To instantiate the GPCA system safety case pattern into a concrete safety case, I will replace the placeholders with specific information from the provided domain details about the Generic Patient-Controlled Analgesia (GPCA) system. Attributes of GPCA hazards, operational scenarios, and specifications associated with safety requirements will be used to develop this case.

Here is the hierarchy of the instantiated safety case following the structure of the provided pattern, using specific system details for the GPCA:

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G1: Operational safety is verified in the GPCA system

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

- C1: All specs are given by safety requirements SR1.1, SR1.2, SR1.4, SR1.5, SR1.10, SR3.4.6, SR6.1.3, SR6.1.4

\* undeveloped

- G2: All operational hazards are mitigated

- S3: Argument over operational hazards

- C2: Operational hazards are given by "Overinfusion" and "Underinfusion"

- G3: Overinfusion is mitigated

- S4: Argument over the applied scenarios of Overinfusion

- C3: All related scenarios are given by operational settings for Overinfusion

- G4: Overinfusion is mitigated under high flow rate scenario

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

- C4: All related specs are given by safety requirement SR1.10

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

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

- C5: Properties are given by "Flow rate sensor is equipped", "Flow rate is less than 90% of the programmed rate setting"

- G6: Flow rate must be less than 90% of the programmed rate setting

- S7: Argument over the source of the property definition

- C6: Source is given by FDA standard

- G7: FDA standard is appropriate and trustworthy

- Sn1: source verification document

- G8: Property definition is sufficiently rigorous

- Sn2: flow rate property specification document

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Explanation of Instantiation:

- \*\*GPCA system\*\*: This refers to the Generic Patient-Controlled Analgesia system.

- \*\*High flow rate scenario\*\*: Represents situations where flow rate exceeds normal operational thresholds.

- \*\*Safety requirements such as SR1.1, SR1.2, etc.\*\*, are explicitly listed as they define critical safety aspects.

- \*\*Flow rate sensor and properties\*\*: Specific safety features and requirements are considered critical and are explicitly addressed.

- \*\*FDA standard\*\*: Used as a credible source confirming the appropriateness of the safety measures.

The placeholder information was replaced with specifics about the system, hazard scenarios, required properties, and credible sources to fully represent the context and specifics of the GPCA system. This instantiation now forms a robust safety assurance case grounded in the operational specifics of the GPCA system, addressing various operational hazards in structured arguments leveraging GSN.