is a four-wheel drive land vehicle is not safeguards. Due to the assumption of a four-wheel drive vehicle, the protected area may be approached from any direction.

While some speed reduction is possible for off-road approaches due to soil conditions, in general, a four-wheel drive vehicle will develop sufficient traction on unimproved roads and overland paths to achieve the full design speed in approximately the same distance as would be needed for paved surfaces. Consequently, no credit was taken for speed reduction on non-paved approaches.

The design does incorporate the use of natural features for speed reduction and access limitations as follows:

1. Lake Ontario, north of the site, prohibits any land vehicle access.

2. There is a natural embankment east of the site and north of Deer Creek which is greater than 5 feet in height and has an angle from horizontal of approximately 50 degrees. Per Ref. 6.6, this is adequate to prohibit access of a vehicle.

3. Deer Creek and the natural slope to its north in the area north of the Training Center and Simulator Building combine to reduce vehicle speed. The result is a VBS energy requirement approximately one-third of KE_{MAX}.

Two other points to note regarding speed reduction are as follows:

1. A conventional unreinforced chain link fence has little vehicle stopping capability. No credit was taken for energy dissipation by the existing fence of the PA boundary. Likewise a section of the existing fence which is reinforced with cable was ignored since anchorage details are not in accordance with those provided in Reference 6.5.

2. Permanent structures can be used for speed reduction. In general, the structure must be located close to the VBS to be useful for speed reduction. Structures located at a distance greater than L/2 (where L is the width of the structure parallel to the fence line) from the VBS are not useful as a speed reduction measure. No buildings external to the VBS are used for speed reduction although the Offsite Warehouse and Old Steam Generator Storage Facility could be considered.

The selection of barriers was made after consideration of:

- barrier energy requirements
- installed cost
- future maintenance requirements for the barriers
- aesthetics
- effects on security operations, maintenance operations, traffic patterns and parking
- site flooding impact

A discussion of the individual portions of the VBS follows.

4.2 Passive Barriers

The cable bollard system east of the site is designed to cut off the approach from the east. Limited speed reduction was available here, but none was considered. The system is thus designed for KE_{MAX}

The cable bollard system along the west perimeter is also designed for KE_{MAX} due to the limited potential for speed reduction. Several options for the location of the VBS were considered and the decision was based on maintaining the existing access to the storage area and meteorological tower. Sufficient distance is provided between the cable bollard system and the existing Perifeld system to preclude the cable from interfering with the Perifeld system. A minimum 20 feet distance from the inner fence is maintained as an isolation zone.

The design of these systems is based on cable size and bollard spacing which results in a maximum cable ductility ratio less than that of approved designs specified in Reference 6.5. The design also includes sag posts which maintain cable height relative to grade.

Concrete jersey barriers are used along the southern perimeter. Along the north edge of the main parking lot, the asphalt pavement which serves as the barrier anchorage foundation is substantial and may be considered base material per Reference 6.5. This barrier, therefore, provides a resistance greater than KE_{MAX}. No speed reduction or traffic control measures are necessary in the main parking lot.

East of the main parking lot, additional asphalt pavement of similar construction was placed to provide a KE_{MAX} resistance for the jersey barrier. This was necessary to ensure the capability to stop a vehicle approaching from the main access road.

The remaining concrete jersey barriers east of those described above are anchored into the existing soil in accordance with the details in Reference 6.5. This provides a barrier resistance less than KE_{MAX} which is acceptable since speed reduction is possible. A vehicle making an approach will be forced to slow down to negotiate the creek. From the creek to the VBS, a 10% slope exists. The combination of low initial velocity, slope and limited run (approximately 120 feet) will sufficiently limit the vehicle kinetic energy to 1/3 KE_{MAX} for which barriers staked into soil are sufficient.

4.3 Active Barriers

Two new active barriers have been installed. They are located at the main access gate west of the Security Building and at the Receiving Dock. They are incorporated into the line of protection formed by the existing jersey barriers. The gates chosen are Delta Scientific model SC3000S crash rated gates which provide a resistance greater than KE_{MAX}

5.0 SUMMARY

This report details the evaluations performed to document that safe shutdown capability is maintained in the event of occurrence of the Design Basis Explosion (DBX). The DBX evaluations and the VBS design meet the requirements of 10 CFR 73 and Regulatory Guide 5.68. , Adequate protection from the DBX and Design Basis Vehicle is provided at the existing Protected Area boundary.

6.0 REFERENCES

6.1 NUREG/CR-6190, Vol. 1, "Protection Against Malevolent Use of Vehicles at Nuclear Power Plants Vehicle Barrier System Siting Guidance for Blast Protection", Revision 1, December 1994.

6.2 Rochester Gas and Electric Corporation R.E. Ginna Nuclear Power Plant Appendix R Submittal, Revision 6, November 5, 1993.

6.3 Letter dated April 11, 1983, D.M. Crutchfield (NRC) to J.E. Maier (RG&E), Subject: "Fire Protection SER - R.E. Ginna Nuclear Power Plant".

6.4 R.E. Ginna Nuclear Power Plant Updated Final Safety Analysis Report, Revision 10, 12/93.

6.5 NUREG/CR-6190, Vol. 2, "Protection Against Malevolent Use of Vehicles at Nuclear Power Plants Vehicle Barrier System Selection Guidance", Revision 1, December 1994.

6.6 NUREG/CR-4250, "Vehicle Barriers: Emphasis on Natural Features", July 1985.

6.7 Letter dated October 25, 1994, A.R. Johnson (NRC) to R.C. Mecredy (RG&E), Subject: "Summary of Regional Workshops on Malevolent Use of Vehicles at Nuclear Power Reactors".

6.8 Letter dated January 26, 1995, "T.E. Tipton (NEI) to Attendees NEI Workshop on Barriers - December 6-7, 1994, Supplemental Passive Barrier System Designs to Meet Security Requirements to Protect Against Malevolent Use of Vehicles".

6.9 Errata to NUREG/CR-6190, Vol. 2, Rev. 1, March 1997

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