Debris Hazards & Risk Management Toolkit

Module 5 - USAR Debris Clearance, Structural Hazards & Safety Management

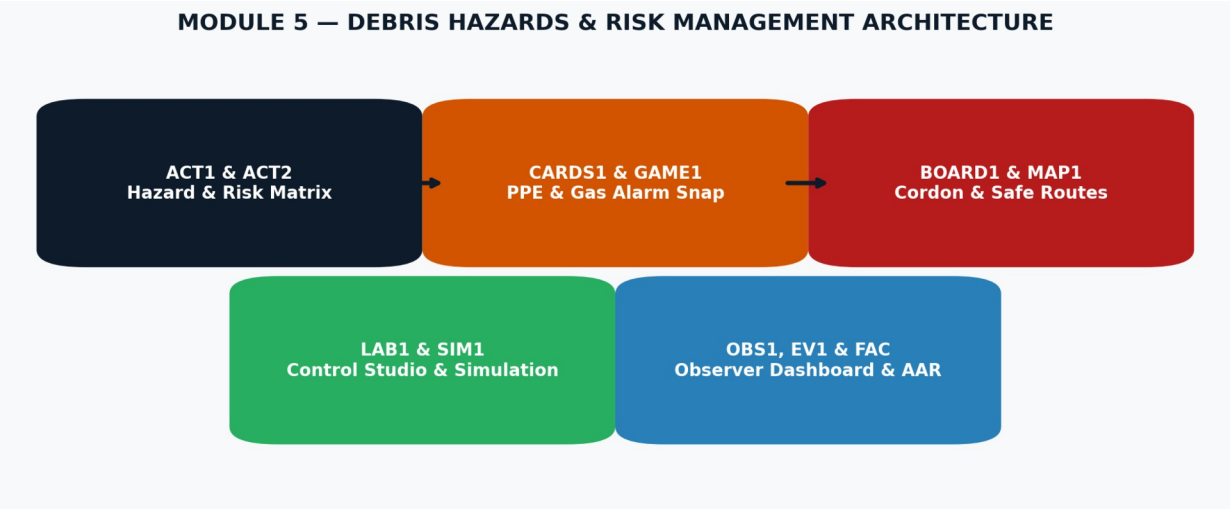


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OV — Toolkit Overview & System Architecture



Hazard & Risk Identification

Differentiate physical debris hazards, toxic airborne dust, flammable gas leaks, and secondary collapse risks.

PPE Pack-Out & Safety Snap

Equip crews with EN 397 helmets, N95 dust masks, 4-gas monitors, and cut-resistant gloves for hazard zones.

Cordon Zones & Safe Egress

Establish 1.5x height Hot Zone cordons, clean decontamination tracks, and clear primary egress pathways.

ACT1 — Hazard Spectrum Wall



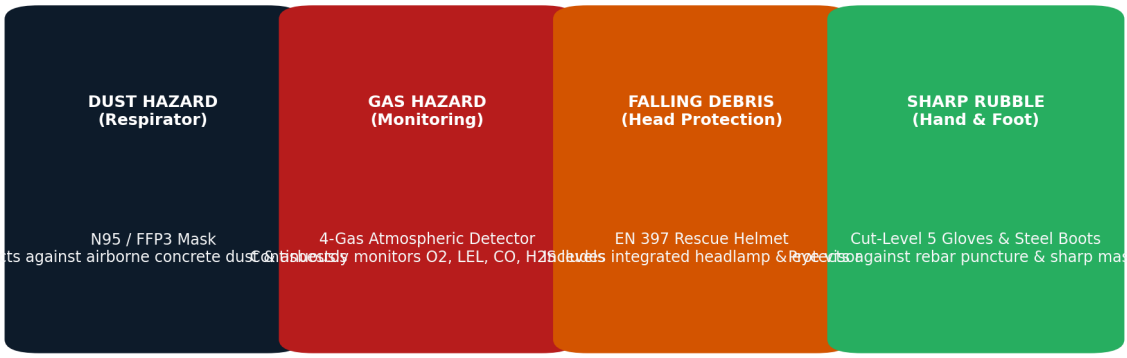
Hazard Category	Primary Debris Risk Factor	Required Control Barrier
Physical / Mechanical	Sharp jagged rebar & unstable masonry blocks	Steel-shank safety boots & heavy leather gloves
Airborne / Chemical	Fine silica concrete dust & asbestos fibers	N95 / FFP3 dust mask & crew rotation
Atmospheric / Gas	LPG gas line fracture & toxic CO accumulation	4-gas detector monitoring & explosive ventilation
Structural Instability	Overhanging cantilevered slab & loose facade	Pneumatic shoring & 1.5x height cordon zone

ACT2 — Debris Risk Mosaic Matrix



Risk Tier	Probability & Severity Assessment	Operational Command Decision
Low Risk (Green)	Minor surface dust, stable low-level rubble	Standard USAR PPE; proceed with search
Medium Risk (Yellow)	Moderate dust, dangling wires, small voids	Equip N95 masks; deploy spotter
High Risk (Orange)	Concentrated gas smell, leaning load wall	Evacuate void; deploy gas detector & shoring
Critical Risk (Red)	Active gas leak alarm, unstable cantilever	NO GO; evacuate 1.5x height Hot Zone immediately!

CARDS1 — USAR PPE Pack-Out Requirements



Hazard Scene	Mandatory PPE Item	Operational Verification
Dust Cloud Void	N95 / FFP3 Mask + Sealed Goggles	Verify seal check before entering void.
Narrow Void Crawl	Rescue Helmet + Elbow & Knee Pads	Inspect helmet chin strap & headlamp battery.
Gas Alarm Scene	4-Gas Monitor + Self-Contained Breathing App.	Calibrate gas detector in fresh air first.

GAME1 — Gas Alarm Snap Decisions



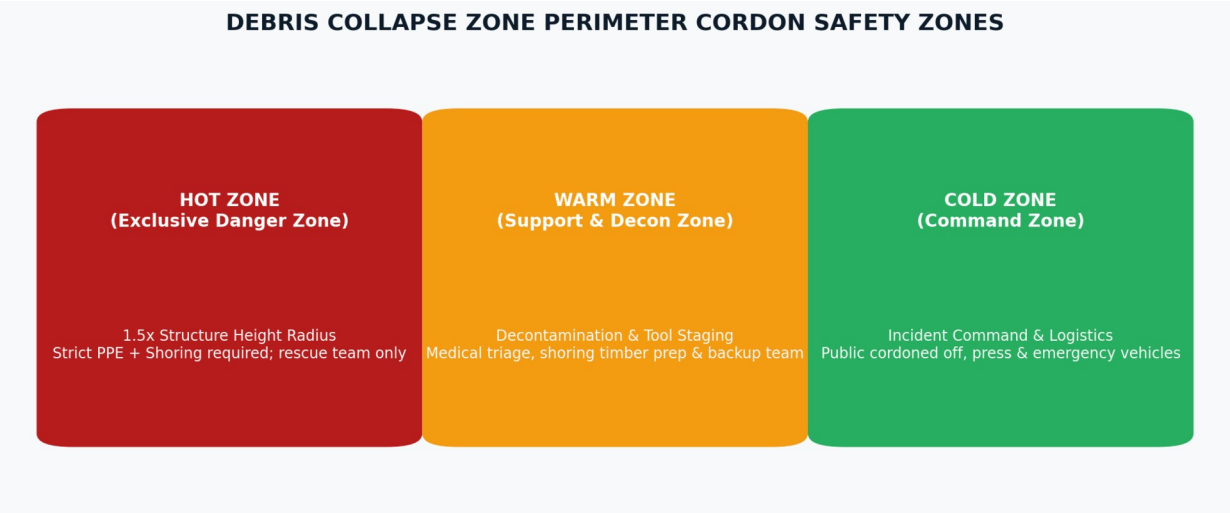
Field Scenario Inject	20-Second Decision Rule	Correct Signal Card
Gas detector alarms at doorway	Evacuate doorway immediately; isolate gas valve	RED (Evacuate Hot Zone)
Volunteer smells LPG, no victim visible	Hold entry; deploy explosive gas meter	YELLOW (Hold & Test)
Oxygen reading normal (20.9%), no smell	Proceed with search; maintain continuous monitoring	GREEN (Proceed with Caution)

GAME2 — Signal & Silence Relay



INSARAG Signal Command	Horn / Whistle Pattern	Team Action Requirement
EVACUATE (Emergency)	3 short blasts (repeated continuously)	Cease work immediately & evacuate Hot Zone!
CEASE OPERATION (Silence)	1 long blast	Stop all power tools & maintain total silence for acoustic search.
RESUME OPERATION	1 long blast + 1 short blast	Resume search and debris clearance operations.

BOARD1 & CARDS2 — Cordon Chess & Red Flags



Cordon Safety Zone	Distance Parameter	Authorized Personnel & Operations
Hot Zone (Danger)	1.5x Structure Height	USAR rescue team only; full shoring & PPE required.
Warm Zone (Support)	50m perimeter	Decontamination, tool staging, shoring timber prep & medics.
Cold Zone (Command)	100m+ perimeter	Incident command post, media center, public cordoned off.

MAP1 — Safe Route Sketchpad



Egress Route Feature	Safety Assessment Criterion	Field Implementation
Primary Egress Path	Unblocked corridor with 2m clearance	Clear debris rubble; post high-vis egress arrows.
Secondary Escape Route	Alternative route away from leaning facade	Verify secondary exit clear of gas lines.
Hazard Bypass Zone	Avoid unstable overhanging balconies	Erect high-vis hazard tape around balcony zone.

LAB1 — Hazard-to-Control Studio



Identified Debris Hazard	Control Measure Barrier	Observable Field Evidence
Gas leak	Evacuate Hot Zone + 4-gas detector check	Gas alarm sound / LPG odor / meter reading
Concrete dust cloud	N95 / FFP3 respirator + rotate crews every 30m	Reduced visibility / coughing / dust layer
Unstable brick wall	Construct T-shoring box + monitor tilt angle	Visible wall crack propagation / mortar dust fall

SIM1 — Fixed Simulation: Collapsed Apartment Block

A four-storey residential block has partially collapsed after an earthquake. Two survivors may be inside. The team must control debris hazards while preserving search speed.

Simulation rule: The scenario is fixed. The facilitator can vary timing and questioning, but not the core injects or safety logic.

Simulation video

Open the linked file in your browser or media player.



[OPEN VIDEO — CLICK TO PLAY]

OBS1 — Observer Dashboard & Safety Score



Safety Dimension	1 - Weak	2 - Developing	3 - Effective	4 - Strong
Gas Alarm Response	Gas alarm ignored	Delayed evacuation	Prompt gas test & exit	Flawless gas protocol
Dust & PPE Control	PPE missing in void	Partial PPE compliance	Full PPE enforced	Rigorous crew rotation
Cordon Enforcement	Cordon boundary breached	Loose cordon line	Strict Hot Zone cordon	Flawless perimeter control

EV1 & EV2 — Team Pulse Meter & Exit Passport



Pulse Meter Metric	Self-Assessment Rating	Target Team Action
Risk Awareness	Rated 3.8 / 4.0	Maintain continuous hazard identification in voids.
Emergency Communication	Rated 3.6 / 4.0	Practice INSARAG acoustic signals during search.
Team Safety Coordination	Rated 3.9 / 4.0	Designate safety officer for every debris scene.

FAC & References — Facilitator Quick Guide



- INSARAG Guidelines (2020). Volume II: Preparedness and Response — Debris Hazards & Safety.
- OSHA 1926 Subpart P (2018). Excavation, Trenching, and Debris Shoring Standards.
- ISO 45001 (2018). Occupational Health and Safety Management Systems.
- UN OCHA / INSARAG (2019). Urban Search and Rescue Debris Management Guidelines.

Digital adaptation note: Each worksheet, PPE pack-out card, cordon diagram, and AAR rubric can be published as an independent web component under WP3. SIM1 is suitable for timed online scenario updates, role selection, and post-simulation reflection.

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