European Model for Inhabited Areas (ERMIN)

Tom Charnock

28th January 2010

Centre for Radiation, Chemical and Environmental Hazards

Introduction

The ERMIN work-package

The Model

The Database

Implementation as an operational tool

© HPA

ERMIN work package of the EURANOS project

Work package partners:

Health Protection Agency, Centre for Radiation, Chemical and Environmental Hazards, U K

Risø National Laboratory for Sustainable Energy, Technical University of Denmark, Denmark

Helmholtz-Zentrum Muenchen, Germany

Forschungszentrum Karlsruhe, IKET, Germany

Danish Emergency Management Agency, Denmark

Prolog Development Center, Denmark

Bundesamt für Strahlenschutz, Germany

Development of ERMIN model

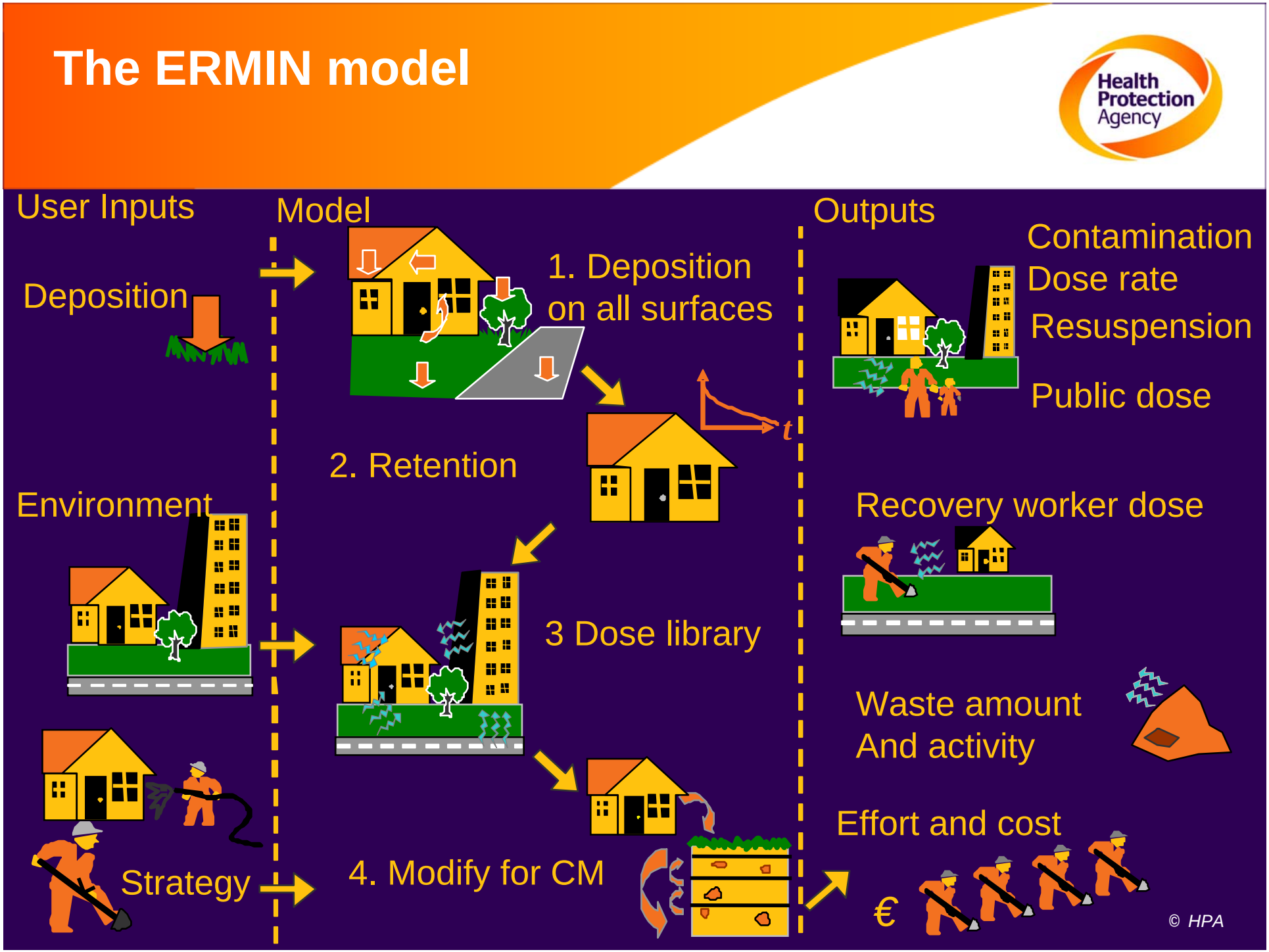
Development of Inhabited Area Monitoring Module (IAMM)

Integration of both within ARGOS and RODOS – Operational!

EURANOS

© HPA

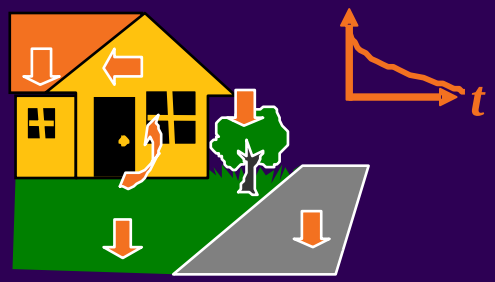
The ERMIN model



Data: Initial Deposition and Retention

Initial deposition and retention:

- Extensive review of the literature
- Most suitable for a reactor accident
- Dry, wet and wet/dry



© HPA

Data: Idealised environments

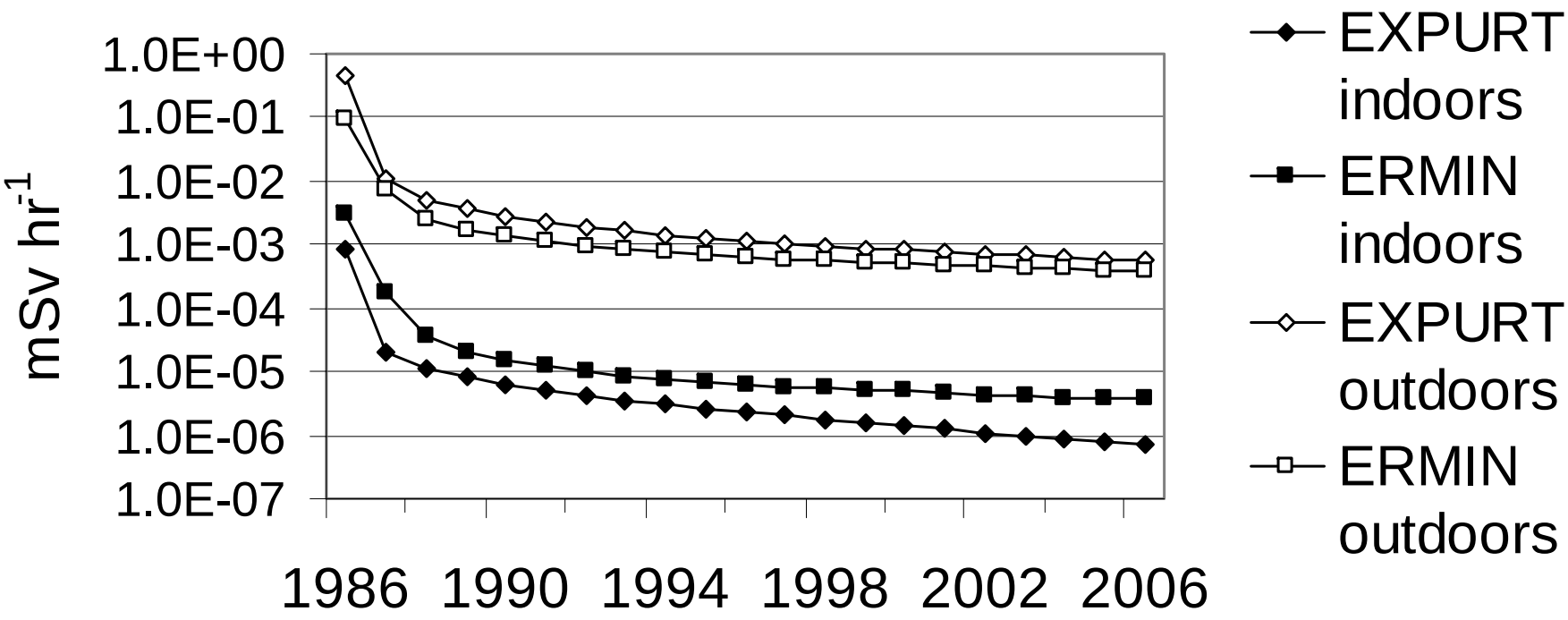
- **Based on existing studies; Monte Carlo modelling**
- **Unit dose rates; modification and completion required**
- **Beta dose; simple assumptions**

Street of detached prefabricated houses	Meckbach et al, 1988
Street of semi-detached houses with basement	Meckbach et al, 1988
Street of semi-detached houses without basement	Jones et al, 2006
Street of terraced houses	Meckbach, 1988
Multi-storey block of flats amongst other house blocks	Meckbach, 1988
Multi-storey block of flats opposite parkland	Meckbach, 1988
Industrial site (Incomplete dose library)	Kis et al, 2003
Large open area	Jones et al, 2006

© HPA

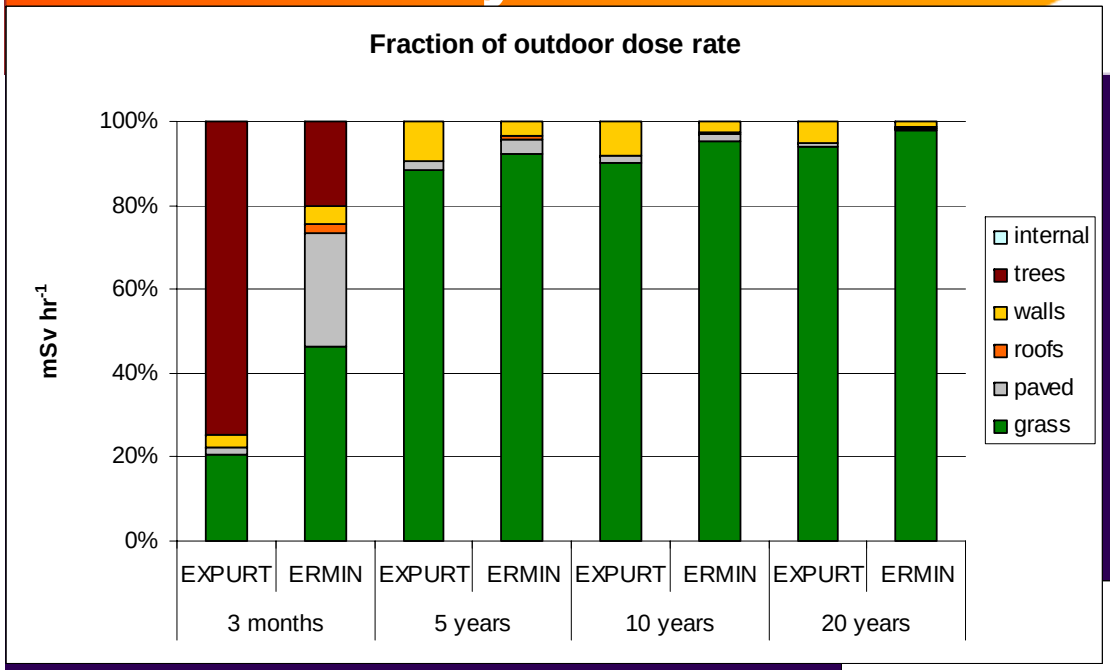
Comparison with EXPURT - total dose rate

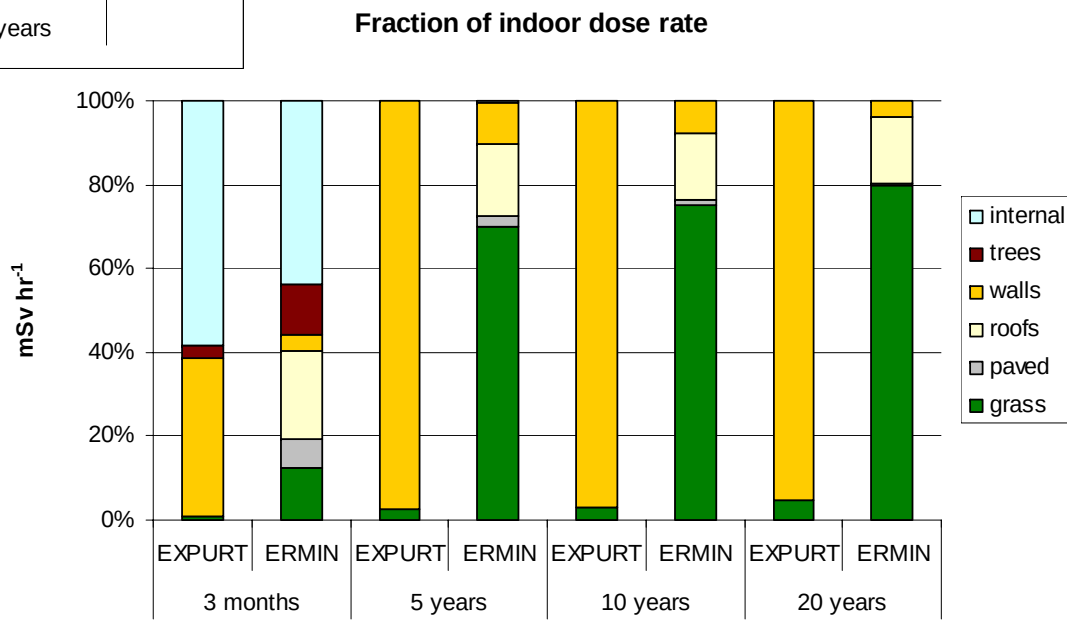
Predicted external gamma dose rate indoors and outdoors in a multi-storey building environment



© HPA

Comparison with EXPURT – dose rate by surface





Implementation

- Recovery strategy
  - Radiological: dose
  - Logistical: equipment, manpower, time
  - Acceptability to stakeholders: perception, legality
- Health professionals, government, residents, other users of the area, workers implementing strategy etc
- EVATECH project: how decision makers work

© HPA

Implementation

Implemented as modules in RODOS and ARGOS

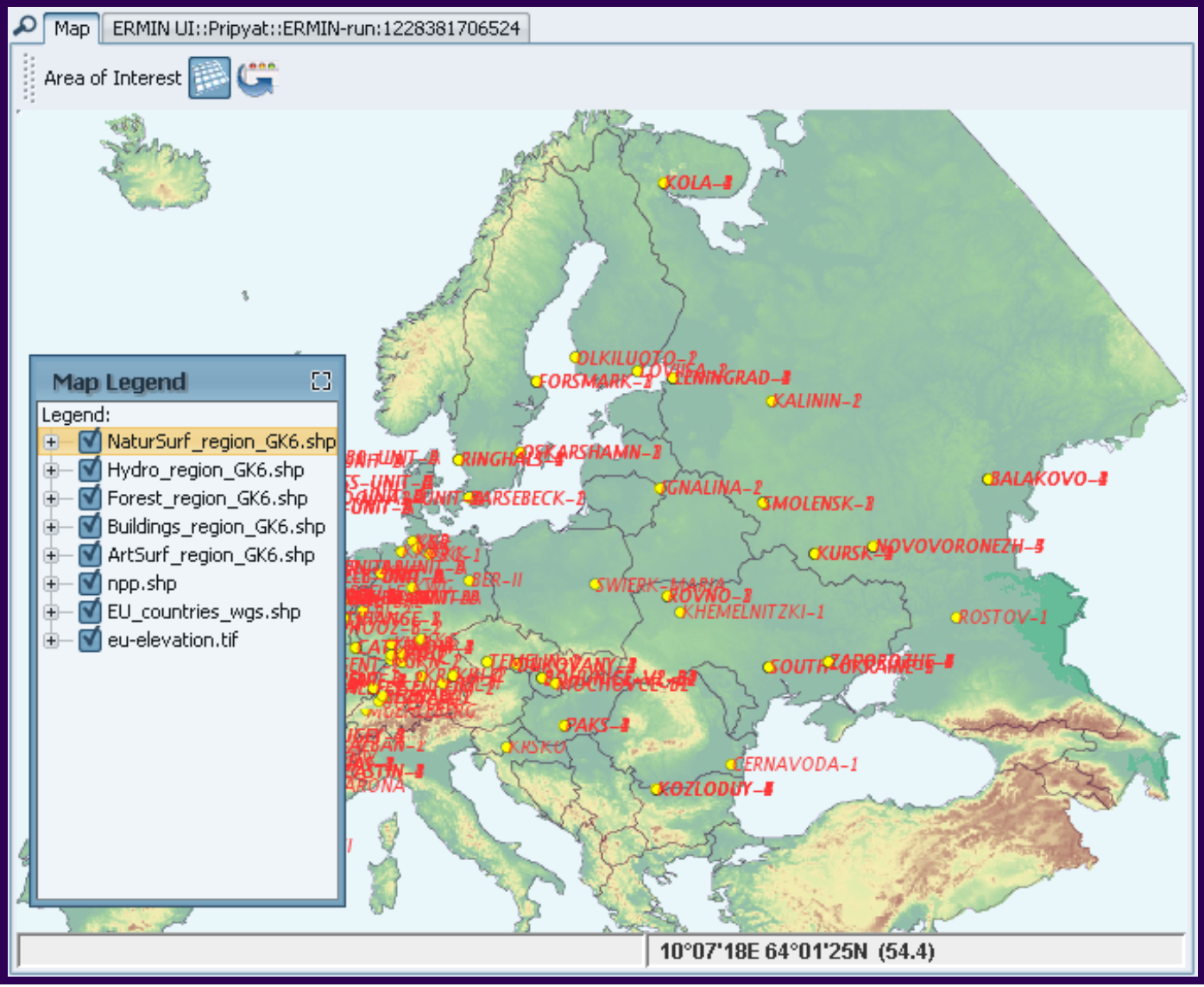
User interaction by defining regions

- environment description, deposition, emergency countermeasures, recovery countermeasures
- RODOS and ARGOS can also take deposition from ADM or IAMM

RODOS and ARGOS; map based interface

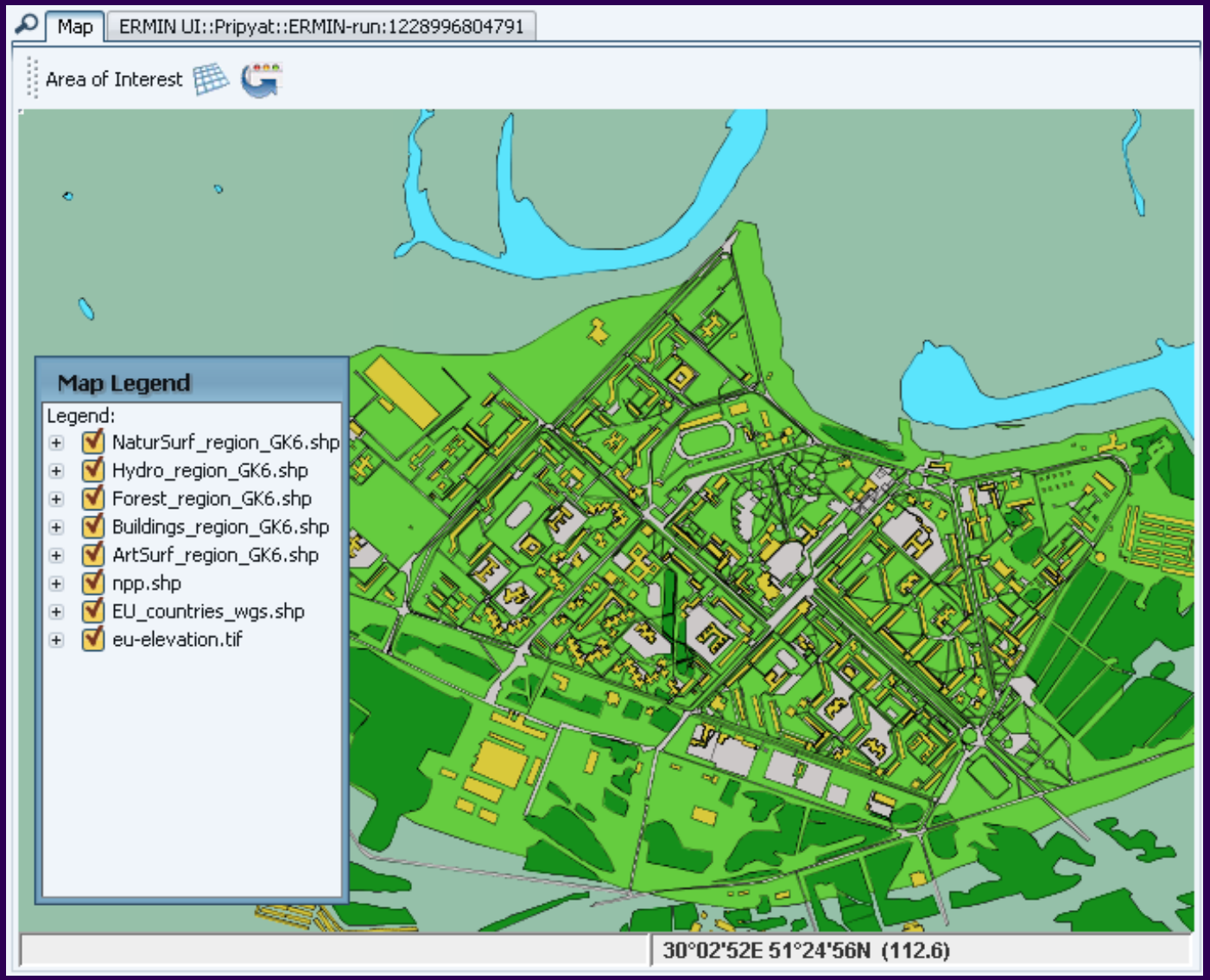
© HPA

Example scenario - JRODOS



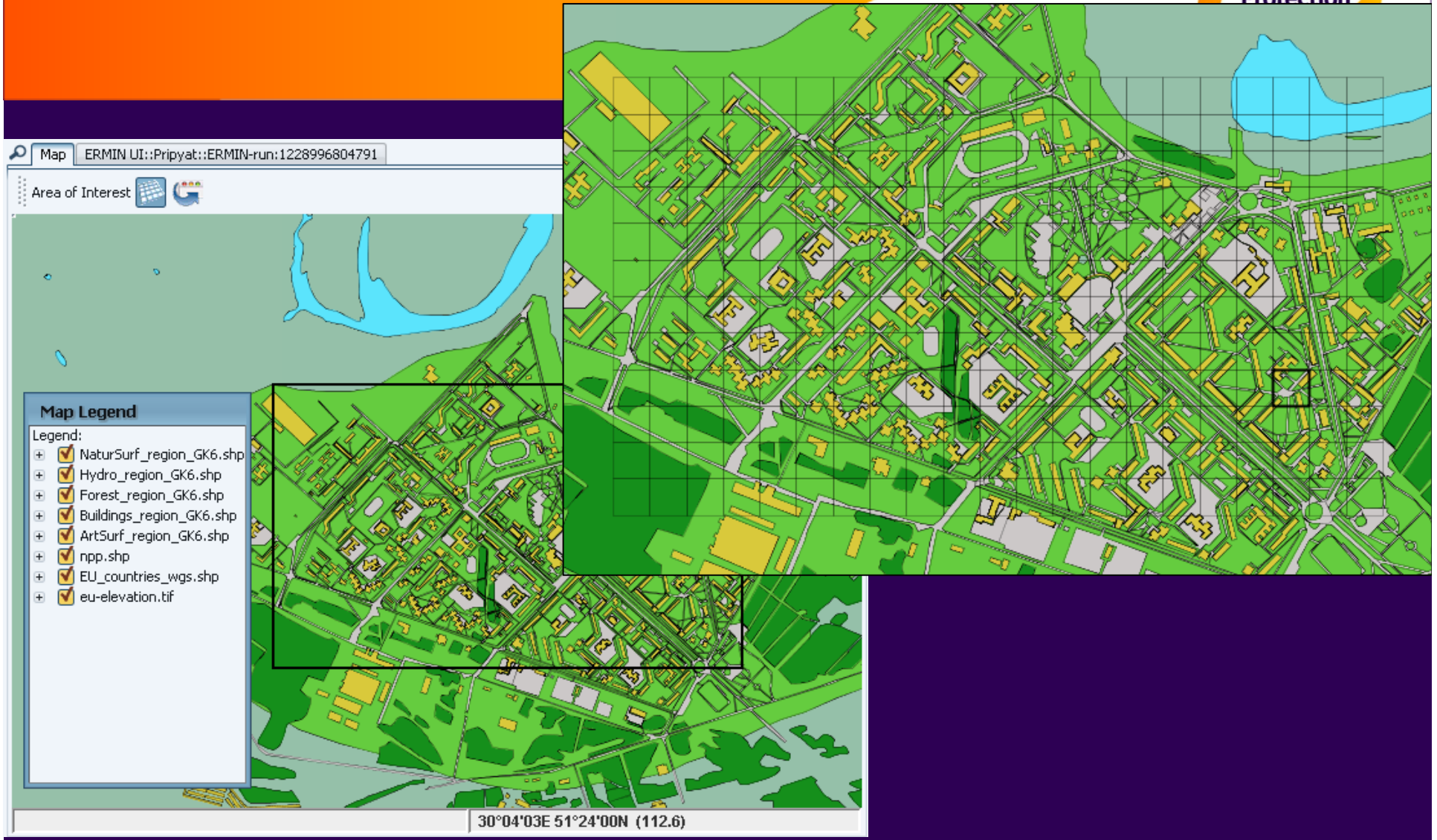
© HPA

Example scenario - JRODOS



© HPA

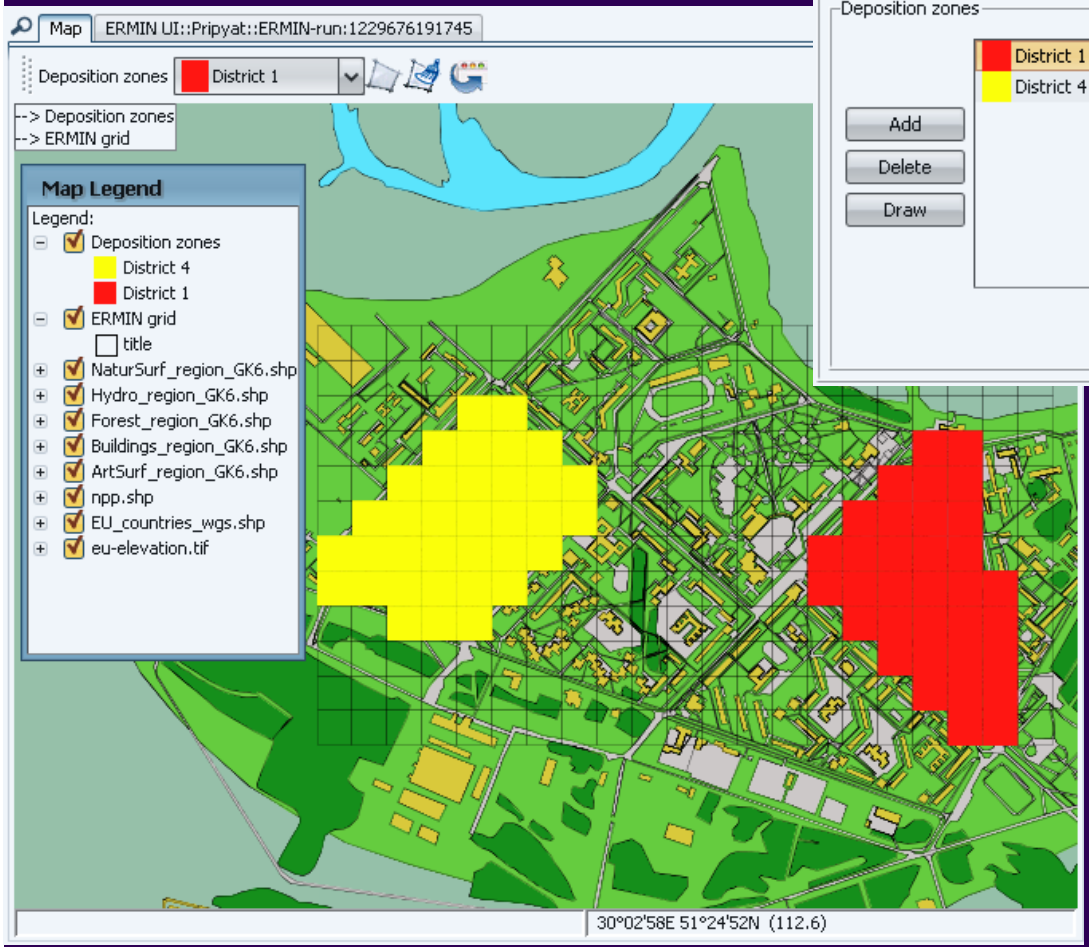
Example scenario – area of interest

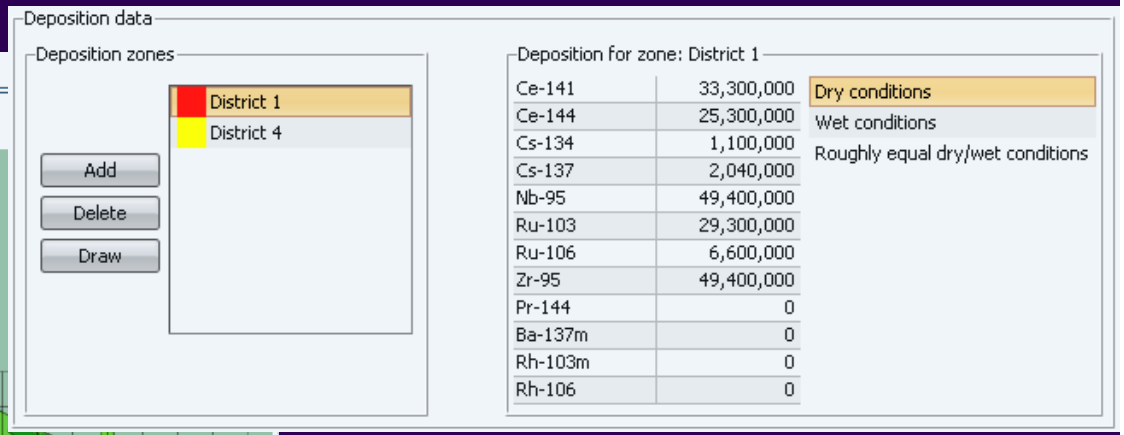


© HPA

Example scenario – initial deposition

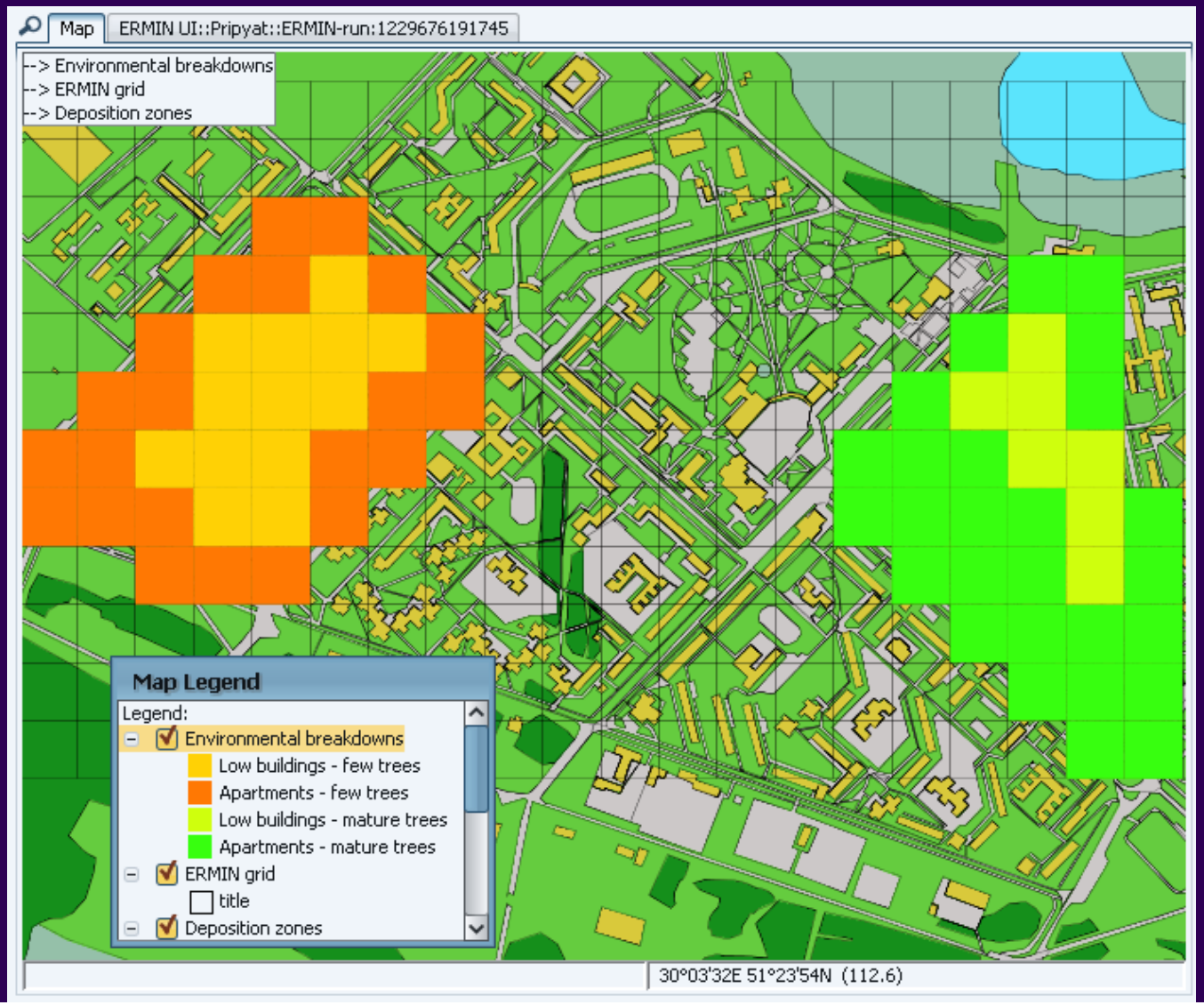
Atmospheric model, direct input and IAMM





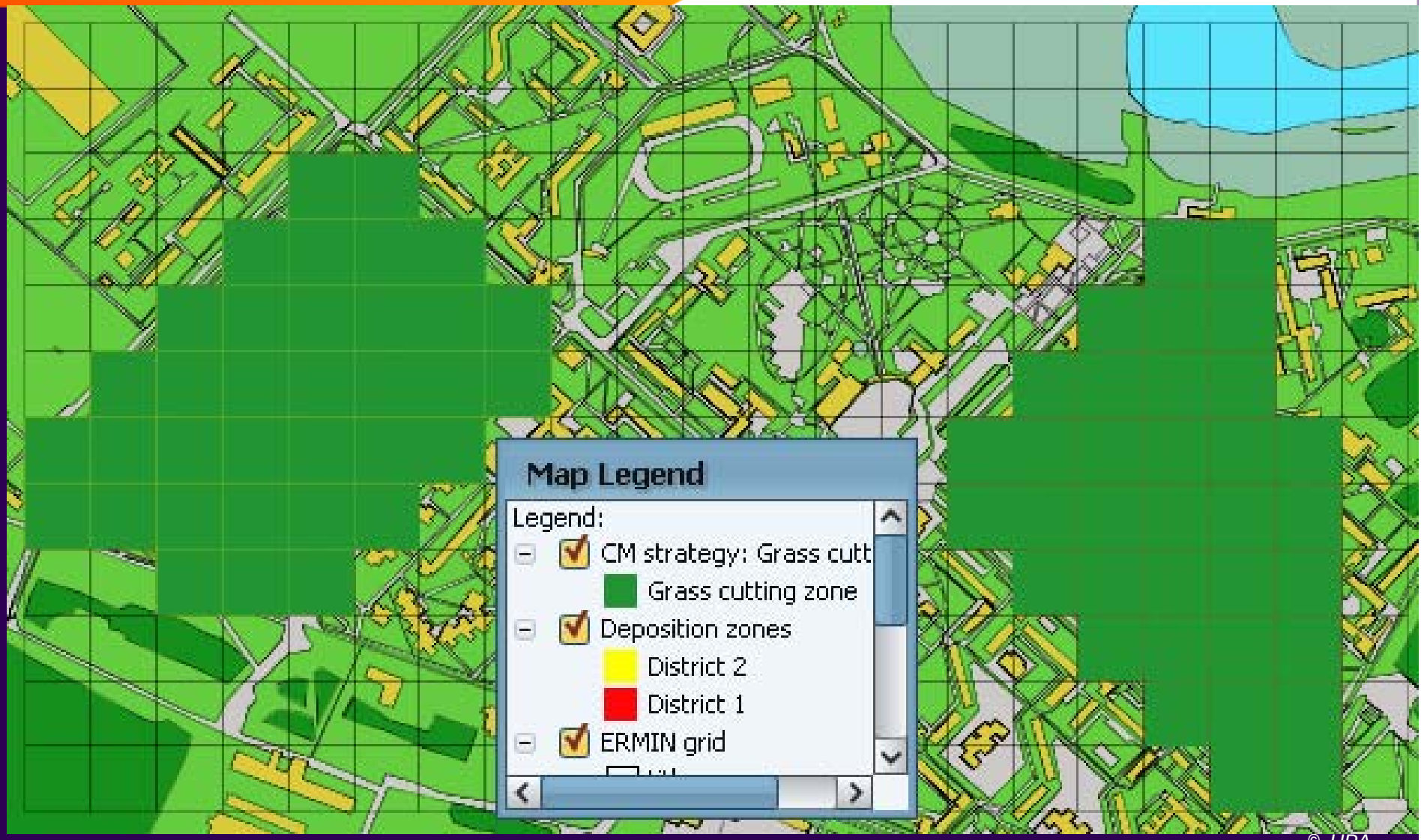
© HPA

Example scenario – environment description



© HPA

Example scenario – countermeasure strategy



© HPA

Example scenario – comparing strat

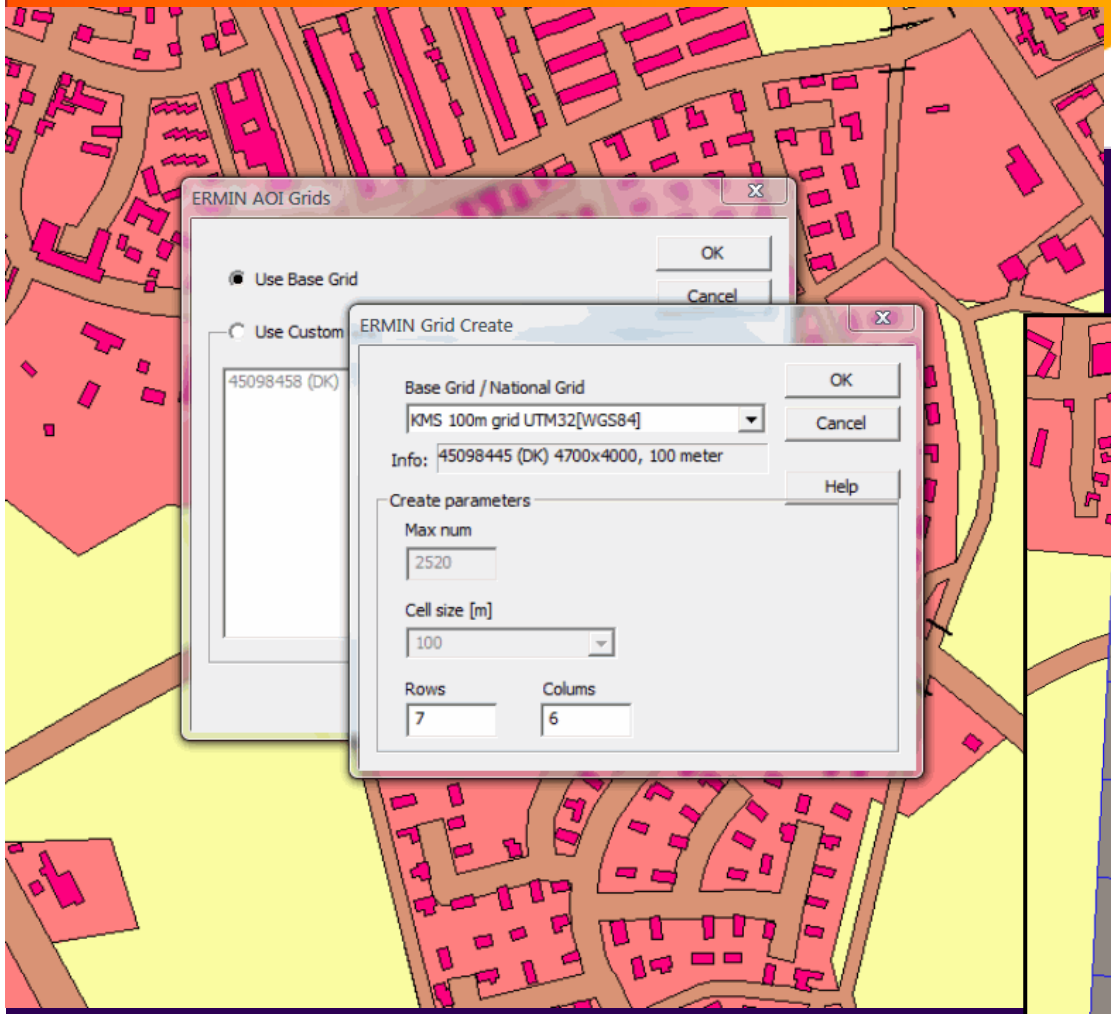
Map | ERMIN UI::Pripyat::ERMIN-run:1233244226540 | Summary::Pripyat::ERMIN

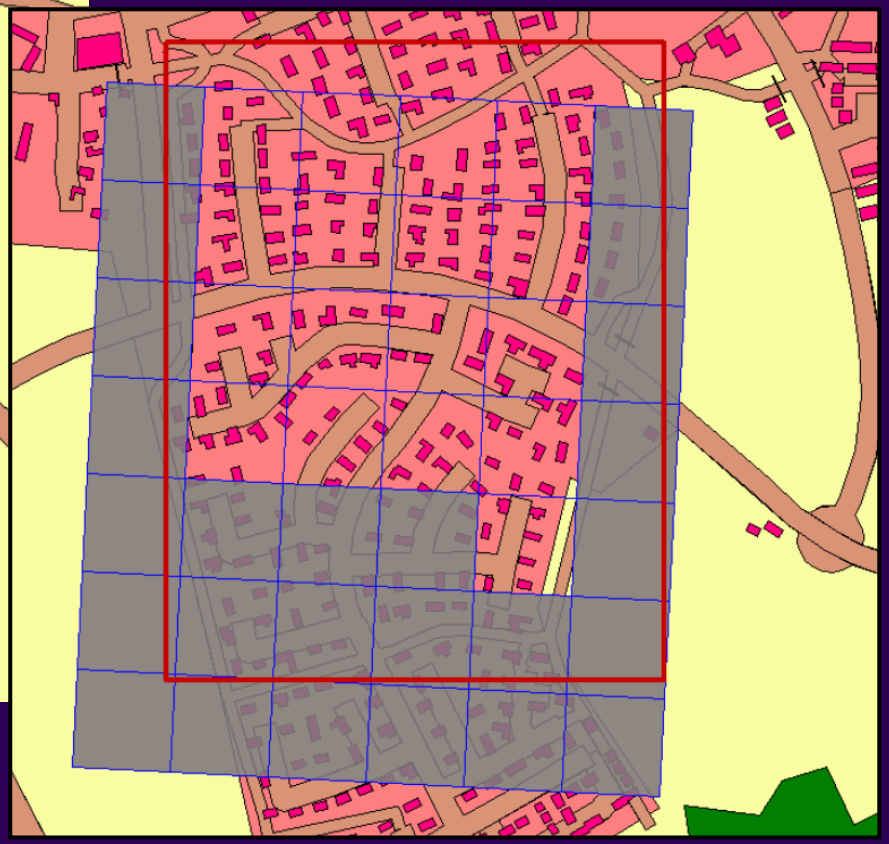
Position	No countermeasures (365.0 days)	Relocation district 1	Grass cutting only
Total waste produced (kg)	0.0	0.0	23876.0
Maximum beta/gamma emitting radionuclide concentration produced (Bq kg-1)	0.0	0.0	1.61304346E9
Maximum alpha emitting radionuclide concentration produced (Bq kg-1)	0.0	0.0	0.0
Average beta/gamma emitting radionuclide concentration produced (Bq kg-1) calculated from the total beta/gamma emitting radionuclide removed (Bq) divided by the total material removed (kg)	0.0	0.0	1.0352887E9
Average alpha emitting radionuclide concentration produced (Bq kg-1) calculated from the total beta/gamma emitting radionuclide removed (Bq) divided by the total material removed (kg)	0.0	0.0	0.0
The total man days that the population of the area of interest is outside the area of interest because of evacuation or relocation (man days)	0.0	0.0	0.0
The maximum total area affected by evacuation and relocation (m2)	0.0	340000.0	0.0
The total m2 days that are lost to evacuation and relocation (m2 days)	0.0	2040000.0	0.0
The maximum individual worker dose from any single countermeasure applied anywhere in the area of interest (Sv)	0.0	0.0	3.672179E-4
The total collective workdose from all countermeasures applied in the area of interest (man Sv)	0.0	0.0	0.009862037
The total public collective normal living effective dose (man Sv) in the area of interest over a defined integration period	0.0	0.0	0.0
The saved total public collective normal living effective dose (man Sv) n the area of interest over a defined integration period	0.0	0.0	0.0
The total collective public normal living skin dose in the area of interest over a defined integration period from external exposure to beta radiation (man Sv)	0.0	0.0	0.0
The saved collective public normal living skin dose in the area of interest over a defined integration period from external exposure to beta radiation (man Sv)	0.0	0.0	0.0
The maximum public individual normal living effective dose in the area of interest over a defined integration period (Sv). The sum of the dose from exposure to external irradiation over the period and committed effective dose from inhalation of radioactivity over the same period	0.28369495	0.2679136	0.2709546
The maximum saved public individual normal living effective dose in the area of interest over a defined integration period (Sv). The sum of the dose from exposure to external irradiation over the period and committed effective dose from inhalation of radioactivity over the same period	0.0	0.015781343	0.012905464
The maximum public individual normal living skin dose from exposure to external beta radiation in the area of interest over a defined integration period (Sv)	1.3531139	1.2949849	1.1657126
The maximum saved public individual normal living skin dose from exposure to external beta radiation in the area of interest over a defined integration period (Sv)	0.0	0.058128953	0.21403831
The amount work required for implementing the countermeasure strategy in the area of interest (man days)	0.0	0.0	0.99483335
The amount of personnel required for implementing the countermeasure strategy in the area of interest (man)	0.0	0.0	69.0

Exported to Web-HIPRE decision analysis tool

© HPA

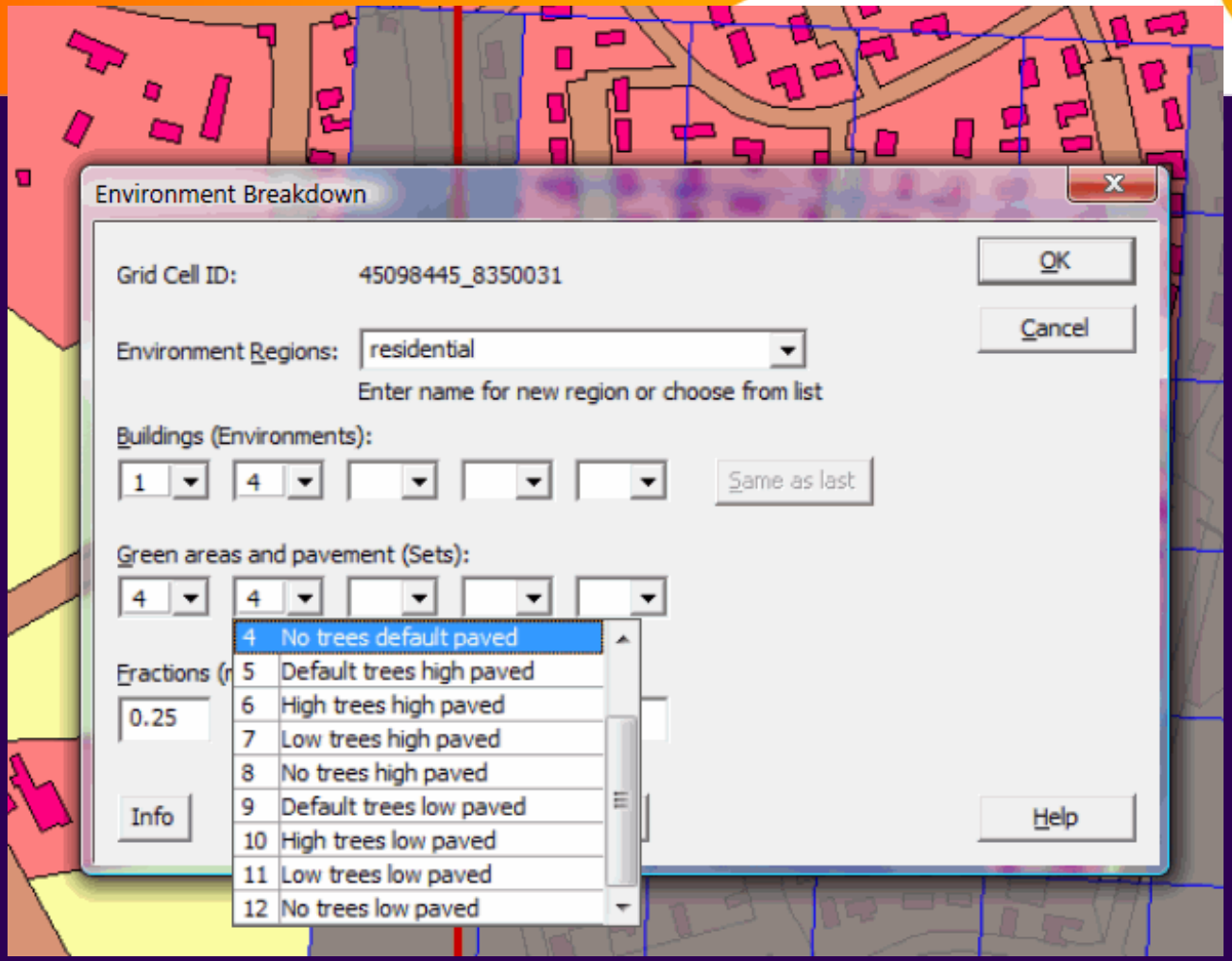
Implementation in ARGOS





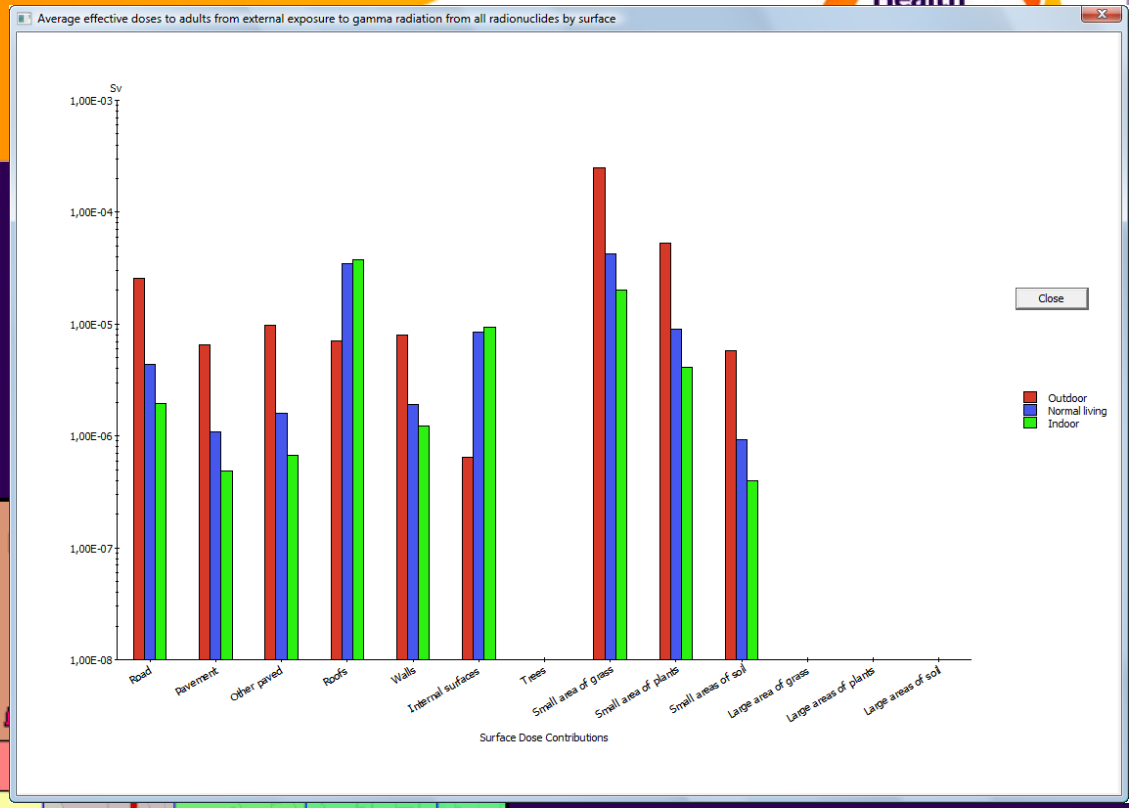
© HPA

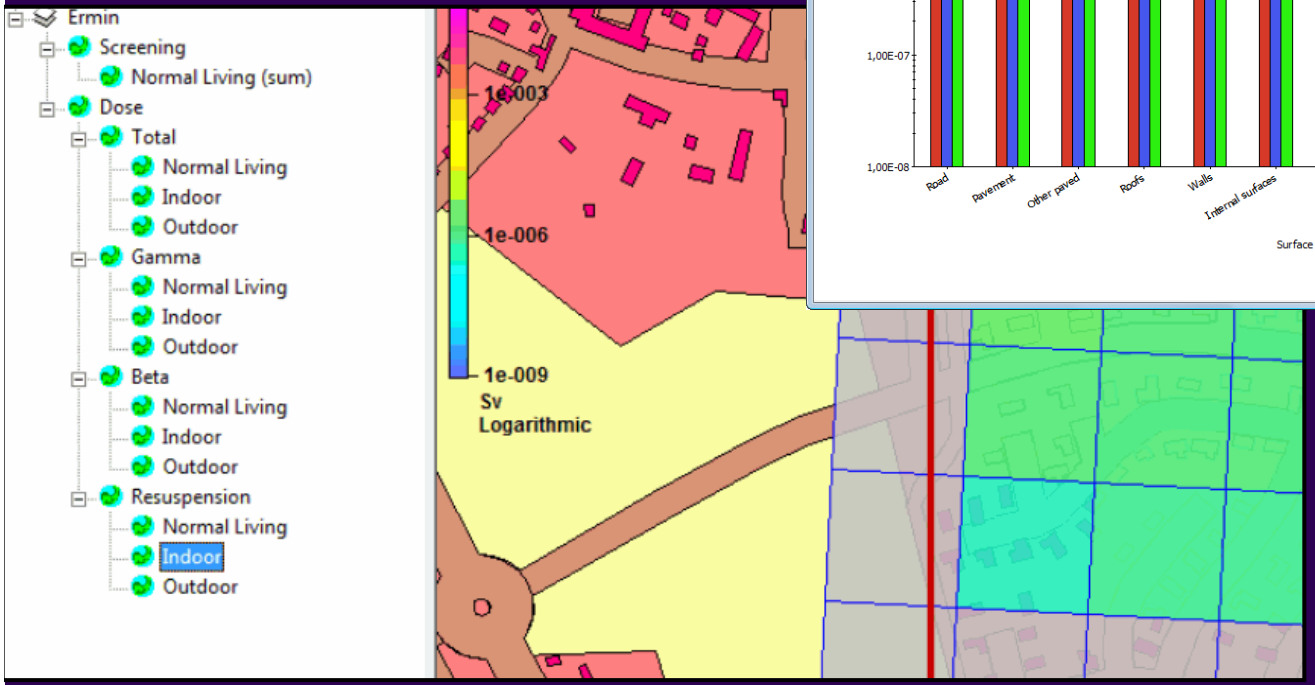
Implementation in ARGOS



© HPA

Implementation in ARGOS





© HPA

Future work

Project proposal to expand database for explosion scenarios:
- initial deposition, long term retention, decontamination

Additional environments?

© HPA