Given the safety case pattern for a Generic Patient-Controlled Analgesia (GPCA) system, we will instantiate the pattern to create a concrete safety case mapping. Below is the instantiated hierarchical structure of the safety case:

Assumption for instantiation:

- {system} = GPCA System

- {operational hazard} = overdose and underdose

- {scenario} = during standard operation and emergency operation

- {spec} = drug delivery specifications and alarm specifications

- {property} = delivery rate and alarm volume

- {source} = FDA regulations and manufacturer guidelines

@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

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

- S3: Argument over operational hazards

- G3: Overdose is mitigated

- S4: Argument over the applied scenarios of overdose

- G4: Overdose is mitigated under standard operation

- S5: Argument over all specs related to standard operation

- G5: Drug delivery specifications are appropriate for standard operation

- S6: Argument the appropriateness of drug delivery specifications over properties

- G6: Delivery rate is appropriate for drug delivery specifications

- S7: Argument over the source of the delivery rate definition

- G7: Source is appropriate and trustworthy

- Sn1: FDA regulations

- G8: Delivery rate definition is sufficient

- Sn2: Manufacturer guidelines

- G4: Overdose is mitigated under emergency operation

- S5: Argument over all specs related to emergency operation

- G5: Alarm specifications are appropriate for emergency operation

- S6: Argument the appropriateness of alarm specifications over properties

- G6: Alarm volume is appropriate for alarm specifications

- S7: Argument over the source of the alarm volume definition

- G7: Source is appropriate and trustworthy

- Sn1: FDA regulations

- G8: Alarm volume definition is sufficient

- Sn2: Manufacturer guidelines

- G3: Underdose is mitigated

- S4: Argument over the applied scenarios of underdose

- G4: Underdose is mitigated under standard operation

- S5: Argument over all specs related to standard operation

- G5: Drug delivery specifications are appropriate for standard operation

- S6: Argument the appropriateness of drug delivery specifications over properties

- G6: Delivery rate is appropriate for drug delivery specifications

- S7: Argument over the source of the delivery rate definition

- G7: Source is appropriate and trustworthy

- Sn1: FDA regulations

- G8: Delivery rate definition is sufficient

- Sn2: Manufacturer guidelines

- G4: Underdose is mitigated under emergency operation

- S5: Argument over all specs related to emergency operation

- G5: Alarm specifications are appropriate for emergency operation

- S6: Argument the appropriateness of alarm specifications over properties

- G6: Alarm volume is appropriate for alarm specifications

- S7: Argument over the source of the alarm volume definition

- G7: Source is appropriate and trustworthy

- Sn1: FDA regulations

- G8: Alarm volume definition is sufficient

- Sn2: Manufacturer guidelines

@End\_Assurance\_case

This structure outlines the logical relationships and dependencies within the safety case of GPCA system, using levels indicated by dashes. Each goal, strategy, and solution is linked to the appropriate context, and goals are split based on specific operational hazards and their mitigation scenarios, ensuring clarity and structure in demonstrating the operational safety of the GPCA system.