To instantiate the given safety case pattern for the Generic Patient-Controlled Analgesia (GPCA) system and provide a safety case in a hierarchical tree format, we will address the placeholders based on the specific requirements and the domain information provided.

### Instantiated Safety Case (Hierarchical Tree Format):

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- G1: Operational safety is verified in GPCA system

- S1: Argument over the satisfaction of all specs over GPCA system (undeveloped)

- G2: All operational hazards are mitigated

- S3: Argument over operational hazards

- G3: Underinfusion is mitigated

- S4: Argument over the applied scenarios of Underinfusion

- G4: Underinfusion is mitigated under low flow scenario

- S5: Argument over all specs related to low flow scenario

- G5: Flow rate sensor is appropriate for low flow scenario

- S6: Argument the appropriateness of flow rate sensor over properties

- G6: Flow rate less than 90% of the programmed rate setting is appropriate for flow rate sensor

- S7: Argument over the source of the property definition

- G7: FDA standard is appropriate and trustworthy

- Sn1: FDA standard documentation provided

- G8: Property definition of flow rate is sufficient

- Sn2: Technical specification of flow rate sensor

- G4: Underinfusion is mitigated under inaccurate rate programming scenario (undeveloped)

- G3: Overinfusion is mitigated

- S4: Argument over the applied scenarios of Overinfusion

- G4: Overinfusion is mitigated in scenario of excessive bolus request

- S5: Argument over all specs related to excessive bolus scenario

- G5: Dose limit control is appropriate for excessive bolus scenario

- S6: Argument the appropriateness of dose limit control over properties

- G6: Dose limit exceeded due to excessive bolus requests is appropriate for dose limit control

- S7: Argument over the source of the property definition

- G7: Expert opinion is appropriate and trustworthy

- Sn1: Expert opinion documentation

- G8: Property definition of dose limit is sufficient

- Sn2: Clinical safety guideline documentation

- Contexts and Supporting Elements:

- C1: All specs are given by specs for flow sensor and dose limit control

- C2: Operational hazards specified as Underinfusion and Overinfusion

- S2: Argument over reliability in all suitable levels of GPCA system (undeveloped)

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### Description

This safety case translates the pattern into a specific scenario regarding the GPCA system, focusing on its hazards ("Overinfusion" and "Underinfusion"). Strategies argue over the operations and mechanisms (specs) like the flow rate sensor and dose limit control under different scenarios and properties to ensure hazards are effectively mitigated. The safety requirements from the domain information are used to fulfill specified goals and strategies. Each safety requirement directly interfaces with the corresponding strategy or goal to validate the hazard mitigation. Forms of evidence (like FDA standards and expert opinions) validate the assumptions and properties related to the system's operational safety.