

Response to Action Item 3-53 Section 3.5.1.3

MCB Issue List Regarding APR-1400, FSAR Section 3.5.1.3

Issue #1-a (AI 3-53.7)

In general, the staff finds the information in the APR1400 FSAR to be ambiguous and contradictory with regard to whether the turbine orientation for the APR1400 is favorably-oriented or may be unfavorably-oriented in accordance with the definitions given in Regulatory Guide (RG) 1.115, Revision 2, "Protection Against Turbine Missiles". For example, the information identified below is confusing to the staff.

a. Based upon the above, the staff cannot determine conclusively whether the intent within the APR1400 design is that the turbine is favorably-oriented or unfavorably-oriented, as defined by RG 1.115, Revision 2. If the applicant's intent is for the turbine to be favorably-oriented, confirm there are no essential SSCs within the low-trajectory turbine missile strike zone such that the turbine generator is favorably-orientated as defined in RG 1.115, Revision 2 and revise the sections and figures of the FSAR listed in the above table accordingly. Specifically, a statement such as the following should be included "The T/G has a favorable orientation to minimize the potential effects of turbine missiles on essential (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) SSCs," which is currently in Tier 1 of the APR1400 FSAR, Section 2.7.1.1.1(1.b).

Response

Because there are no essential SSCs within the low-trajectory turbine missile strike zone, the turbine is favorably-oriented. Tier 1 Section 2.7.1.1.1 (1.b) and Tier 1 Table 2.7.1.1-1 (1.b) will be revised to clarify the turbine favorable orientation.

Impact on DCD

Tier 1 DCD Section 2.7.1.1.1 and Tier 1 Table 2.7.1.1-1 will be revised as shown in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 1**2.7 Plant Systems****2.7.1 Power Generation Systems****2.7.1.1 Turbine Generator****2.7.1.1.1 Design Description**

since they are located outside the low
trajectory turbine strike zone

The turbine generator (T/G) is a non safety-related system that converts the energy of the steam produced from the steam generators into rotational energy and then electrical energy.

The T/G has favorably oriented turbines. Potential missiles from the failure of the T/G should not affect essential SSCs. The low pressure turbine rotor integrity is ensured by the combination of design, material properties including fracture toughness, tests, and inspections of the rotor to limit the probability of turbine missile generation. Turbine rotor components and turbine stop and control valves will be inservice tested and inspected at intervals in accordance with industry practice or as specified by the manufacturer to meet turbine missile generation probability requirements.

The T/G is located within the turbine building and consists of:

- a. One (1) double-flow high pressure (HP) turbine
- b. Three (3) double-flow low pressure (LP) turbines
- c. A generator and exciter
- d. Two (2) sets of moisture separator and reheaters
- e. Associated piping, valves, control system
- f. Auxiliary systems

The main stop valves (MSVs) and control valves (CVs) are arranged in series at the HP turbine inlet and control the steam flow entering the HP turbine. The intermediate stop valves (ISVs) and intercept valves (IVs) are arranged in series at the inlet to the LP turbines,

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and control steam flow to the LP turbines. The non-return check valves are installed in the extraction lines to the feedwater heaters.

- 1.a The arrangement of the T/G system is as described in the Design Description of Subsection 2.7.1.1.1.
- 1.b The T/G has a favorable orientation to minimize the potential effects of turbine missiles on essential (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) SSCs. ~~The essential SSCs that are located within the low-trajectory turbine missile strike zone are failsafe or protected by physical barriers.~~
- 2.a The mechanical overspeed trip system initiates the T/G trip upon reaching the overspeed setpoint.
- 2.b The electrical overspeed trip system, which is independent of the normal speed control system and mechanical overspeed trip system, initiates a T/G trip by an electrical signal at a speed slightly higher than for the mechanical overspeed trip.
3. The control system generates the electrical signals in the main control room (MCR) for T/G trip.
4. The MSVs, CVs, ISVs, and IVs close reacting to a T/G trip signal.
5. The non-return check valves on extraction lines close reacting to T/G trip signal.
6. The reactor trip signal from the plant control system initiates a T/G trip.
7. The turbine and turbine valve in-service test and inspection program includes scope, frequency, methods, acceptance, disposition of reportable indications, corrective actions, and technical basis for inspection frequency.
8. The probability of a strike by a turbine missile is sufficiently low to prevent equipment damage to essential SSCs.
9. The as-built turbine material properties, turbine rotor and blade designs, pre-service inspection and testing results and in-service testing and inspection

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Table 2.7.1.1-1 (1 of 3)

Turbine Generator ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1.a The arrangement of the T/G system is as described in the Design Description of Subsection 2.7.1.1.1	1.a Inspection of the as-built T/G system configuration will be conducted.	1.a The as-built T/G conforms with the functional arrangement as described in the Design Description of Subsection 2.7.1.1.1.
1.b The T/G has a favorable orientation to minimize the potential effects of turbine missiles on essential (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) SSCs. The essential SSCs that are located within the low-trajectory turbine missile strike zone are failsafe or protected by physical barriers.	1.b Inspections of turbine orientation with respect to the essential SSCs will be conducted. The consequences of turbine missile impact on those SSCs that are located within the low-trajectory turbine missile strike zone defined by Figure 1 of Regulatory Guide 1.115, Rev. 2, will be analyzed.	1.b An analysis exists to confirm that any essential SSCs (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) that are located inside the low trajectory turbine missile strike zone are failsafe or are protected by physical barriers.
2.a The mechanical overspeed trip system initiates the T/G trip upon reaching the overspeed setpoint.	2.a A trip test will be conducted on the as-built main turbine system to ensure the T/G trips on reaching an overspeed setpoint.	2.a A report of testing exists documenting that as-built MSVs, CVs, ISVs, and IVs close when the mechanical overspeed trip system reaching a setpoint for overspeed protection initiates the T/G trip.
2.b The electrical overspeed trip system, which is independent of the normal speed control system and mechanical overspeed trip system, initiates a T/G trip by an electrical signal at a speed slightly higher than for the mechanical overspeed trip.	2.b A trip test will be conducted on the as-built main turbine system by an actual or simulated trip signal.	2.b A report of testing exists documenting that as-built MSVs, CVs, ISVs, and IVs close when the system initiates the T/G trip by an actual or simulated signal.
3. The control system generates the electrical signals in the main control room (MCR) for T/G trip.	3. Tests will be conducted on the as-built T/G system by controls in the MCR.	3. A report of testing exists documenting that Controls in the as-built MCR close the MSVs, CVs, ISVs, and IVs.

no

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Issue #1-b (AI 3-53.7)

b. If there are essential SSCs in the low-trajectory turbine missile strike zone, whether or not they are protected, failsafe, etc., then the turbine generator is unfavorably-orientated and the applicable paragraphs in APR1400 FSAR, Tier 2, Sections 3.5.1.3 and 10.2.3, and Tier 1, Section 2.7.1.1, should be revised accordingly to be consistent. Note that SSCs that are failsafe or protected by barriers do not determine turbine orientation.

Response

Because there are no essential SSCs within the low-trajectory turbine missile strike zone, the turbine is favorably-oriented. Tier 1 Section 2.7.1.1.1 (1.b) and Tier 1 Table 2.7.1.1-1 (1.b) will be revised to clarify the turbine favorable orientation.

Impact on DCD

Tier 1 DCD Section 2.7.1.1.1 and Tier 1 Table 2.7.1.1-1 will be revised as shown in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 1**2.7 Plant Systems****2.7.1 Power Generation Systems****2.7.1.1 Turbine Generator****2.7.1.1.1 Design Description**

since they are located outside the low
trajectory turbine strike zone

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- c. A generator and exciter
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- e. Associated piping, valves, control system
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and control steam flow to the LP turbines. The non-return check valves are installed in the extraction lines to the feedwater heaters.

- 1.a The arrangement of the T/G system is as described in the Design Description of Subsection 2.7.1.1.1.
- 1.b The T/G has a favorable orientation to minimize the potential effects of turbine missiles on essential (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) SSCs. ~~The essential SSCs that are located within the low-trajectory turbine missile strike zone are failsafe or protected by physical barriers.~~
- 2.a The mechanical overspeed trip system initiates the T/G trip upon reaching the overspeed setpoint.
- 2.b The electrical overspeed trip system, which is independent of the normal speed control system and mechanical overspeed trip system, initiates a T/G trip by an electrical signal at a speed slightly higher than for the mechanical overspeed trip.
3. The control system generates the electrical signals in the main control room (MCR) for T/G trip.
4. The MSVs, CVs, ISVs, and IVs close reacting to a T/G trip signal.
5. The non-return check valves on extraction lines close reacting to T/G trip signal.
6. The reactor trip signal from the plant control system initiates a T/G trip.
7. The turbine and turbine valve in-service test and inspection program includes scope, frequency, methods, acceptance, disposition of reportable indications, corrective actions, and technical basis for inspection frequency.
8. The probability of a strike by a turbine missile is sufficiently low to prevent equipment damage to essential SSCs.
9. The as-built turbine material properties, turbine rotor and blade designs, pre-service inspection and testing results and in-service testing and inspection

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Table 2.7.1.1-1 (1 of 3)

Turbine Generator ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1.a The arrangement of the T/G system is as described in the Design Description of Subsection 2.7.1.1.1	1.a Inspection of the as-built T/G system configuration will be conducted.	1.a The as-built T/G conforms with the functional arrangement as described in the Design Description of Subsection 2.7.1.1.1.
1.b The T/G has a favorable orientation to minimize the potential effects of turbine missiles on essential (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) SSCs. The essential SSCs that are located within the low-trajectory turbine missile strike zone are failsafe or protected by physical barriers.	1.b Inspections of turbine orientation with respect to the essential SSCs will be conducted. The consequences of turbine missile impact on those SSCs that are located within the low-trajectory turbine missile strike zone defined by Figure 1 of Regulatory Guide 1.115, Rev. 2, will be analyzed.	1.b An analysis exists to confirm that any essential SSCs (as defined in Regulatory Guide 1.115, Rev. 2, Appendix A) that are located inside the low trajectory turbine missile strike zone are failsafe or are protected by physical barriers.
2.a The mechanical overspeed trip system initiates the T/G trip upon reaching the overspeed setpoint.	2.a A trip test will be conducted on the as-built main turbine system to ensure the T/G trips on reaching an overspeed setpoint.	2.a A report of testing exists documenting that as-built MSVs, CVs, ISVs, and IVs close when the mechanical overspeed trip system reaching a setpoint for overspeed protection initiates the T/G trip.
2.b The electrical overspeed trip system, which is independent of the normal speed control system and mechanical overspeed trip system, initiates a T/G trip by an electrical signal at a speed slightly higher than for the mechanical overspeed trip.	2.b A trip test will be conducted on the as-built main turbine system by an actual or simulated trip signal.	2.b A report of testing exists documenting that as-built MSVs, CVs, ISVs, and IVs close when the system initiates the T/G trip by an actual or simulated signal.
3. The control system generates the electrical signals in the main control room (MCR) for T/G trip.	3. Tests will be conducted on the as-built T/G system by controls in the MCR.	3. A report of testing exists documenting that Controls in the as-built MCR close the MSVs, CVs, ISVs, and IVs.

no

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Issue #2-a (AI 3-53.8)

In conjunction with Issue #1 above, for APR1400 FSAR, Figure 3.5-1, confirm that the turbine rotor centerline is the same as the centerline of the reactor building. Otherwise, redraw the low-trajectory turbine missile strike zone using the appropriate centerline orientation.

Response

The turbine rotor centerline is the same as the centerline of the reactor containment building. The turbine missile strike zone will be revised to show the turbine rotor centerline.

Impact on DCD

DCD Tier 2, Figure 3.5-1 will be revised to show the turbine rotor centerline as shown in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 2

Security-Related Information – Withhold Under 10 CFR 2.390

Replace with Figure A
on next page

Figure 3.5-1 Turbine Missile Strike Zone

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Figure A

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 3.5-1 Turbine Missile Strike Zone

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MCB Issue List Regarding APR-1400, FSAR Section 3.5.1.3

Issue #2-b (AI 3-53.8)

b. In addition, revise APR1400 FSAR, Figure 3.5-1 to identify the essential SSCs from APR1400 FSAR, Table 3.5-4 directly on Figure 3.5-1, so that it can be verified that all essential SSCs are not in the low-trajectory turbine missile strike zone.

Response

The locations of essential SSCs in Table 3.5-4 will be marked in Figure 3.5-1 to show that all essential SSCs are not in the low-trajectory turbine missile strike zone.

Impact on DCD

DCD Tier 2, Figure 3.5-1 will be revised as shown in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 2

Security-Related Information – Withhold Under 10 CFR 2.390

Replace with Figure A
on next page

Figure 3.5-1 Turbine Missile Strike Zone

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Figure A

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 3.5-1 Turbine Missile Strike Zone

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Issue #2-c (AI 3-53.8)

Finally, revise Figure 1.2-1 as necessary, to be consistent with Figure 3.5-1.

Response

Figure 3.5-1 of the turbine missile strike zone will be revised to incorporate the site plot plan shown in Figure 1.2-1. Therefore, there is no need to revise Figure 1.2-1.

Impact on DCD

DCD Figure 3.5-1 will be revised as shown in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

APR1400 DCD TIER 2

Security-Related Information – Withhold Under 10 CFR 2.390

Replace with Figure A
on next page

Figure 3.5-1 Turbine Missile Strike Zone

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Figure A

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 3.5-1 Turbine Missile Strike Zone