Post-accident Preparedness Initiatives in Spain

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From central emergency management to coordinated assessment and decision-making

The long-term contamination of water bodies and catchments was the target of the **MOIRA** system, developed during Euratom Research Programmes FP4 and FP5.

Then in FP6, within **EURANOS** Project, it was tested in a realistic environment in Spain in 2007

2007 exercise. Context and Objectives

- A decision-making exercise organised in Spain, hosted by the Nuclear Safety Council (CSN).
- The first one of this nature organised in Spain.
- **Main purpose: to foster communication and interaction between different cooperating agencies involved in decision-making in case of radioactive contamination of water bodies or catchments**
- Unique opportunity to test the MOIRA system

2007 exercise: developed at CSN's Emergency Centre (SALEM)

Open to international group
of observers (EURANOS partners)

MOIRA

EURANOS

2007 exercise. Scenario

- Almaraz NPP: 2 PWRs, 1000 Mwe each
- Cooling provided by Arrocampo Reservoir, connected to the Tagus River.
- The scenario was based on a level 2-PSA severe accident sequence.

MOIRA

EURANOS

2007 exercise. Evaluation and conclusions about MOIRA

- MOIRA proved to be a **helpful tool** for decision making in such scenarios.
- Requirements for a proper implementation:
  - Good **background environmental and socio-economic data**.
  - Data should be **prepared in advance and maintained** updated for a successful operational use.
  - Generic typical environments can be useful to get generic results, but **site specific peculiarities are relevant!**
- This kind of tools can help to enhance **public reassurance**
  - **realistic evaluation** of the social, economical, and ecological impact of possible recovery strategies.
  - Good aid for **cross-agency interaction** and common understanding of all related issues.
- **Some facilitation and technical assistance is needed**: evaluation of behaviour of contamination in the long-term, sampling strategy, etc.

2007 exercise. Evaluation and general conclusions

- Revealed the need of better interface and understanding between agencies and stakeholders
- Allowed all participants to have a more detailed knowledge of their respective competencies and capacities, as well as of their counterparts.
- Increased awareness and knowledge among stakeholders, and prepare plans for certain countermeasures.
- Future collaborations were identified.

MOIRA

EURANOS

2007 exercise. Evaluation and general conclusions (2)

- **Open point**: management of such a crisis from a psychological and sociological point of view…
  - For instance: how to communicate that drinking water is not a critical exposure pathway in the long-term?
- Explaining countermeasures to the population could become really problematic!

Reliable assessment tools seem necessary to put issues in their right perspective

MOIRA

EURANOS

From central emergency management to coordinated assessment and decision-making engaging local stakeholders

In FP7, as part of **NERIS-TP** Project:

- New activities developed
- Based on the **NERIS framework** for post-accident preparedness

Main actors

- CIEMAT and UPM are working together in close interaction with the Nuclear Safety Council (CSN)
- CSN is the national authority responsible to
  - provide radiological advice
  - integrate and coordinate the emergency response and support by the different public bodies and companies engaged in keeping the radiological situation under acceptable conditions after a nuclear accident or radiological event
- CSN collaboration has be essential in identifying and engaging the main actors
- CIEMAT and UPM act as technical advisors and facilitators

Original planning of the Spanish work within NERIS-TP WG3

First Steps

- **Selecting the territories** in which the pilot methodology on emergency and post-emergency preparedness will be implemented
- **Contact with the different participants**
- Decision with regard to the kind of **scenarios to be developed**. >> **Development of the Scenarios**

Intermediate Steps

- Organise **thematic sessions / workshops with the engaged actors**
  - To **show the available tools (European and national tools)**
  - To **discuss and select the questions at stake**: legal framework, roles and responsibilities, with emphasis in the rehabilitation phase; food supply safety; protection to the local economic sectors; long-term follow-up; etc.
- **Adapt / customise the existing tools** to the local level and the peculiarities of Spain
- **Two or more table-top exercises**, one-two days duration

Final Steps

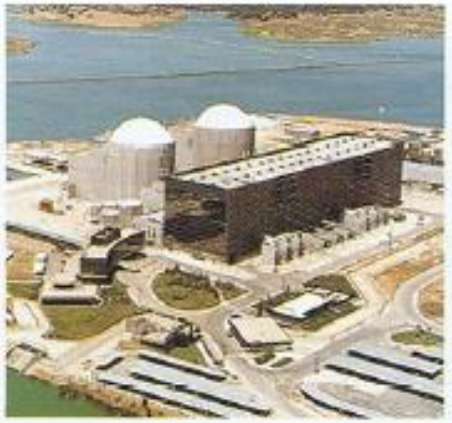
- To **adapt / improve tools and methodology** for engagement of the local actors as identified during the exercises.
- A proposal of **action guide** for the local preparedness in the country is foreseen to be produced.
- A **final open workshop** will be organised to disseminate the conclusions and the guidance produced to the rest of nuclear areas of Spain.

Spanish NPPs

Temporarily (maybe permanent) shutdown

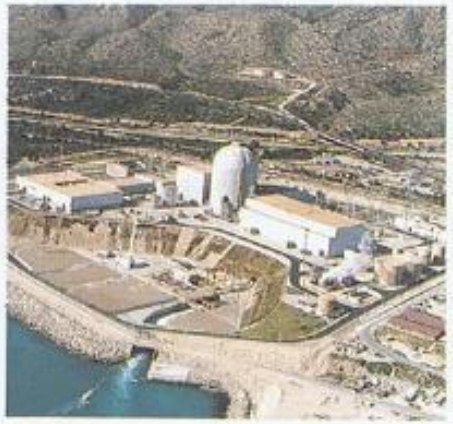
GAROÑA
BWR 450 MWe

ALMARAZ
PWR 2 x 980 MWe



ASCÓ
PWR 2 x 980 MWe

COFRENTES
BWR 1000 MWe



VANDELLOS 2
PWR 980 MWe

TRILLO
PWR 1066 MWe

Selecting territories and type of accident

- The **zone around Ascó NPP** has been selected as territory impacted by a **severe accident in the nuclear power plant**
- It is included in the **Nuclear Emergency Plan of Tarragona province – Catalonia region**

Objectives

- In order to select and define the scenarios the following aspects are considered:
  - **I. Threat assessment** – what are possible scenarios that could cause radioactive contamination of our municipality/local territory?
  - **II. Sensitivity analysis** – what parts of the local community would be most heavily affected by a contamination situation?
  - **III. Evaluating mitigating actions** – what are the choices? Can they be implemented in our community? What are the national recommendations?
- Once the points I, II and III will be fully developed for the selected areas, the result will be complete scenarios on which the full exercises could be developed.

Objectives

Final Objective of the tabletop exercise

- Complete analysis and discussion of the threats (I), sensitivity of the area (II), mitigating alternatives and their feasibility and effectiveness (III), as well as the involvement of local, regional and national actors (IV).
- The conclusions of the exercise should **help to better clarify the roles and responsibilities at each level** and to identify the need for improvement with regard to cooperation along the chain

  national ⇔ regional ⇔ municipality/local.

Steps done

- **Preparatory meetings**
  - **13 June 2011** at CSN : decision to support the proposed activities and to implicate different departments at CSN. Emergencies and Environmental Radiation protection General Subd.
  - **6 July 2012** at CSN : decision to focus on the long-term rehabilitation post nuclear accident. The legal framework for the rehabilitation phase is a pending issue that needs to be addressed in the coming revision of the nuclear emergency regulations in Spain. The exercise could greatly help
  - **25 September 2012** at the Government Sub delegation in Tarragona: CSN gets the engagement from the Director of the Nuclear Emergency Plan in Tarragona (highest Central Government authority in the province)
  - **15 October 2012** at the Government Sub delegation in Tarragona: ad-hoc meeting to discuss about the NERIS platform, the NERIS-TP project, the available tools, and the objectives and the way to develop the exercise:
    - Director of the Nuclear Emergency Plan of Tarragona
    - General Subdirector of Emergencies, CSN
    - Representatives of the General Direction of Civil Protection (Central Gov. and Tarragona)
    - Representatives of the Autonomous Community Government (Catalonia)
    - Representatives from the Municipalities of the selected area (local authorities) and their Association (AMAC)
    - Nuclear Power Plant representative

Steps done

- **Full support and engagement from the Director of the Nuclear Emergency Plan of Tarragona (Central Government Representative -*Subdelegado del Gobierno*-, in the province)**
- **Selection of territories: Ascó – Tarragona and surrounding provinces**
- **Decision with regard to the kind of scenarios to be developed:**
  - **Severe accident at the NPP** (from *Stress-Tests* of the NPP)
  - **Focus on the long-term rehabilitation post nuclear accident**

- **Development of Scenarios:**
  - **Winter scenario, with focus on urban contamination**
  - **Summer scenario, with focus on agriculture**

Link to scenarios

Development of scenarios

- Full detailed description report
- Powerpoint presentations
- Interactive use of JRODOS, ERMIN, MOIRA during the exercise

Steps in 2013

- Final agreement on the programme for the exercise (by e-mail)
- **Preparatory workshop** (19 March 2013):
    - Module 1. General framework of nuclear and radiological emergencies. Problematic and context. (1,5 h)
    - Module 2. Presentation of the coordination exercise NERIS-2013/PENTA. (45 min)
    - Module 3. Demonstration of the available tools (1 h)
    - Final discussion on the scenario, observers and partners to participate in the exercise
- Finalisation of the scenarios with identification of zones within vulnerable areas susceptible for intervention, selection of potential countermeasures.
- Final customisation of tools: JRODOS - ERMIN – MOIRA - Handbooks.
- Development of the **Toptable exercise**. (5 June 2013)

Development of the Tarragona Exercise

- **5 June 2013 in Tarragona**
- **About 40 participants (+ Ciemat and UPM):**
- Directorate of the Emergency and Civil Protection offices: Central Government representation in the province (Subdelegación del Gobierno). Headed by its Director, which is the maximum authority or the Emergency Plan.
  - Civil Protection: General delegate for Catalonia. Two delegates from central General Directorate
- CSN, Nuclear Safety Council: 2 experts from central office, 2 from local NPPs (head of the radiological group)
- Logistic Group: Emergency responders, Security and public order. Representatives from groups of strategic security (Guardia Civil, national), regional police (Mossos de Escuadra) and local policemen.
- Sanitary Group: Central Catalonian and local services
- ENRESA (National Company for Radioactive Waste Management) representative
- Ascó NPP representative. Coordinator of the in-site Emergency Plan
- Agricultural Services of Catalonia. Director of territory services
- Municipalities: La Palma d'Ebre (2 repr.); Ascó (2 repr.); García (1 repr); Tarragona (2 repr.); Reus (1 repr.); Tortosa (1 repr.)
  - 3 majors. Representation of the territorial community. Heads of local Civil Protection Services.
- University Rovira I Virgili (Tarragona). Radiological surveillance laboratories.

Main points discussed during the Tarragona Exercise

- **Urban areas:**
  - Would the estimated doses without countermeasures justify the return of the population evacuated during the emergency or it would be necessary a prior cleaning of the urban environment?
  - Would the area be habitable after cleaning? What strategy is most appropriate? What criteria should have more importance?
  - How to develop the radiological control of the area and people during and after cleaning?
  - How could radioactive waste generated be managed?

Main points discussed during the Tarragona Exercise

- **Social aspects:**
  - Is the disruption of social and economic activity for several months recoverable? What mechanisms and by which actors should be implemented for a limited socio-economic impact?
  - Organisation of accommodation and services out of the relocated-contaminated areas. Organization of the transfer and return of the population.
  - Communication policies: how avoid chaos media and associated social disorder?

Main points discussed during the Tarragona Exercise

- **Agricultural areas:**
  - What can be the best management alternatives? For how long the food restrictions would be necessary in large production areas?
  - Are the available tools (Handbook, JRODOS models…) adequate for the studied region? (vineyards, fruit trees, rice…)
  - How could large food production systems be monitored? Are we prepared or is there a need for new developments?
  - How to establish adequate communication channels with the consumers?
  - Which actors should be aware and implicated in the preparedness?

Main points discussed during the Tarragona Exercise

- **Problems about basins and hydraulic systems and their use:**
  - Importance of reliable predictions on the long-term evolution
  - Need to evaluate impacts on fish farms, rice cultivation, etc.
  - Which actors should be aware and implicated in the preparedness?

Some conclusions from the Tarragona Exercise

- The recovery phase is not currently included in the legal framework for Emergency Plans in Spain. Activities such as the exercise carried out serve to initiate the debate between administrations and stakeholders potentially affected on how to address and move forward in preparation for the phase of transition or departure of the urgent phase, but probably not to plan a permanent recovery.
- These activities, carried out through working groups created ad-hoc, would serve to study criteria, possibilities and specific alternatives that could / should be considered at the local level in the phase of recovery and that could be collected in the form of procedures in the documents that are prepared for the planning of activities in the recovery phase.
- These studies could develop independently, in parallel or, even before full identification of competent structures which would be included in the documents that are prepared for the planning of activities in the recovery phase.

Current activities and perspectives

- **Since July 2013**, collaboration with CSN and the General Directorate of Civil Protection and Emergencies (GDCPE) of the Spanish Ministry of the Interior in the preparation of the **CURIEX-2013 exercise** (*Cáceres Urgent Response International Exercise*), organized by the GDCPE, in cooperation with the Central Government Representative's Office (Subdelegación del Gobierno) in Cáceres province and the European Commission [http://www.curiex.es/en/home]
- **July 2013**, two meetings at GDCPE with representatives of the regional and local administrations. Presentation of methods and tools for the rehabilitation phase post-accident. Exchange of opinions. Identification of customisation needs.
- **September – October.** Development of scenario for the transition phase to long-term management of the rehabilitation phase. Using JRODOS, Handbooks (in Spanish) and MOIRA. Emphasis on the river-reservoirs contamination.
- **5-6-7 November 2013**. CURIEX-2013 Exercise. Support – facilitation during the exercise (mainly day 3 of the exercise), following the NERIS framework.

Final activities in NERIS-TP

- **December 2013**. Analysis / Guidance / Recommendations for the development of plans for the long-term rehabilitation post –accident (month 34-35)
- **January 2014. Final national workshop (month 36).** Open to all nuclear local zones
- **January 2014.** Participation to the NERIS-TP workshop in Oslo where the Spanish work would be presented.
- Encourage interaction of the Spanish stakeholders with other national groups (from other countries) involved in NERIS.

- PREPARE project is starting, and there will be additional activities involving interaction with stakeholders, on food and goods contamination, on public communication, etc.

Many thanks!

Development of scenarios

Steps in developing the scenarios for use in the tabletop exercise:

- Selecting the accident scenarios
  - Source Term
  - Meteorological conditions
  - Regional Data (Population, Land cover, Agricultural Production, Dietary Habits)
- Modelling consequences of the accident
  - Using JRODOS, ERMIN, MOIRA
- Testing intervention strategies, proposing alternatives
  - Selection of vulnerable zones regarding response to radiological impact.
  - Selection of potential countermeasures from **ERMIN** for urban management, **Handbooks** for agricultural production, **MOIRA** for freshwater uses and contamination of catchment.

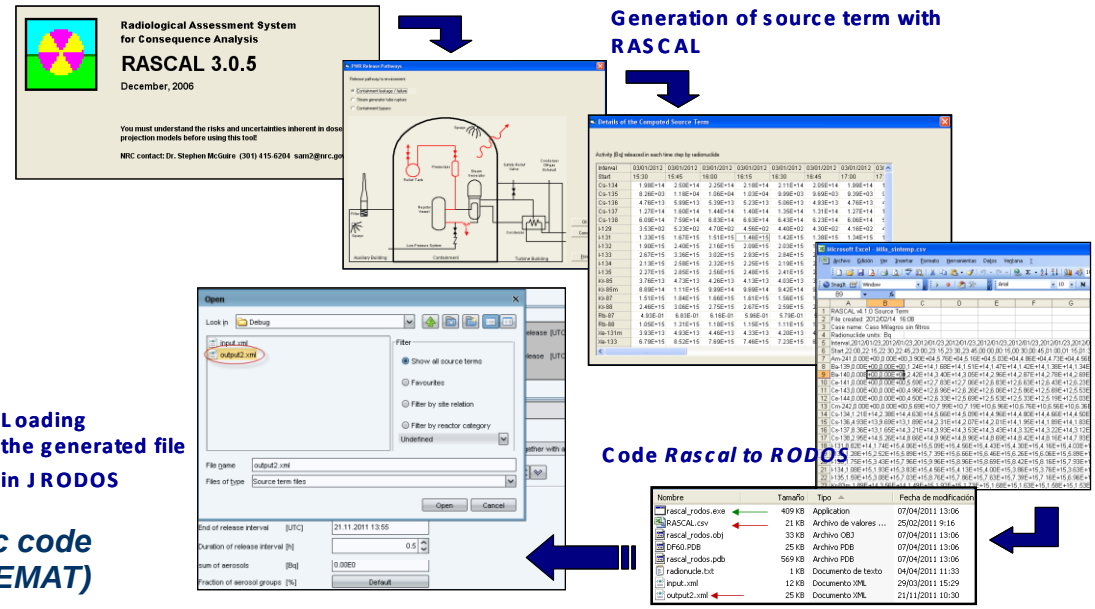
Source Term

- Based on the Action Plan post-Fukushima (*stress-tests*):
  - Large releases of long duration based on the specific study of Ascó NPP
  - Accident sequence caused by total loss of the internal and external power supply
  - Containment overpressure and filtered venting (system to be installed)
  - Total release of Cs-137:1.7 PBq / Cs-134: 2.4 PBq . 92 hours duration
- Analysed with RASCAL code to provide a full source term input to JRODOS system

RASCAL CODE (Radiological Assessment System for Consequence AnaLysis)

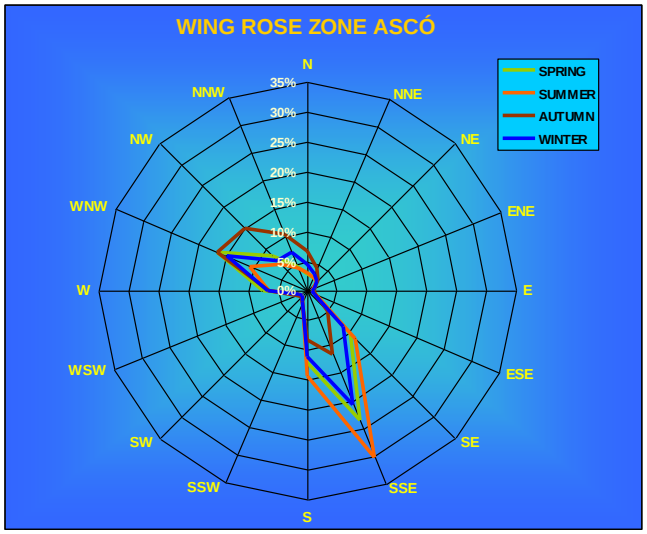
The Source Term module calculates a time-dependent source term for a wide variety of accidents based on plant conditions for many different facility types.

CHAIN OF STEPS



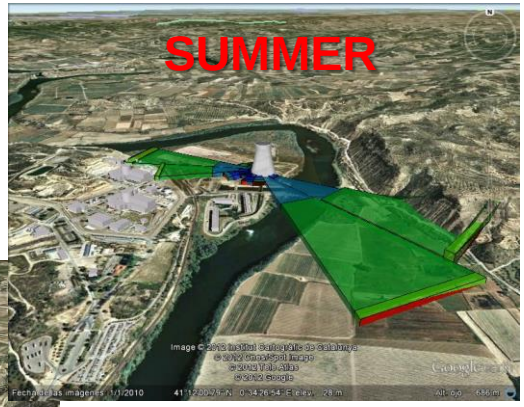
Coupling "RASCAL to RODOS" (specific code developed by CIEMAT)

Selecting Meteorological Data



Characteristic meteorology selected:

- **Summer season (July):** winds from SSE (from sea to valley). Focus on impact on agriculture.
- **Winter season (January):** winds from WNW (from valley to sea). Focus on urban contamination (Vinebre village).



Wind speed direction (blowing from))

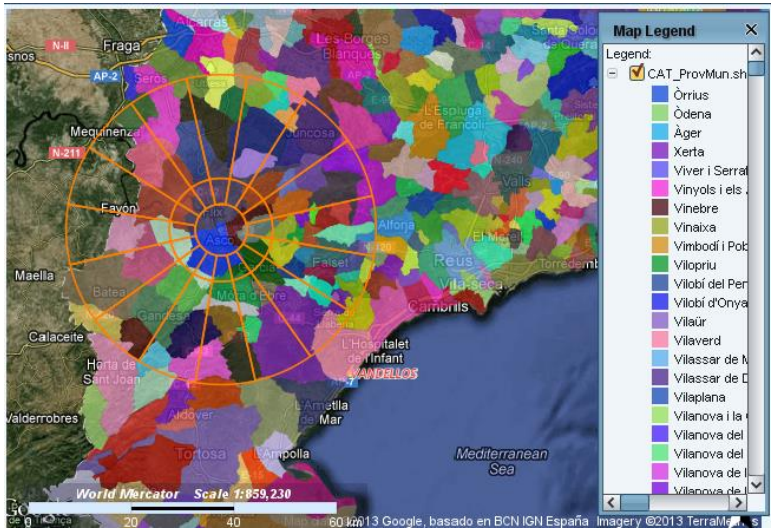
Source of Meteorological data:

Numerical weather prediction data: Prognostic meteorological data taken from the national weather service (AEMET) in the format required by RODOS.

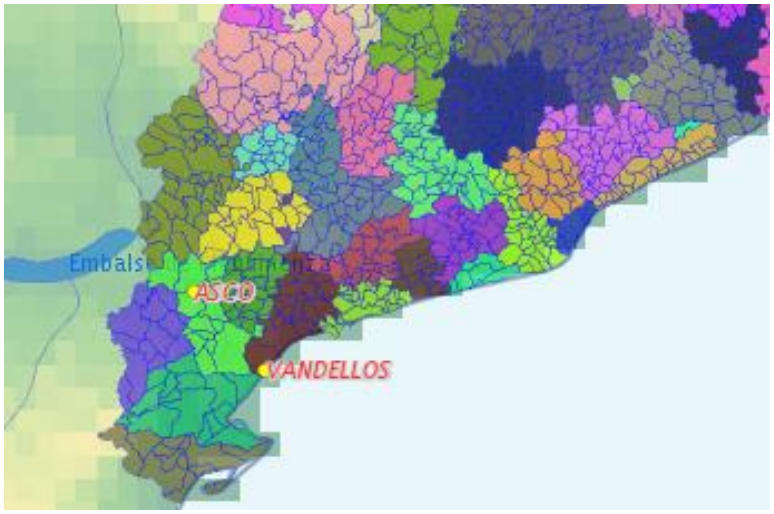
Selecting Regional Data

Selection of Regional Data for the surrounding zone of Ascó and incorporation into JRODOS system

codine	Name	Population	Suface (km^2)	Density
43019	Ascó	1634	74,32	21,99
43048	Corbera d'Ebre	1171	53,47	21,90
43056	Fatarella (La)	1130	56,48	20,01
43058	Figuera (La)	135	18,67	7,23
43060	Flix	4061	115,98	35,01
43065	Garcia	594	52,05	11,41
43085	Molar (El)	297	22,97	12,93
43093	Móra d'Ebre	5795	44,89	129,09
43094	Móra la Nova	3238	15,79	205,07
43099	Palma d'Ebre	425	38,22	11,12
43125	Riba-roja d'Eb	1336	99,48	13,43
43152	Torre de l'Espa	679	27,91	24,33
43177	Vinebre	459	26,42	17,37
Zone I	**TOTAL**	**20954**	**647**	**32,40**



Surrounding municipalities

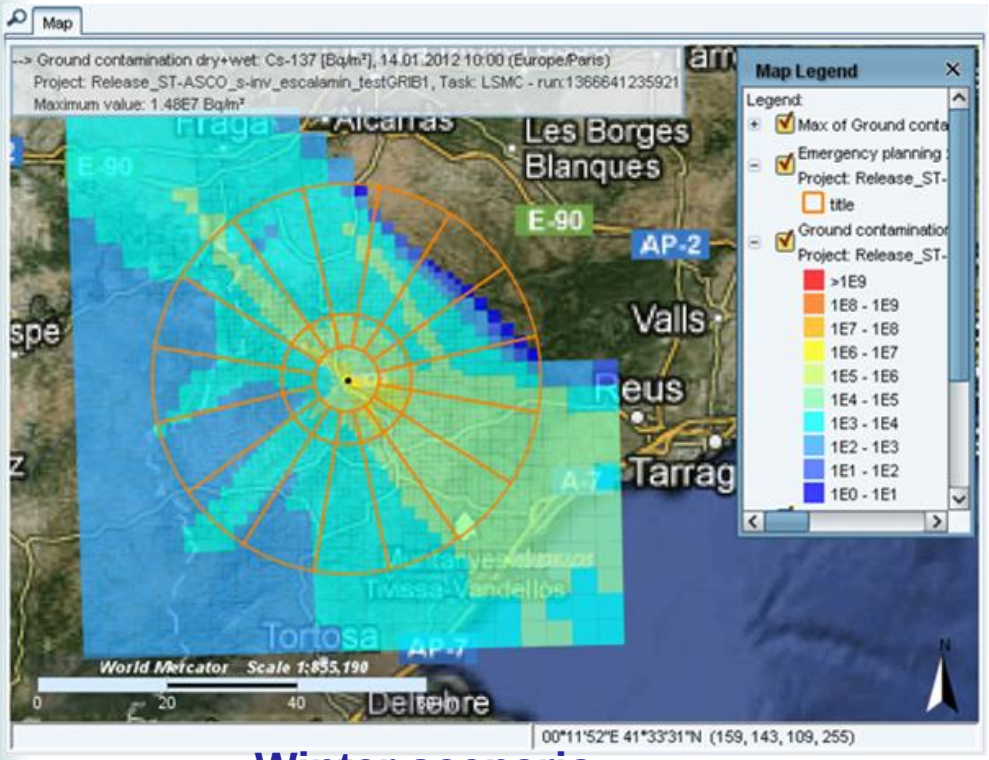


Agricultural regions in the area

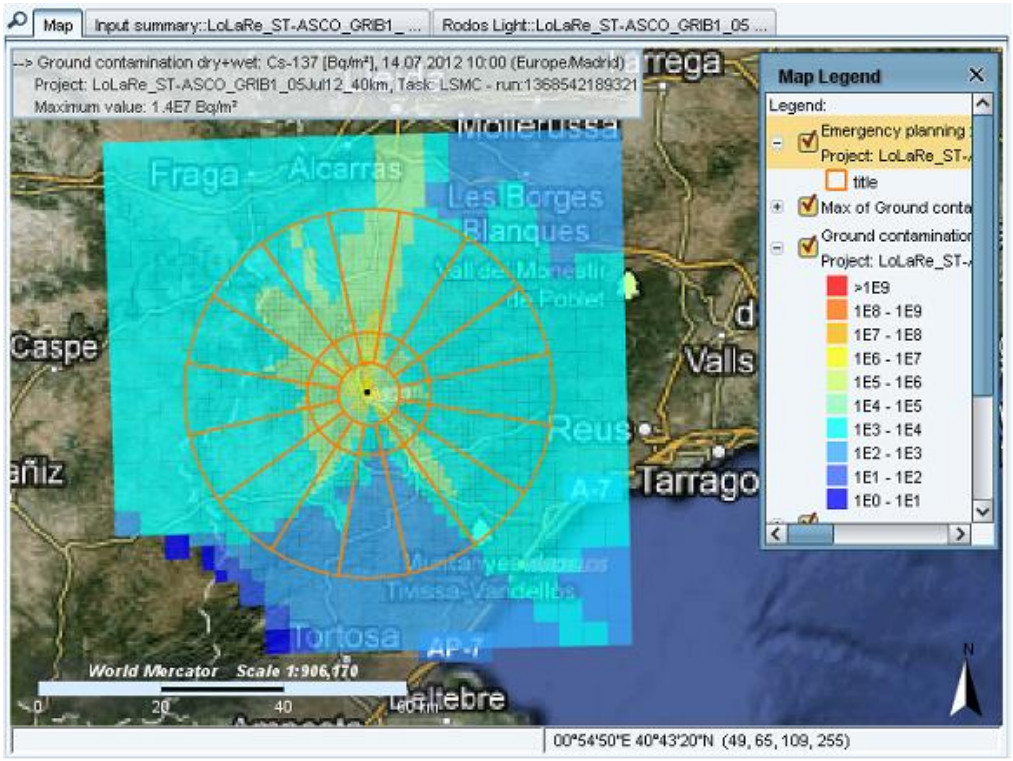
Land cover	Total	Percent (%)
Coniferous	30255,12	46,73
Olivar	11163,13	17,24
fruit	9428,89	14,56
Shrubland	5822,60	8,99
labor	2454,41	3,79
vineyard	2163,09	3,34
Rangeland and grassland	1172,58	1,81
water	1023,45	1,58
unproductive	1018,80	1,57
broadleaved	245,69	0,38
rice	0,00	0,00
TOTAL SURFACE (Ha)	**64747,76**	**100,00**

Results

- Ground contamination with Cs-137 (Bq/m^2)

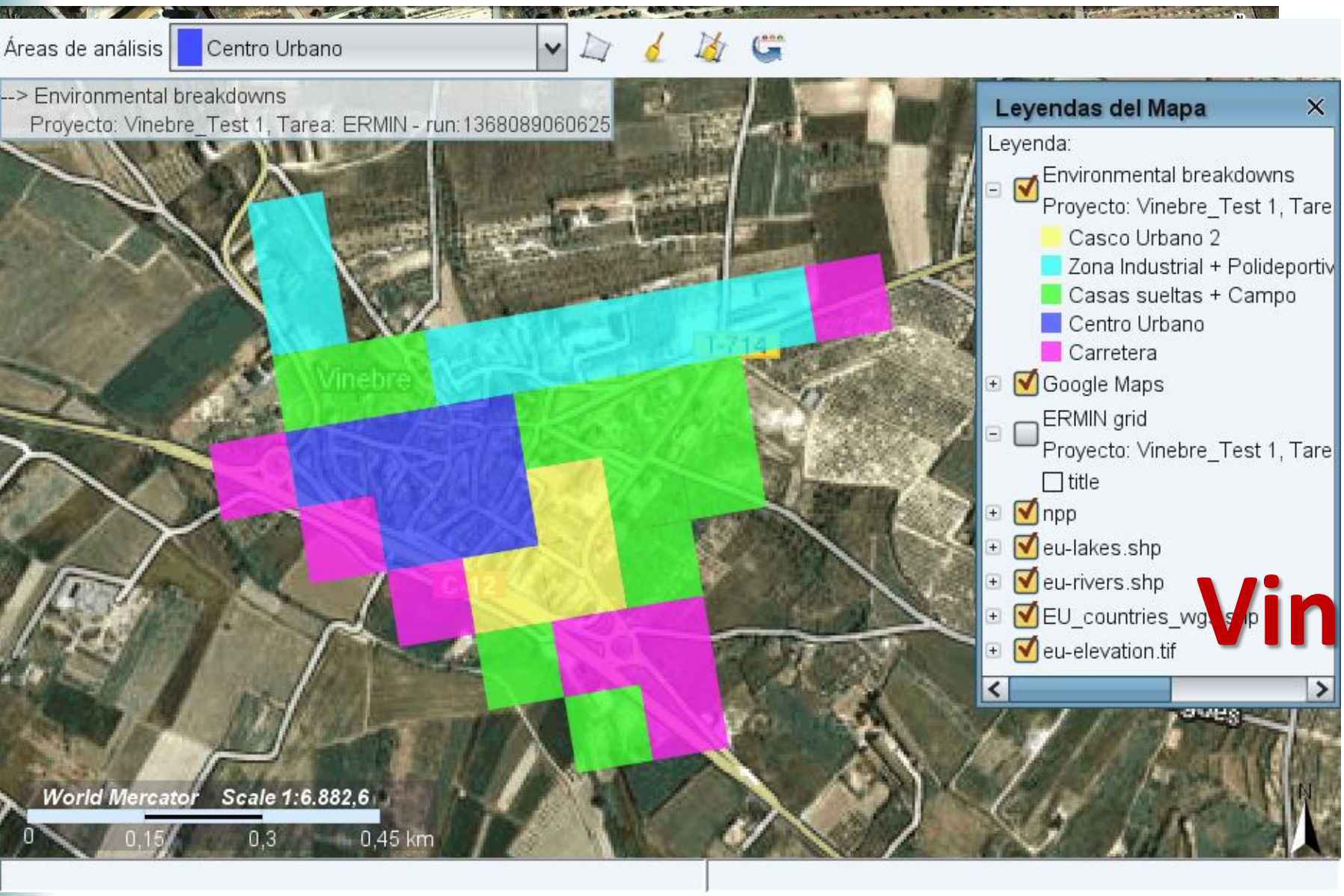


Winter scenario

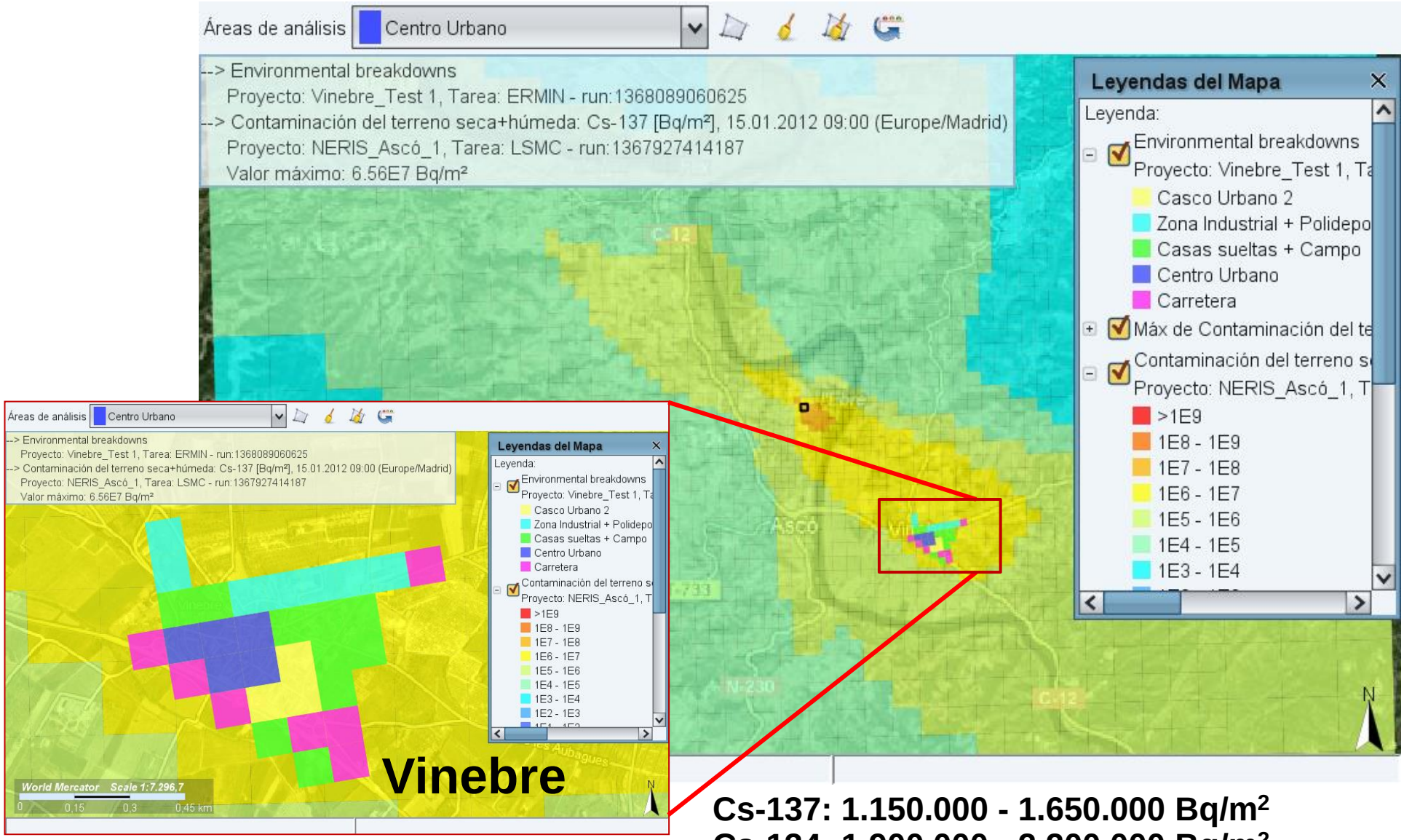


Summer scenario

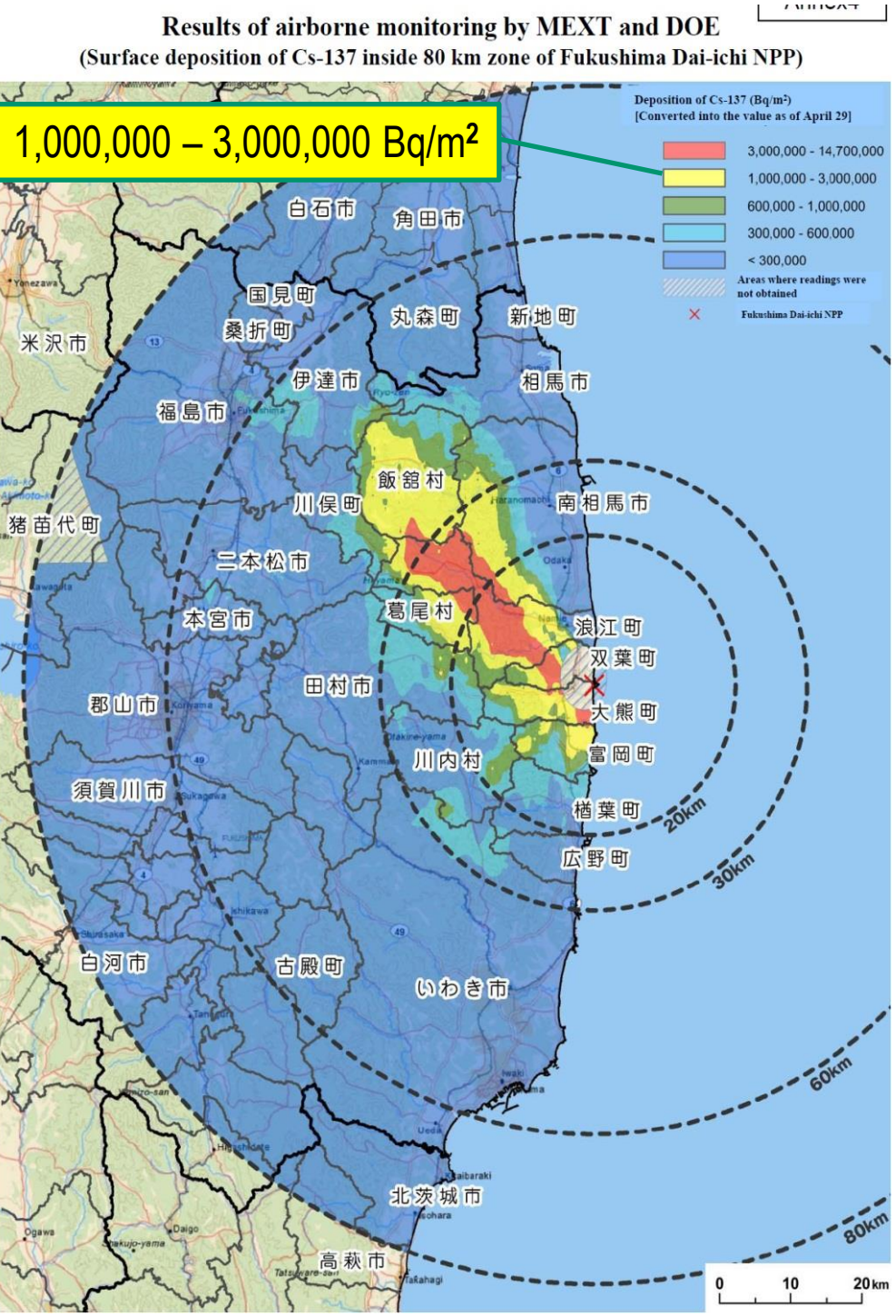
ERMIN. Customization – inhabited zones types. Near Ascó.

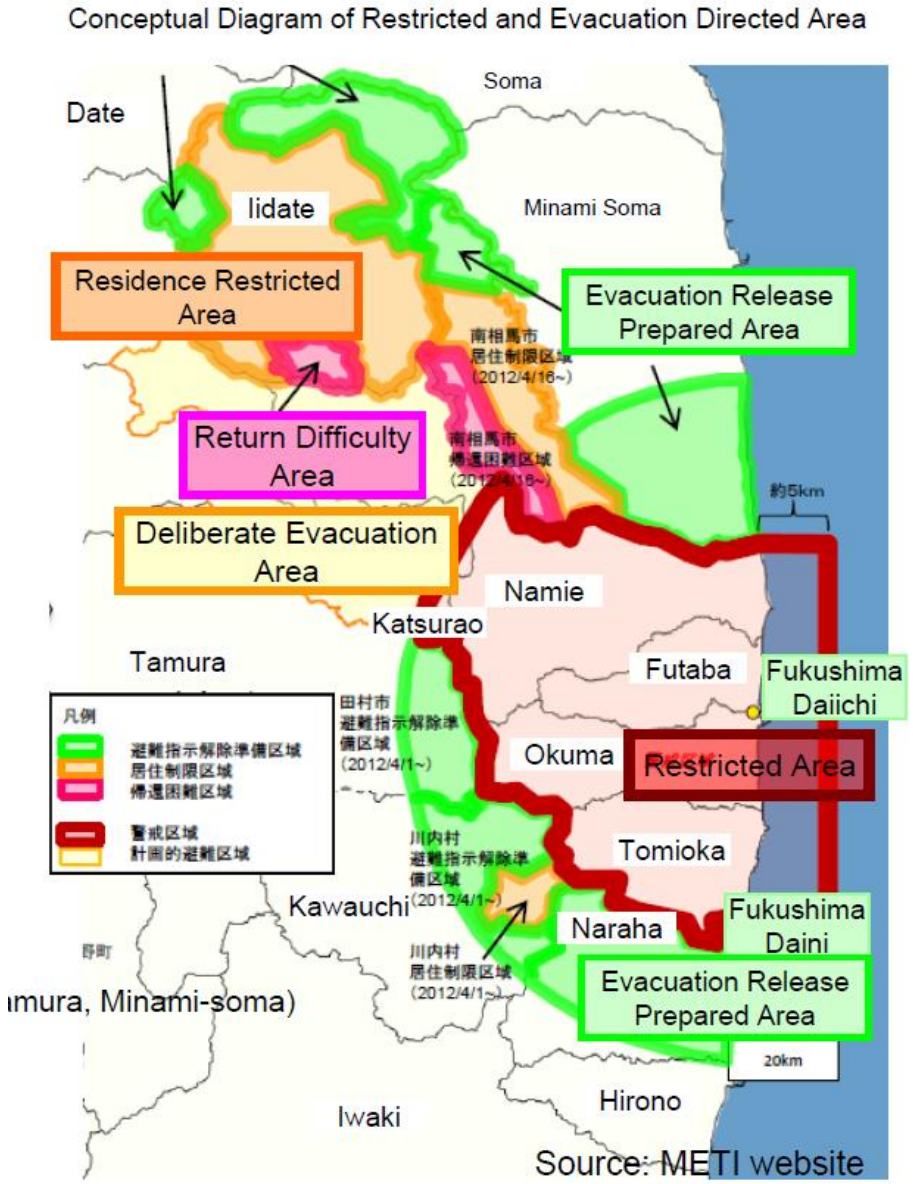


Total ground deposit of Cs-137 (Bq/m²) in the near zones after the simulated accident



Cs-137: 1.150.000 - 1.650.000 Bq/m²
Cs-134: 1.900.000 - 2.200.000 Bq/m²





Reference from Fukushima:
Residence Restricted Area
(decontamination)

EURANOS Handbook for Inhabited Areas. Selection table for buildings (example)

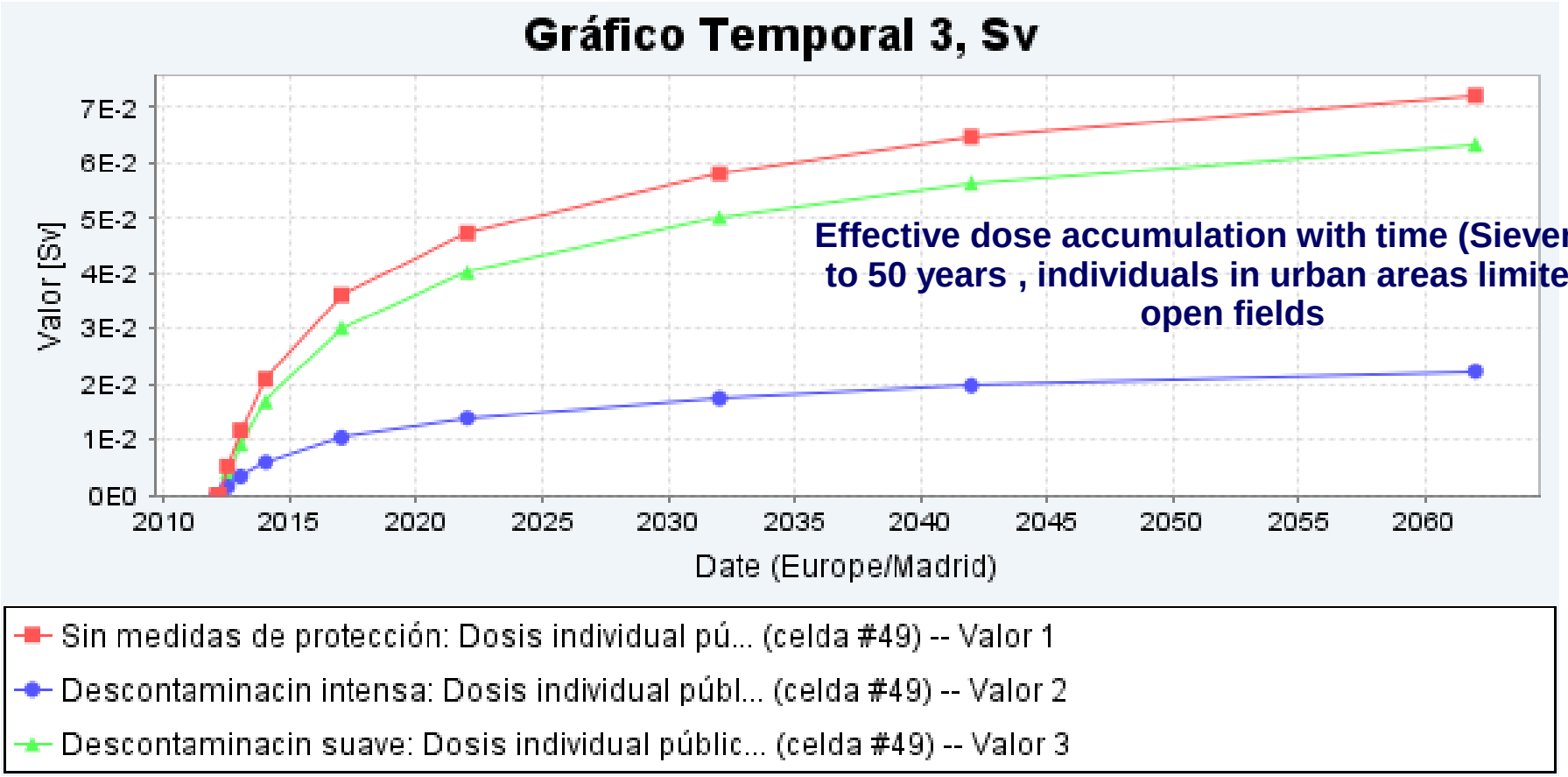
Tabla 7.11 Tabla de selección de las opciones de gestión para los edificios

Cuando aplicar	Temprana (T) días-semanas	Medio – Largo (M/L) (meses – años)
Restringir el acceso		
Reubicación permanente de las áreas residenciales (8)		
Prohibición del acceso público a las zonas no residenciales (9)		
Restringir el acceso a la fuerza de trabajo (temporal o al personal) a las zonas no residenciales (10)		
Reubicación temporal de las zonas residenciales (11)		
Superficies externas		
Demoler los edificios (12)		
Chorro abundante de agua (13)		
Lavado a alta presión (14)		
Abrasión mecánica de las paredes de madera (15)		
Recubrimientos pelables (49)		
Cepillado del techo (16)		
Limpieza del techo mediante agua caliente a presión (17)		
Sustitución del techo (18)		
Chorro de arena (19)		
Retirada de nieve (50)		
Sujetar (fijar la contaminación a la superficie) (20)		
Tratamiento de las paredes con nitrato de amonio (21)		
Superficies y objetos internos		
Otros métodos de limpieza (lavado, champú, limpieza a vapor) (23)		
Retirada de muebles, tapicerías y otros objetos (24)		

Clave:

	Recomendada con pocas restricciones.
	Recomendada pero requiere una evaluación adicional para superar algunas restricciones.
	Existen restricciones económicas o sociales que requieren un análisis completo y un período de consulta.
	Pueden existir restricciones técnicas o logísticas, o la opción puede ser solo apropiada en un sitio específico.

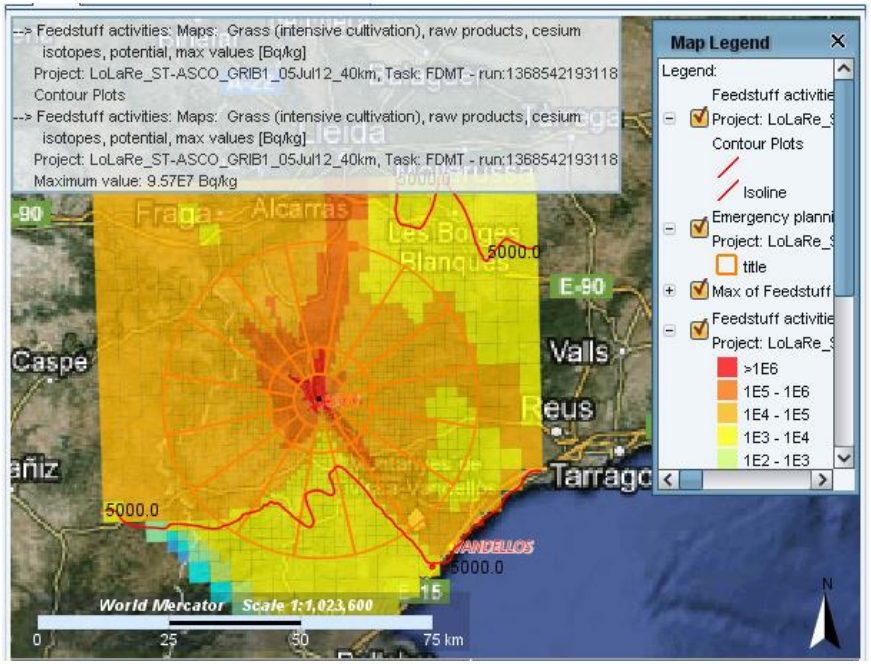
ERMIN. Intervention strategies analysed (example)

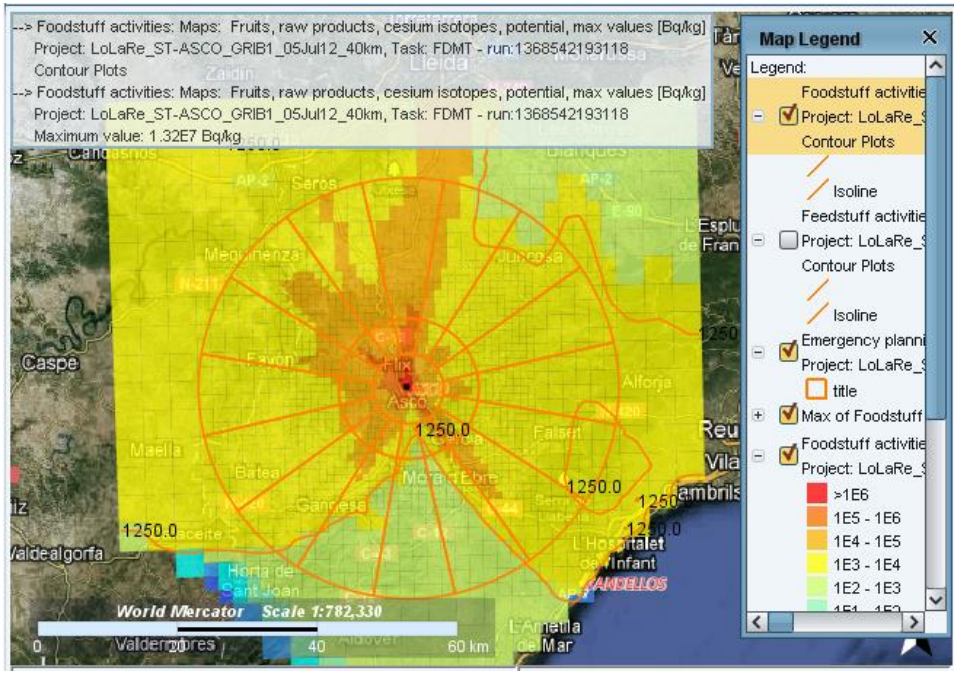


- Without cleaning measures, the annual dose rate would take more than 20 years in lowering of 1 mSv/year (from 2032).
- With “soft" decontamination measures, the reference dose value for long-term would be reached a few years earlier (from 2030).
- And with measures of intense decontamination, in 6 - 7 years (from 2019).

Zones of interest.

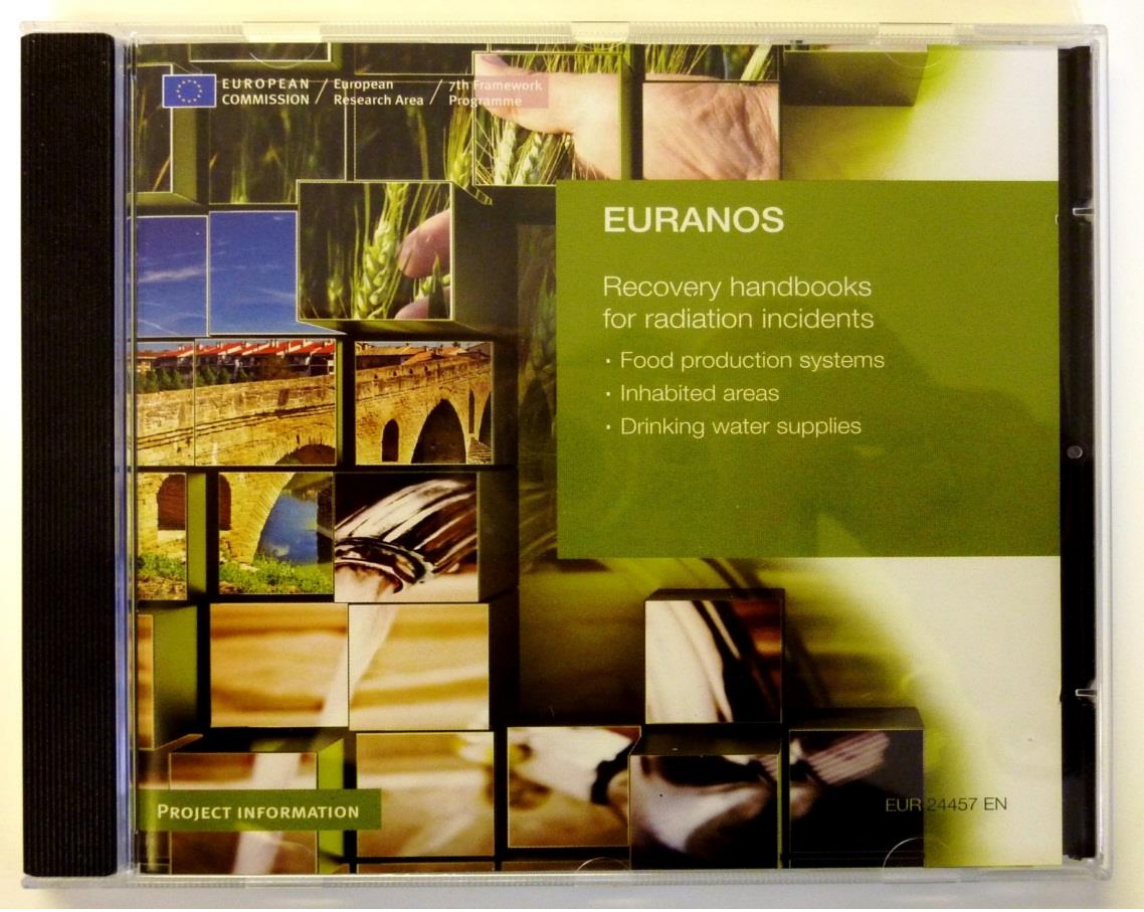
Food production systems





- Maps of maximum activity concentration (Bq/kg) in feedstuff and crops for human consumption (fruits).
- Outline marks the area restricted for commercialization of such crops, i.e. exceeding sometime intervention levels according to EU standards.

EURANOS recovery handbooks for management of food production systems, inhabited areas and drinking water supplies



- Translated into Spanish
- Being widely disseminated