Based on the information provided in the domain description for the Generic Patient-Controlled Analgesia (GPCA) system and the placeholders from the safety case pattern, we can instantiate this pattern to create a detailed safety case. Below is the hierarchical tree representation of the instantiated safety case for the GPCA system.

@Assurance\_case

- 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: Overinfusion is mitigated

- S4: Argument over the applied scenarios of Overinfusion

- G4: Overinfusion is mitigated under excessive bolus requests scenario

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

- G5: Dose limit check spec is appropriate for excessive bolus requests scenario

- S6: Argument the appropriateness of dose limit check spec over properties

- G6: Property "dose limit exceeded due to excessive bolus requests" is appropriate for dose limit check spec

- S7: Argument over the source of the property definition

- G7: Source "FDA standard" is appropriate and trustworthy

- Sn1: FDA standard documentation

- G8: "dose limit exceeded" definition is sufficient

- Sn2: Definition documentation

- G3: Underinfusion is mitigated

- S4: Argument over the applied scenarios of Underinfusion

- G4: Underinfusion is mitigated under flow rate mismatch scenario

- S5: Argument over all specs related to flow rate mismatch scenario

- G5: Flow rate sensor spec is appropriate for flow rate mismatch scenario

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

- G6: Property "flow rate does not match the programmed rate" is appropriate for flow rate sensor spec

- S7: Argument over the source of the property definition

- G7: Source "Expertise opinion" is appropriate and trustworthy

- Sn1: Expert opinion documentation

- G8: "flow rate does not match" definition is sufficient

- Sn2: Definition documentation

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

- Context (C1: All specs are given by spec.allInstances())

- Context (C2: Operational hazards are given by operational hazard.allInstances())

- Context (C3: All related scenarios are given by operational hazard)

- Context (C4: All related specs are given by scenario.spec.allinstances())

- Context (C5: Properties are given by spec.property.allinstances())

- Context (C6: Source is given by property.source)

@End\_Assurance\_case

This safety case breaks down overinfusion and underinfusion into scenarios and arguments over corresponding mitigations with the strategies and solutions given specifications and sources that are deemed reliable. Each goal has been developed from a placeholder to reflect specific aspects like scenarios, specifications, and sources from the domain information detailing the GPCA system.