Emergency Planning Zones Across Europe: Practical Differences in National Implementation

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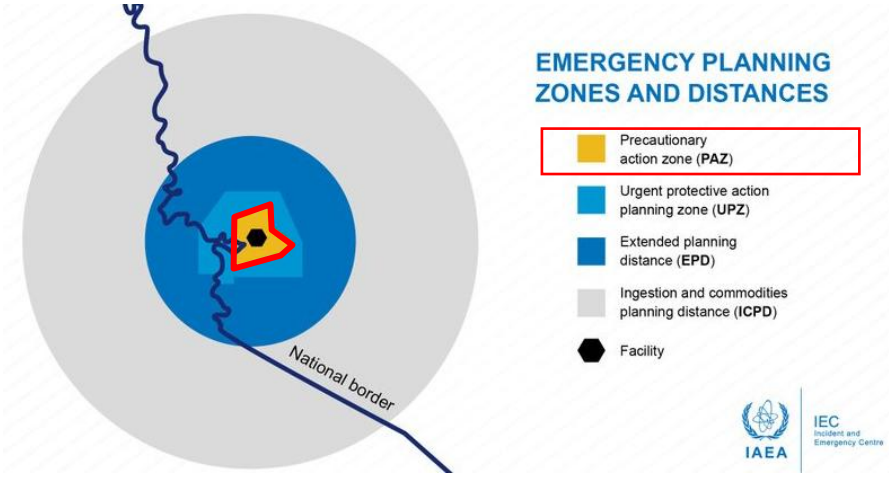
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH
GIROSCOPE

Paris ASNR, 29.04.2026

Co-funded by the European Union

PAZ – Overview (Precautionary Action Zone)

- Purpose: prevent deterministic effects (high acute doses)
- Typical range: 3–5 km (IAEA reference)
- Immediate actions: evacuation, sheltering
- Driven by severe accident dose thresholds
- Key factors: population density, evacuation routes, geography

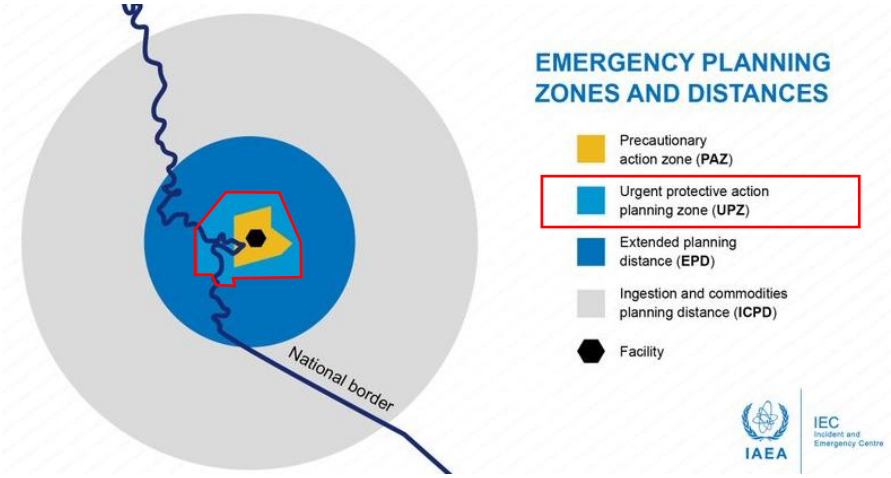


PAZ – National Implementation Summary

- Poland – Defined for large facilities (>100 MW) with very high dose thresholds covering both external (10 h) and internal (30 days) exposure;
- Germany – Implemented as a "central zone" up to ~5 km with detailed dose-based criteria for different population groups;
- United Kingdom – DEPZ typically 1–3 km, set by local authorities based on hazard assessment and intervention levels;
- Sweden – PAZ about 5 km with clear dose criteria and regional responsibility for planning and implementation;
- France – No standard PAZ, except limited ~100 m perimeters in specific cases (e.g. transport incidents);
- Canada (Ontario) – Equivalent AAZ of ~3 km with defined intervention thresholds for sheltering, iodine, and evacuation.

UPZ – Overview (Urgent Protective Action Zone)

- Purpose: reduce stochastic health effects
- Typical range: 5–30 km
- Actions: iodine tablets, sheltering, evacuation
- Based on projected short-term doses
- Often subdivided into risk sectors

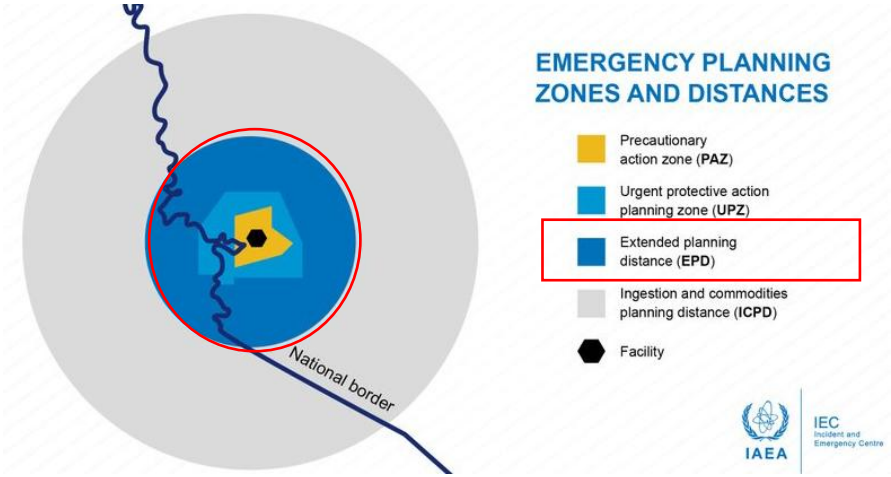


UPZ – National Implementation Summary

- Poland – Defined for Category I and II facilities with thresholds of ≥100 mSv effective dose or ≥50 mSv thyroid dose within 7 days;
- Spain – Defined as Zone I (~10 km) with subzones (0–3, 3–5, 5–10 km) and pre-planned measures like sheltering, evacuation, and iodine;
- Germany – Implemented as a "middle zone" (5–20 km) with dose criteria for sheltering, iodine, and evacuation (e.g. ≥10–100 mSv, thyroid-specific thresholds);
- United Kingdom – Covered within DEPZ, typically 1–3 km, defined locally based on hazard assessment and intervention levels;
- France – Predefined distances (2, 5, 20 km) with action thresholds (e.g. >10 mSv sheltering, >50 mSv evacuation);
- Canada – Equivalent DPZ of ~10 km with standard intervention criteria aligned with other planning zones.

EPD – Overview (Extended Planning Distance)

- Purpose: long-term exposure monitoring
- Typical range: up to 100 km
- Focus: environmental dispersion + ingestion pathways
- Includes rivers, wind patterns, vulnerable sites
- Supports long-term countermeasures

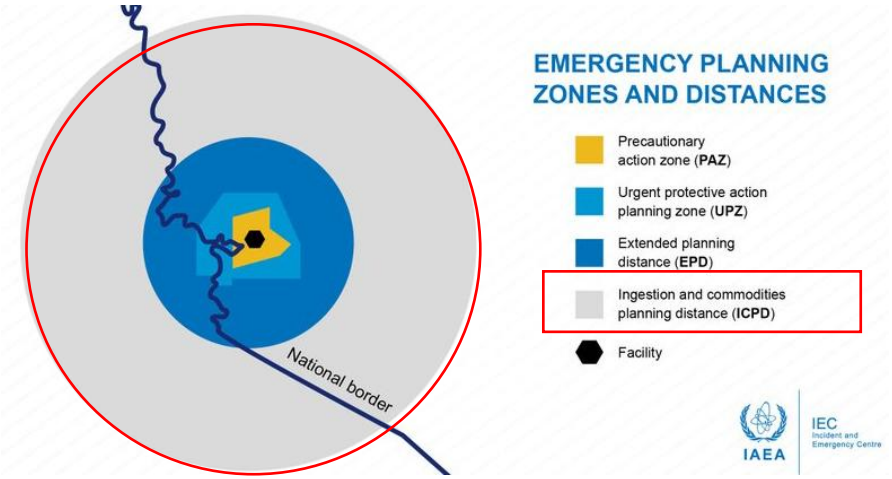


EPD – National Implementation Summary

- Poland: Extended Planning Distance for Category I (>100 MW) and II (2–100 MW) facilities; criterion: projected effective dose ≥ 100 mSv in 1 year (including ingestion exposure); focuses on long-term population protection.
- Germany: "Outer Zone" around NPPs (approx. 20–100 km); criteria include sheltering and iodine thyroid protection thresholds (e.g., >10 mSv effective dose for sheltering; thyroid dose >50 mSv for <18 years; >250 mSv for adults 18–45); includes 7-day exposure assumptions.
- United Kingdom: Outline Planning Zone (OPZ) around nuclear sites (~30 km typical); government-defined rather than fixed criteria; covers severe but very unlikely accident scenarios beyond reasonably foreseeable events.
- Sweden: Extended Planning Distance (EPD) ~100 km; relocation criterion: 20 mSv effective dose in first year; sheltering threshold: 10 mSv over 7 days; iodine thyroid protection: 50 mSv (1-year-old equivalent).
- France: PPI (Plan Particulier d'Intervention) zone ~20 km; predefined emergency response and public information measures within this radius.
- Canada: Contingency Planning Zone (CPZ) ~20 km; based on generic dose criteria aligned with additional action zone principles (similar protective action thresholds).

ICPD – Overview (Ingestion & Commodities)

- Purpose: control contaminated food & water
- Range to: ~300 km or national scale
- Focus: agriculture, supply chains, distribution
- Managed via food safety regulations
- Often national-level rather than distance-based



ICPD – National Implementation Summary

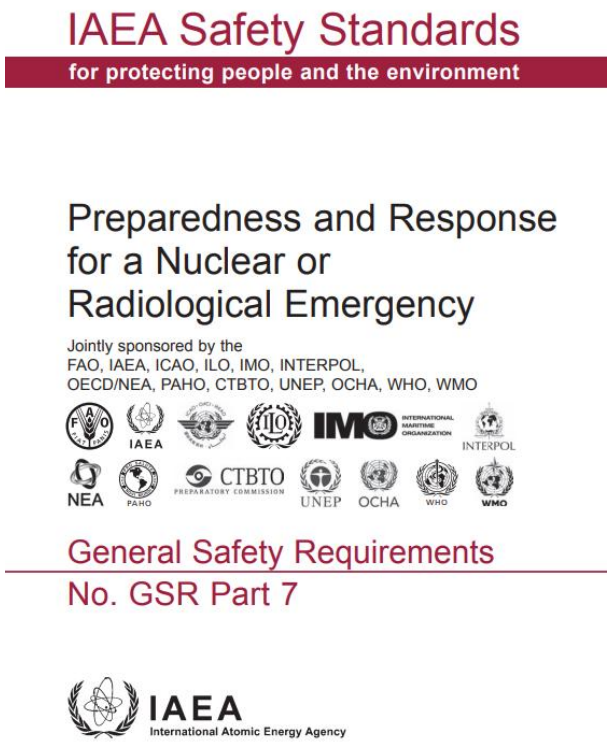
- Poland: ICPD for Category I (>100 MW) and II (2–100 MW) facilities; criterion: projected effective dose ≥ 10 mSv/year from ingestion of food and water; focuses on long-term food chain contamination control.
- Spain: Zone II / Long-duration Protection Measures Zone; radius ~10–30 km around nuclear unit; focuses on delayed exposure pathways including contaminated food, water, and resuspension inhalation.
- Germany: No fixed ICPD zone; national approach covers whole territory; iodine distribution planned for children, youth, and pregnant women; food controls based on EURATOM thresholds for restrictions on food and feed.
- United Kingdom: No dedicated ingestion planning zone; relies on Maximum Permitted Levels (MPLs) in food and Action Levels in drinking water; decisions apply nationally to food distribution and consumption advisories.
- Sweden: No defined ICPD zone; food protection measures apply nationwide; planning uses ingestion dose criterion of 1 mSv/year to guide restrictions and interventions.
- France: PPI zone (~20 km) for immediate actions; food and commodity restrictions during emergencies based on EURATOM thresholds and ingestion dose criteria (~20 mSv/year).
- Canada: Ingestion Planning Zone (IPZ) ~50 km radius; criteria: 3 mSv/year total ingestion dose, with sub-limits of 1 mSv/year for water, milk, and other food products.

Meteorology – National Approaches

- Poland: Uses both probabilistic and deterministic modelling; probabilistic approach requires ≥3 years of historical meteorological data and includes real precipitation; deterministic approach uses stability classes D and F with and without site-specific precipitation scenarios.
- Greece: Uses real-time meteorological data from the Hellenic National Meteorological Service for simulations and operational assessment.
- Germany: Applies probabilistic modelling with long-term multi-site simulations; uses statistical meteorology (incl. percentile-based results, e.g. 80th percentile) rather than single fixed weather cases.
- United Kingdom: Uses both deterministic and probabilistic methods; deterministic typically applies stability classes D and F; probabilistic modelling uses historical weather datasets and high-percentile outcomes (e.g. 95th percentile impacts).
- Sweden: Uses ~10 years of meteorological data to capture variability; results are expressed as coverage of weather cases (e.g. 70–90% depending on protective action).
- France: Emergency zones are not based on fixed meteorological scenarios; real-time weather data and forecasts are used during incidents, while safety studies use representative "realistic" weather cases.
- Canada: Relies on real-time meteorological forecasts during emergencies; decisions are based on current and predicted weather conditions rather than predefined climatological scenarios.

Regulatory Framework

- Poland: SAR-based full accident set (≥10^{-7}/year); operator defines scenarios; legally binding under Atomic Law.
- Greece: Based on IAEA GSR Part 7 and EU BSS Directive; fully transposed into national law; legally binding.
- Spain: Design-basis and beyond-design-basis accidents; PLABEN framework; EU/IAEA compliant; legally binding.
- Germany: Probabilistic SSK-based severe accident scenarios (incl. INES-7-like); advisory (non-binding) recommendations.
- United Kingdom: Full hazard evaluation under REPPIR 2019; risk-based approach with no fixed probabilities; legally binding.
- Sweden: Two severe accident cases (with/without mitigation, incl. worst-case); legally binding national framework.
- France: Scenario-based severe accidents defined by operators; regulatory emergency planning system; legally binding.
- Canada: Severe accident scenarios under provincial PNERP (with/without mitigation, worst-case);



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Key Differences and Strategic Insights

Zone sizes vary across countries:

- PAZ: typically 3–5 km, but smaller in the UK (1–3 km)
- UPZ: usually 5–30 km, but fixed at 10 km in Spain
- EPD: ranges from ~30 km (UK) to ~100 km (Sweden)

Shift from distance-based to dose-based planning:

- Many countries (e.g UK, Germany, Sweden) rely more on **dose criteria (mSv)** than fixed radius

Food and water protection (ICPD):

- Some countries define distances (Poland, Canada)
- Others apply **national-level food safety limits** instead (UK, Germany, Sweden)

General European trend:

- From rigid zones → to **risk-informed, flexible planning**
- From fixed distances → to **dose thresholds and real-time decisions**

Meteorological approach:

- Increasing use of **probabilistic models and historical weather data**
- Real-time weather is critical during actual emergencies

Key Conclusions

Significant national differences in:

- Zone sizes (distances)
- Dose thresholds
- Naming and structure (e.g., UK uses DEPZ instead of PAZ/UPZ)

Conclusion:
Strong conceptual alignment, but flexible national implementation