# Module XX – Recovery Simulation & Failure Drill Capsule

Version: 4.1 | Classification: CTO Mandatory (Emergency Governance Simulation Layer)

Scope: Simulation logic for capsule failure, fork abuse, recovery paths and sovereign reentry

## 0. Purpose & Recovery Governance

This module defines simulated capsule-driven emergency paths used to test and validate recovery behavior across fork abuse, replay attacks, loss of capsule lineage, and invalid certification chains. It defines trigger logic, capsule sequences, reentry control, and certification downgrade response under CTO-auditable constraints.

## 1. Failure Scenarios & Trigger Matrix

Defined test failures:  
- Fork Abuse Capsule (FAC) issued with invalid federation scope  
- Replay Capsule (RAC) bypassed ledger trace verification  
- Certificate Contamination Capsule (CCC) signed by revoked root  
- Audit Engine loses capsule lineage (missing sequence)  
- Trust Tier mismatch in executing sandbox entity

## 2. Recovery Capsule Chain

Trigger Capsule → Recovery Capsule (GC) → Grace Revalidation Chain Capsule (GRCC) → Reentry Capsule (REC)  
- GC = suspends capsule class and audit lineage  
- GRCC = attempts controlled revalidation via sandbox simulation  
- REC = grants reentry to ledger trace (via CCC override or federation co-sign)

## 3. Simulation Parameters & Drill Output

- Replay = 5x duplicate EC injection with tier violation  
- Fork test = dual CCC injection with mismatched zone ID  
- Recovery must emit 3 valid SCCs per failure path  
- All capsules flagged as simulated (non-executing, no production link)

## 4. Audit Reaction Simulation

- On RAC: Audit chain must freeze ledger segment  
- On CCC: Audit Council emits Fork Divergence Alert Capsule (FDAC)  
- On incomplete GRCC: REC is denied and downgrade remains active

## 5. Certification Path Resilience

Audit council must test if REC chain restores previous CCC or isolates forked path.  
Failure drill confirms that downgrade protocol is reliable and audit trace can recover cross-tier violations.