To instantiate the provided safety case pattern for the Generic Patient Controlled Analgesia (GPCA) system, we will replace the placeholders with system-specific information related to the GPCA. Here, I'll convert the generic placeholders into concrete elements applicable to the GPCA system.

### Instantiate the Safety Case Pattern for GPCA

#### Top-Level Goal

- \*\*Goal (G1, "Operational safety of GPCA is verified")\*\*

- \*\*Strategy (S1, "Argument over the satisfaction of all specifications over GPCA")\*\* - Undeveloped

- \*\*Context (C1, "All specifications for GPCA are given by safety, operational, and performance specifications")\*\*

- \*\*Goal (G2, "All operational hazards associated with GPCA are mitigated")\*\*

- \*\*Strategy (S3, "Argument over operational hazards associated with GPCA")\*\*

- \*\*Context (C2, "Operational hazards are identified from risk analysis and hazard logs")\*\*

#### Addressing Operational Hazards

- Goal (G3, "Operational hazard 'Over-infusion' is mitigated")

- \*\*Strategy (S4, "Argument over the applied scenarios of 'Over-infusion' in use")\*\*

- \*\*Context (C3, "All related Over-infusion scenarios are identified from use-cases and incident reports")\*\*

- Goal (G4, "Over-infusion is mitigated under scenario 'System Failure'")

- \*\*Strategy (S5, "Argument over all specifications related to 'System Failure' scenarios")\*\*

- \*\*Context (C4, "All related specifications are given by technical and safety requirements for 'System Failure' scenarios")\*\*

- Goal (G5, "Specification 'Auto Shutdown on Failure' is appropriate for 'System Failure'")

- \*\*Strategy (S6, "Argument the appropriateness of 'Auto Shutdown on Failure' over properties")\*\*

- \*\*Context (C5, "Properties are given by requirements and functional designs focusing on 'Auto Shutdown' feature")\*\*

- Goal (G6, "Property 'Reliability' is appropriate for 'Auto Shutdown on Failure'")

- \*\*Strategy (S7, "Argument over the source of the 'Reliability' property definition")\*\*

- \*\*Context (C6, "Source of 'Reliability' is given by engineering design documents and reliability analysis reports")\*\*

- \*\*Goal (G7, "Source manufacturer's reliability data is appropriate and trustworthy")\*\*

- \*\*Solution (Sn1, "Verified third-party reliability tests")\*\*

- \*\*Goal (G8, "Property 'Reliability' definition is sufficient")\*\*

- \*\*Solution (Sn2, "Engineering analysis and reliability compliance documentation")\*\*

### Hierarchical Tree Representation:

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- Goal (G1, "Operational safety of GPCA is verified")

- Strategy (S1, "Argument over the satisfaction of all specifications over GPCA") - Undeveloped

- Context (C1, "All specifications for GPCA are given by safety, operational, and performance specifications")

- Goal (G2, "All operational hazards associated with GPCA are mitigated")

- Strategy (S3, "Argument over operational hazards associated with GPCA")

- Context (C2, "Operational hazards are identified from risk analysis and hazard logs")

- Goal (G3, "Operational hazard 'Over-infusion' is mitigated")

- Strategy (S4, "Argument over the applied scenarios of 'Over-infusion' in use")

- Context (C3, "All related Over-infusion scenarios are identified from use-cases and incident reports")

- Goal (G4, "Over-infusion is mitigated under scenario 'System Failure'")

- Strategy (S5, "Argument over all specifications related to 'System Failure' scenarios")

- Context (C4, "All related specifications are given by technical and safety requirements for 'System Failure' scenarios")

- Goal (G5, "Specification 'Auto Shutdown on Failure' is appropriate for 'System Failure'")

- Strategy (S6, "Argument the appropriateness of 'Auto Shutdown on Failure' over properties")

- Context (C5, "Properties are given by requirements and functional designs focusing on 'Auto Shutdown' feature")

- Goal (G6, "Property 'Reliability' is appropriate for 'Auto Shutdown on Failure'")

- Strategy (S7, "Argument over the source of the 'Reliability' property definition")

- Context (C6, "Source of 'Reliability' is given by engineering design documents and reliability analysis reports")

- Goal (G7, "Source manufacturer's reliability data is appropriate and trustworthy")

- Solution (Sn1, "Verified third-party reliability tests")

- Goal (G8, "Property 'Reliability' definition is sufficient")

- Solution (Sn2, "Engineering analysis and reliability compliance documentation")

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