ENCLOSURE 2

APP-GW-GLR-126-NS

Revision 0

"Nuclear Island Response to Aircraft Impact"

Technical Report Number 126

(Public Version)

F-AP-3.2-1 Rev 4

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PATENT REVIEW D. Ekeroth	SIGNATURE / DATE for D. Ekeroth 3/26/08

ORIGINATOR(S) C. Goossen	SIGNATURE / DATE (If processing electronic approval select option) 3/27/08	
ORIGINATOR(S) A. Pfister	SIGNATURE / DATE 3/26/08	
REVIEWER(S)	SIGNATURE / DATE	
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**Plant Applicability: ☐ All AP1000 plants except:
☒ Only the following plants: BNG, HAG, LNG, SVO, VSG, WLG

APPLICABILITY REVIEWER** J. A. Speer	SIGNATURE / DATE 3/31/08
RESPONSIBLE MANAGER* W.E. Cummins	SIGNATURE / DATE W.E. Cummins 3/31/08

* Approval of the responsible manager signifies that the document and all required reviews are complete, the appropriate proprietary class has been assigned, electronic file has been provided to the EDMS, and the document is released for use.

APP-GW-GLR-126 NS **Westinghouse Non Proprietary Class 3** **March 2008**
Revision 0

AP1000 Standard Combined License Technical Report

Nuclear Island Response to Aircraft Impact

Revision 0

Public (redacted) Version with sensitive unclassified nonsafeguards information relative to the physical protection of an AP1000 nuclear plant withheld under 10 CFR 2.390(d).

Westinghouse Electric Company LLC
Nuclear Power Plants
Post Office Box 355
Pittsburgh, PA 15230-0355

1 INTRODUCTION

1.1 Background/Purpose

The purpose of this technical report is to document the assessment of an aircraft crash (ACC) on the AP1000. This assessment takes into account the potential effects of the impact of a large, commercial aircraft. The impacting aircraft analyzed in this report is based upon the force time curve provided to Westinghouse Electric Company by the NRC in July 2007.
The impact of a large, commercial aircraft is a beyond design basis event. The approach to this assessment is consistent with the Nuclear Regulatory Commission's (NRC) approach to beyond design basis events.

The report assesses the effect of the NRC specified ACC on AP1000's core cooling capability, containment integrity, and spent fuel pool integrity and cooling. This report includes an evaluation of AP1000 design features which mitigate the effects of an ACC. With respect to aircraft impact, this report demonstrates the capability of AP1000 to continue to provide adequate protection of the public health and safety by showing that core cooling capability, containment integrity, spent fuel pool integrity, and adequate spent fuel cooling are maintained.

2 TECHNICAL BACKGROUND

2.1 Regulatory Criteria

NRC Regulatory Criteria

Analysis Parameters
The evaluation of plant damage caused by the impact of a commercial aircraft is a complex analysis problem involving phenomena associated with structural impact, shock-induced vibration, and fire effects. The analysis of the aircraft impact considers structural damage, such as that caused by the penetration of hardened components (e.g. engine rotors, landing gear).

Structural Analysis
An assessment of the effects of aircraft fuselage and wing structure is performed.

Shock and Vibration
An assessment of the effects of shock-induced vibration on systems, structures, and components is performed.

Localized Structural Analysis
An assessment of the penetration of hardened aircraft components, such as engine rotors and landing gear is performed. This analysis uses the definition of a hardened component provided to Westinghouse by the NRC in July 2007.

Fire Effects
If perforation of analyzed structural components is predicted, realistic assessments are conducted of the damage to internal systems, structures, and components caused by 1) burning aviation fuel and 2) secondary impacts.

2.2 AP1000 Safety Systems

AP1000 uses extensively analyzed and tested passive safety systems to provide the safety of the plant. All the passive systems meet the NRC single-failure criteria.

The passive safety systems require no operator actions to mitigate design basis accidents. These systems use natural forces such as gravity, natural circulation, and compressed gas to make the systems work. No pumps, fans, diesels, chillers, or other active machinery are used. This eliminates the need for safety related AC power sources. Several valves align and automatically actuate the passive safety systems. To provide high reliability, these valves are designed to actuate to their safeguards positions upon loss of power or upon receipt of a safeguards actuation signal.

The passive safety systems do not require the large network of active safety support systems (AC power, HVAC, cooling water, and the associated seismic buildings to house these components) that are needed in typical nuclear plants. As a result, support systems no longer must be safety class, and they are simplified or eliminated. This simplification applies to the emergency diesel generators and their network of support systems, air start, fuel storage tanks and transfer pumps, and the air intake/exhaust system. The essential service water system and its associated safety cooling towers are replaced with a non-safety-related service water cooling system. The atmosphere is the safety related ultimate heat sink for the AP1000.

With the less physically extensive range of safety-grade equipment, the seismic Category I building volumes are greatly reduced. The majority of safety related equipment is located within containment, resulting in fewer containment penetrations.

The AP1000 passive safety-related systems include:
- The passive core cooling system (PXS)
- The passive containment cooling system (PCS)
- Containment isolation
- The main control room emergency habitability system (VES)

Figures 2-1 and 2-2 illustrate the AP1000 Passive Safety Systems.

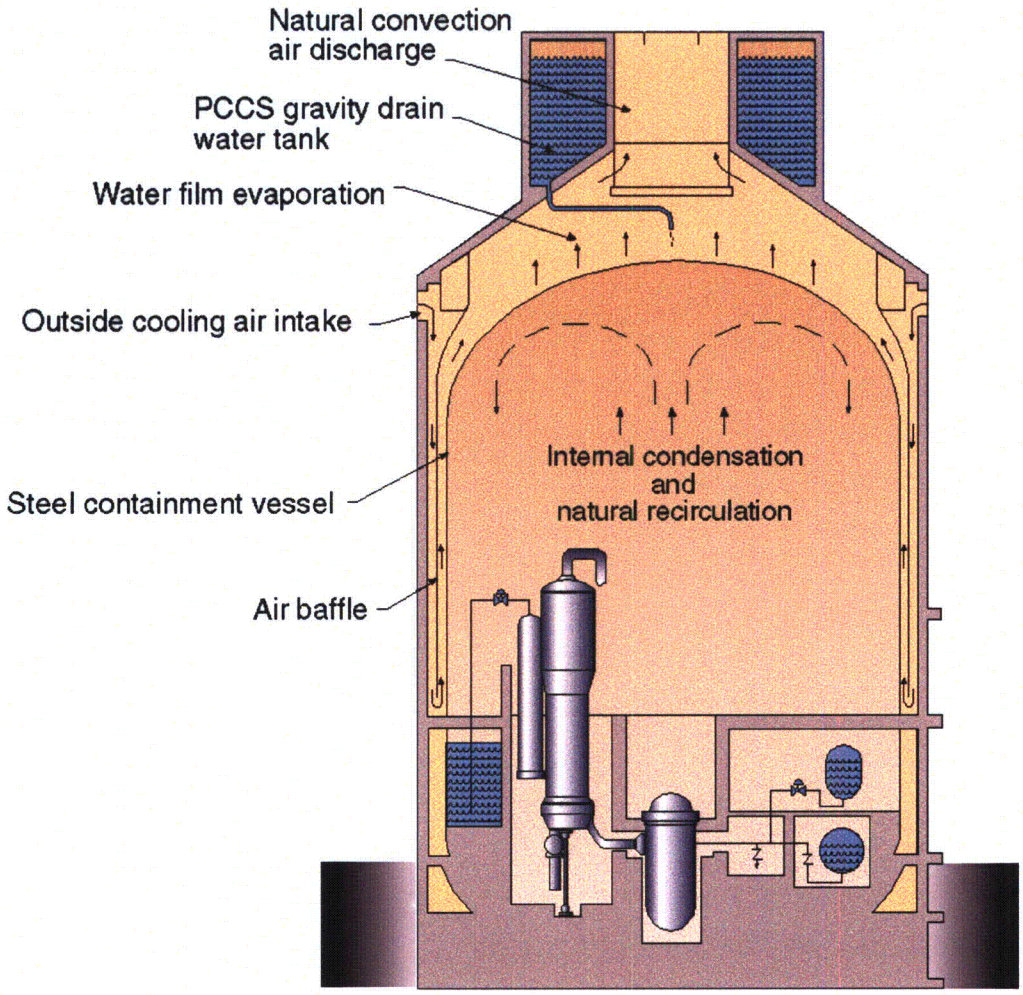

Figure 2-1: AP1000 Passive Safety System

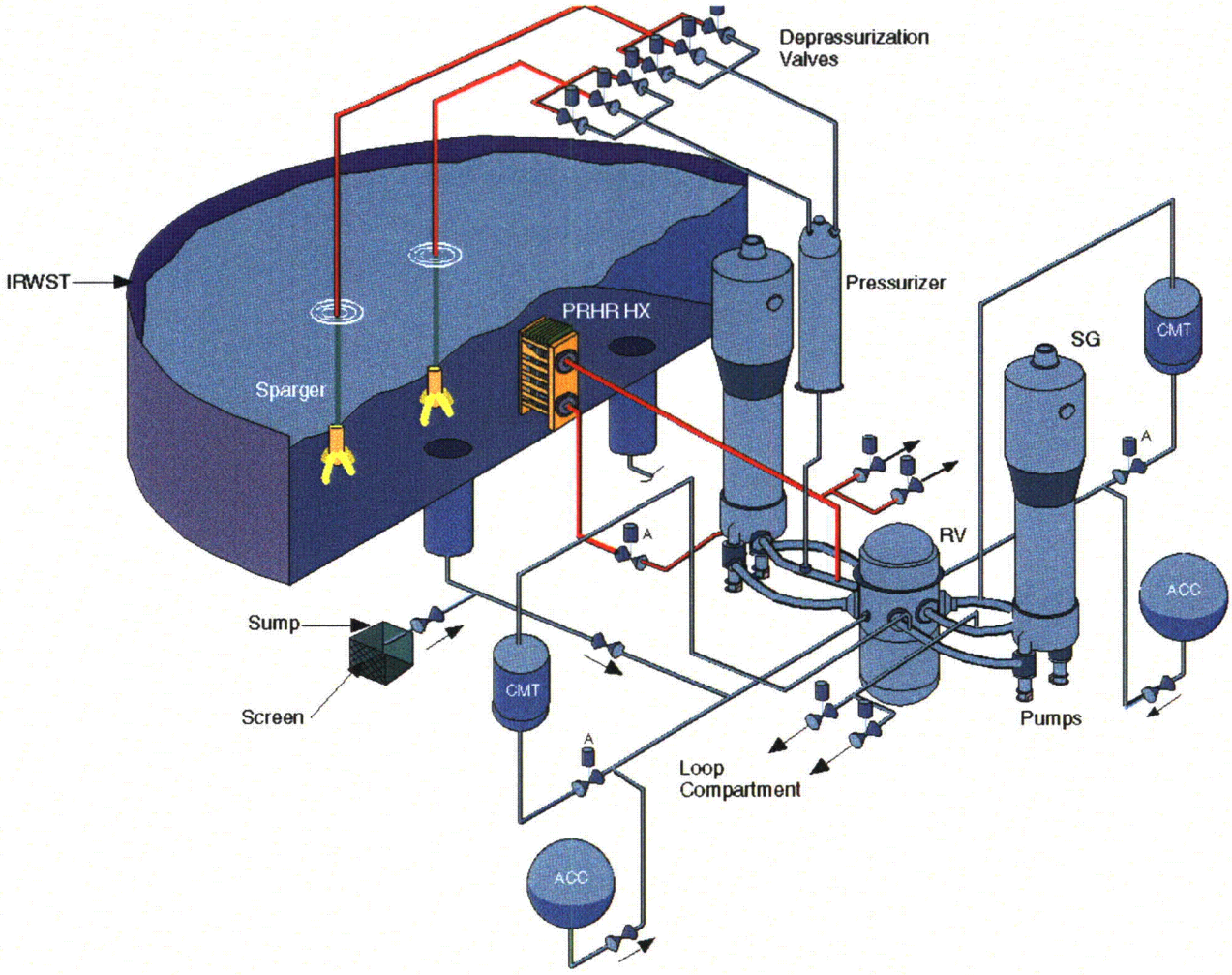

Figure 2-2: Passive Core Cooling

SRL

SRI

6 REGULATOR IMPACT

AP1000's aircraft crash analysis does not adversely impact any existing regulation or regulatory guidance document related to the design certification and licensing process for advanced reactor designs as prescribed in 10 CFR 52.

7 Conclusions

This assessment concludes that AP1000 can continue to provide adequate protection of the public health and safety with respect to aircraft impact as defined by the NRC. The aircraft impact would not inhibit AP1000's core cooling capability, containment integrity, spent fuel pool integrity, or adequate spent fuel cooling based on best estimate calculations

8 DCD MARKUP

19.58.2.3.4 Malevolent Aircraft Impact

Malevolent aircraft impact is discussed in Appendix 19F.

APPENDIX 19F MALEVOLENT AIRCRAFT IMPACT

19F.1 Introduction

The design of AP1000 takes into account the potential effects of the impact of a large commercial aircraft. The impacting aircraft analyzed is based upon the impulse time curve provided by the NRC in July 2007. The impact of a large commercial aircraft is beyond design basis.

19F.1.2 Scope

The evaluation of plant damage caused by the impact of a commercial aircraft is a complex analysis problem involving phenomena associated with structural impact, shock-induced vibration, and fire effects. The analysis of the aircraft impact considers structural damage, such as that caused by the penetration of hardened components (e.g. engine rotors, landing gear).

An assessment of the effects of aircraft fuselage and wing structure is performed.

An assessment of the effects of shock-induced vibration on systems, structures, and components is performed.

An assessment of the penetration of hardened aircraft components, such as engine rotors and landing gear is performed.

Perforation of analyzed structural components is not predicted; therefore, realistic assessments of the damage to internal systems, structures, and components caused by 1) burning aviation fuel and 2) secondary impacts are not required.

19F.2 Background

It is prudent that the design of AP1000 take into account the potential effects of the impact of a large commercial aircraft. The NRC has determined that the impact of a large commercial aircraft is a beyond design basis event. An assessment of this type demonstrates the inherent robustness of AP1000 with regard to potential aircraft impact.

19F.3 Results / Conclusions

The AP1000 Aircraft Impact Assessment is detailed in Technical Report APP-GW-GLR-126 (Reference 1). The assessment concludes that AP1000 can continue to provide adequate protection of the public health and safety with respect to aircraft impact as defined by the NRC. The aircraft impact would not inhibit AP1000's core cooling capability, containment integrity, spent fuel pool integrity, or adequate spent fuel cooling based on best estimate calculations.

19F.4 References

1. APP-GW-GLR-126, March 2008, "AP1000 Nuclear Island Response to Aircraft Impact"

9 REFERENCES

1. "Methodology for Performing Aircraft Impact and Large Explosion Assessments for New Plant Designs", Erin Engineering & Research, Inc. January 2008
2. Mizuno, Jun, et. al. "Investigation on Impact Resistance of Steel Plate Reinforced Concrete Barriers Against Aircraft Impact Part: 1 Test Program and Results", 18th International Conference on Structural Mechanics in Reactor Technology (SMiRT 18), August 7-12, 2005 pp. 2566 to 2571