To instantiate the safety case pattern for a Generic Patient Controlled Analgesia (GPCA) system into an assurance case, I will use the given predicates and replace placeholders with specific instances. The context will be based around the use of a GPCA system that is designed to deliver medication in a hospital setting, ensuring patient safety by mitigating hazards associated with the usage, programming, and equipment.

### Derived Assurance Case

\*\*@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\*\*

- \*\*C1: All specs are given by GPCA system specifications\*\*

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

- \*\*S3: Argument over operational hazards\*\*

- \*\*C2: Operational hazards are given by known hazards in PCA devices\*\*

- \*\*G3: Over-dosage hazard is mitigated\*\*

- \*\*S4: Argument over the applied scenarios of over-dosage hazard\*\*

- \*\*C3: All related scenarios are given by overdose hazard scenarios\*\*

- \*\*G4: Over-dosage hazard is mitigated under manual programming scenario\*\*

- \*\*S5: Argument over all specs related to manual programming scenario\*\*

- \*\*C4: All related specs are given by manual programming safety protocols\*\*

- \*\*G5: Safety lock feature is appropriate for manual programming scenario\*\*

- \*\*S6: Argument the appropriateness of safety lock feature over properties\*\*

- \*\*C5: Properties are given by safety feature specifications\*\*

- \*\*G6: Visibility property is appropriate for safety lock feature\*\*

- \*\*S7: Argument over the source of the visibility property definition\*\*

- \*\*C6: Source is given by manufacturer safety standards\*\*

- \*\*G7: Manufacturer documentation is appropriate and trustworthy\*\*

- \*\*Sn1: Manufacturer safety certification\*\* (source)

- \*\*G8: Visibility property definition is sufficient\*\*

- \*\*Sn2: Detailed visibility feature specification\*\* (property)

### Representation in Hierarchical Tree Format

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- G1: Operational safety is verified in GPCA system

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- C1: All specs are given by GPCA system specifications

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

- S3: Argument over operational hazards

- C2: Operational hazards are given by known hazards in PCA devices

- G3: Over-dosage hazard is mitigated

- S4: Argument over the applied scenarios of over-dosage hazard

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- G4: Over-dosage hazard is mitigated under manual programming scenario

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- G5: Safety lock feature is appropriate for manual programming scenario

- S6: Argument the appropriateness of safety lock feature over properties

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- G6: Visibility property is appropriate for safety lock feature

- S7: Argument over the source of the visibility property definition

- C6: Source is given by manufacturer safety standards

- G7: Manufacturer documentation is appropriate and trustworthy

- Sn1: Manufacturer safety certification (source)

- G8: Visibility property definition is sufficient

- Sn2: Detailed visibility feature specification (property)

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\*\*@End\_Assurance\_case\*\*

This case hierarchically structures goals, strategies, contexts, and solutions to thoroughly assure the operational safety of the GPCA system, addressing specific hazards and scenarios relevant to its use. Each element is tied to a more specific property or scenario to systematically address how each hazard is mitigated.