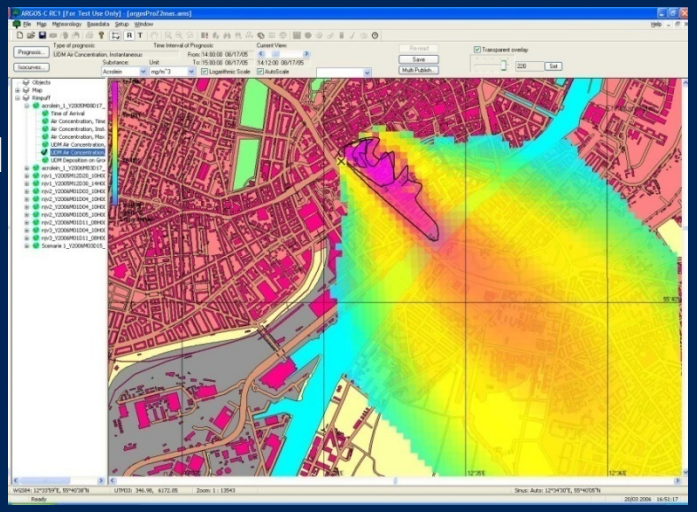
DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# ARGOS, a tool for assessing exposures during a radiological emergencies

International Experts' Meeting on Assessment and Prognosis in Response to a Nuclear or Radiological Emergency, Vienna April 2015

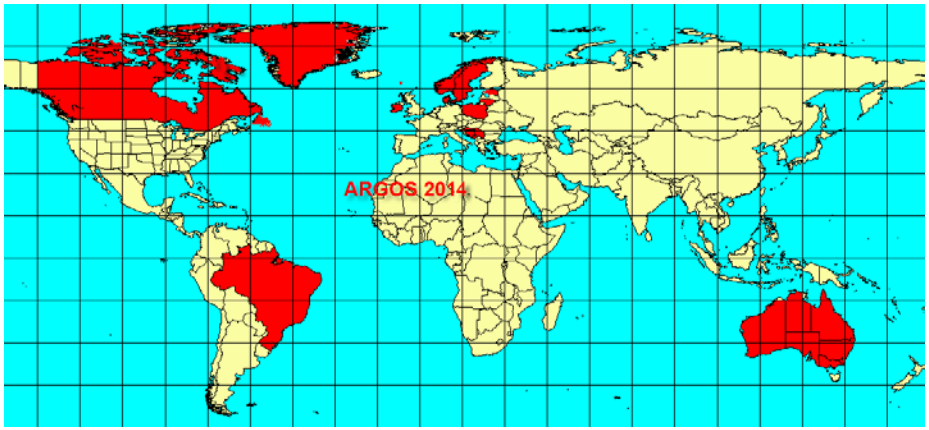


Steen Hoe
Nuclear Division, DEMA

Contact: Hoe@brs.dk

# ARGOS CBRN

- Decision Support System developed since 1993
- Maintained by the ARGOS Consortium (operational Emergency Organisation and PDC-ARGOS) and used worldwide)
- Models from research organisation supported by EU Research programs (FP5,6 and 7) and the ARGOS Countries





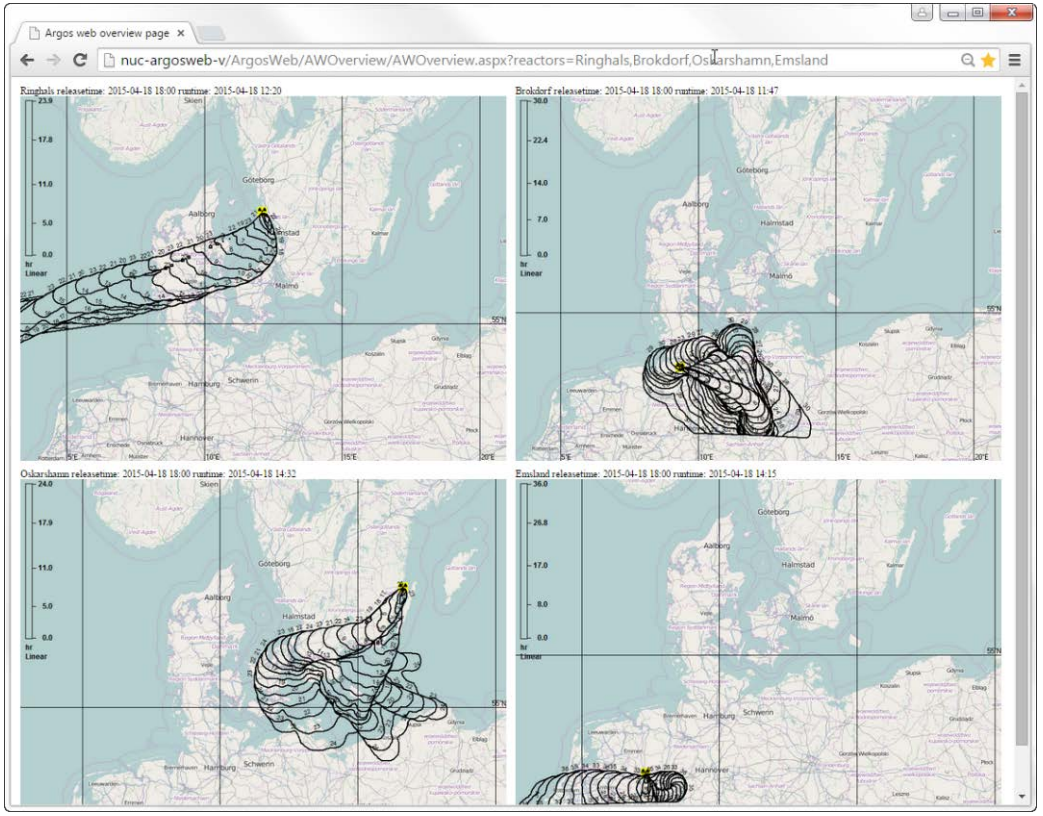

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Danish implementation

- One installation for R,N and C
- Identical metrological data for R, N and C with worldwide meteorological data access.
- Identical GIS data – buildings (Denmark) and populations
- Identical meso-scale dispersion model (RIMPUFF) for R,N and C – Special long range models for N (R)
- Identical Urban dispersion (URD) for R and C
- Identical Food- and Urban dose model for R and N
- Special Chemical source- and consequence model
- Special monitoring data implementation for R and N

# Release, Pre-release and Planning phase

- Automated Dispersion Calculation, time of arrival for closest NPP calculated 4 times daily.
- Automated Dispersion Calculation for urban Areas for R and C

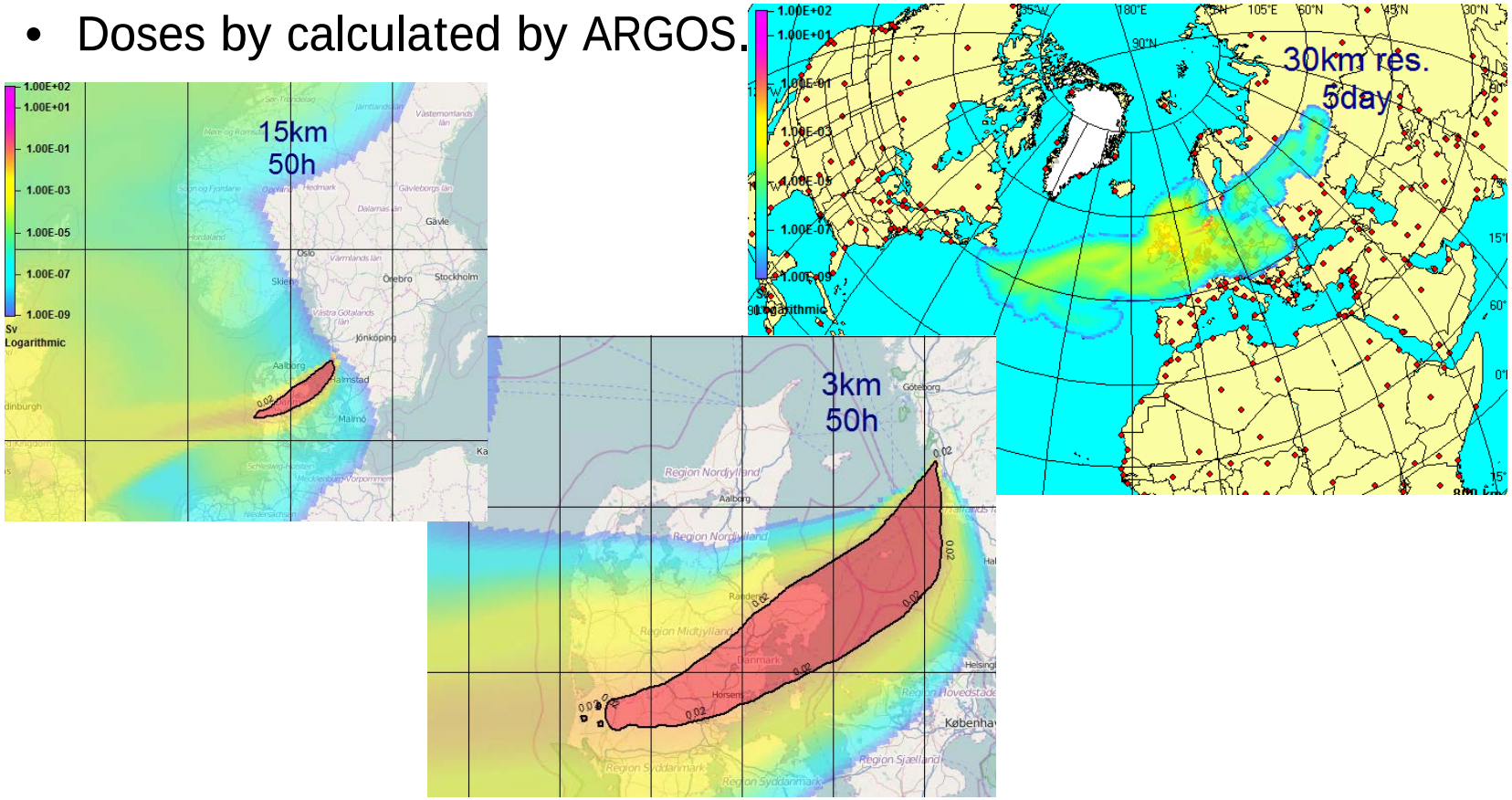





DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Release, Pre-release and Planning phase N

- DERMA: Global Long Range model with horizontal resolution from 3km to 30 km – the 3km model also for R.
- Doses by calculated by ARGOS.

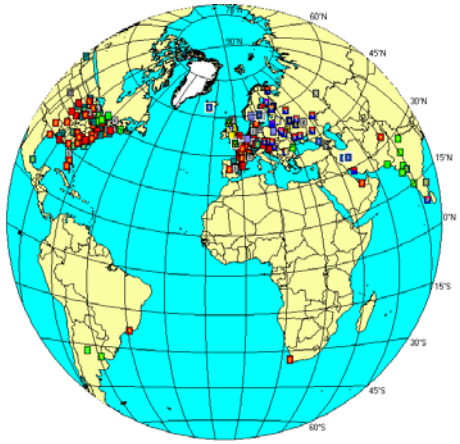




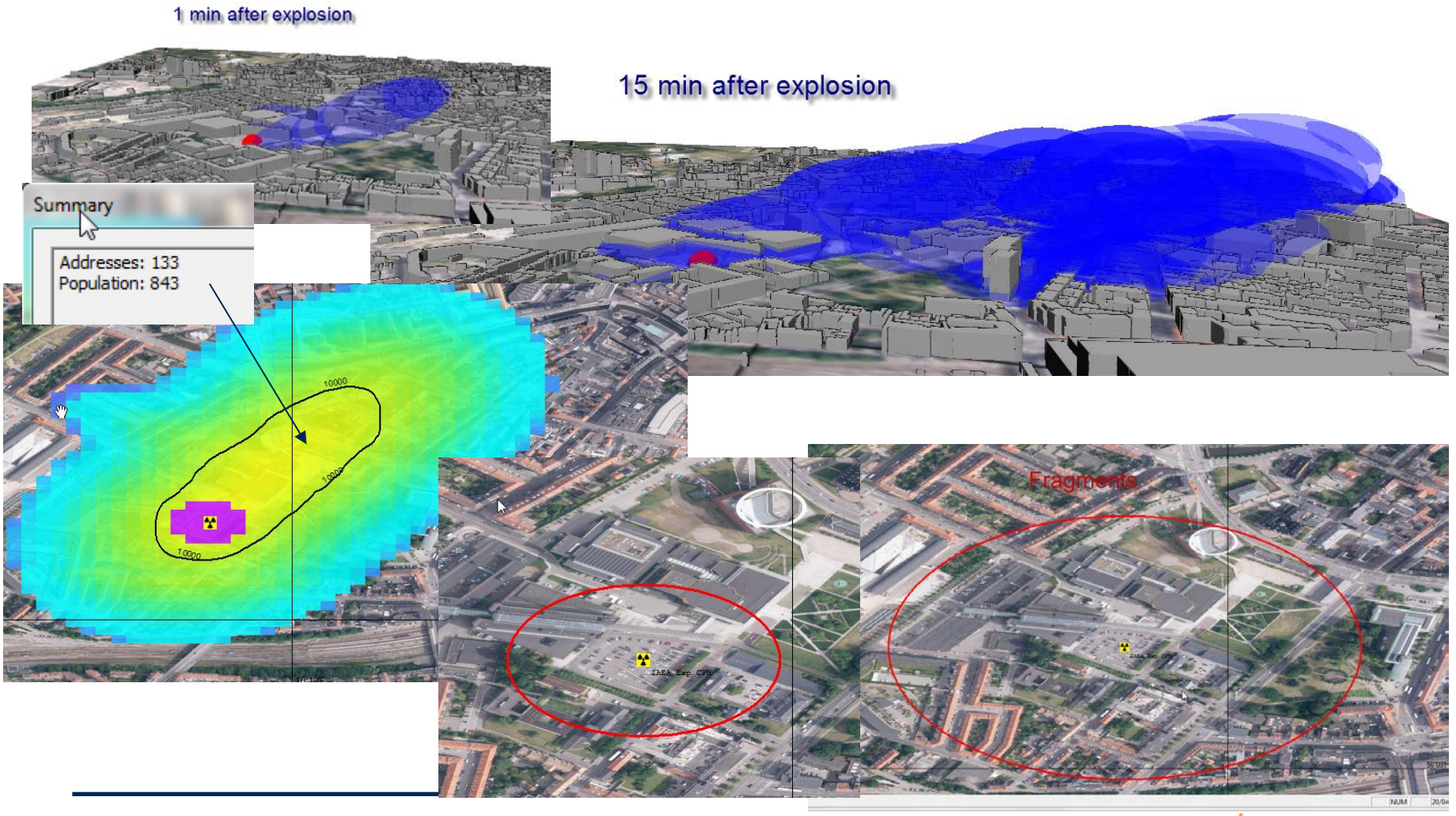

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Release (R,N), Pre-release phase (N) - Source

- RIMPUFF: Dispersion Calculation, with Precipitation from RADAR if possible in
  - Source Term for Reactors from ARGOS DB, multiple sources possible.
  - Source Terms for N multiple point sources.
- URD model also includes “Dirty Bomb” modelling in form of predefined initial shapes (puff column) and initial deposition
- URD will also create a potential damage zone before the actual run



# Urban Dispersion






DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Uncertainty in numerical weather prediction (NWP)

- 25 different NWP dataset from Danish Meteorological Institute (DMI)
- 25 dispersion calculations from the DERMA Long Range Model at DMI
- Dataset only operational for Northern Europe.
- ARGOS user can share these data

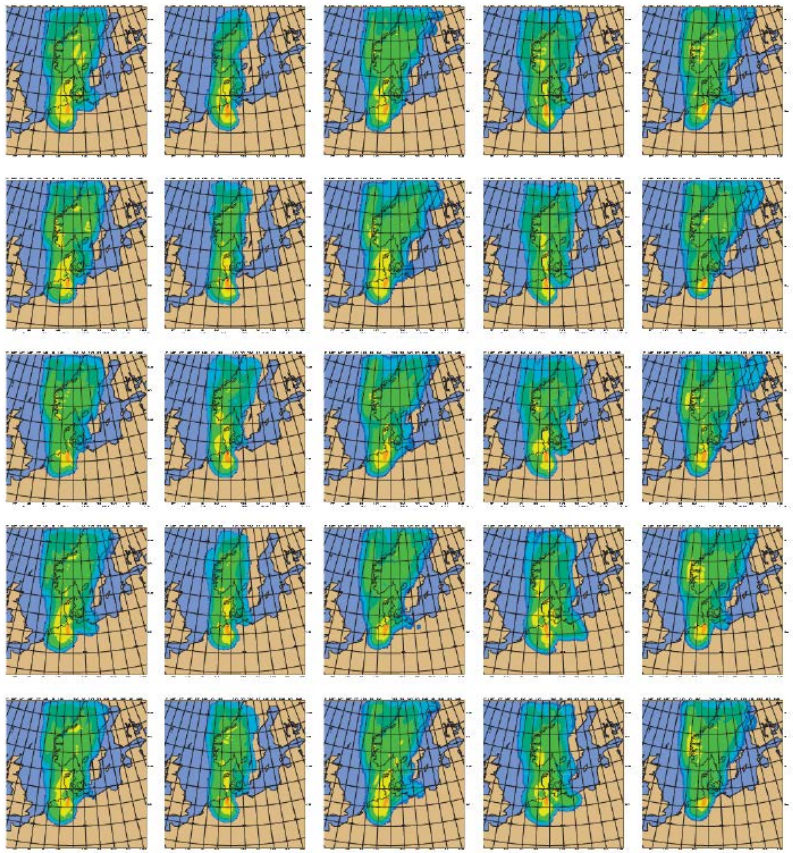
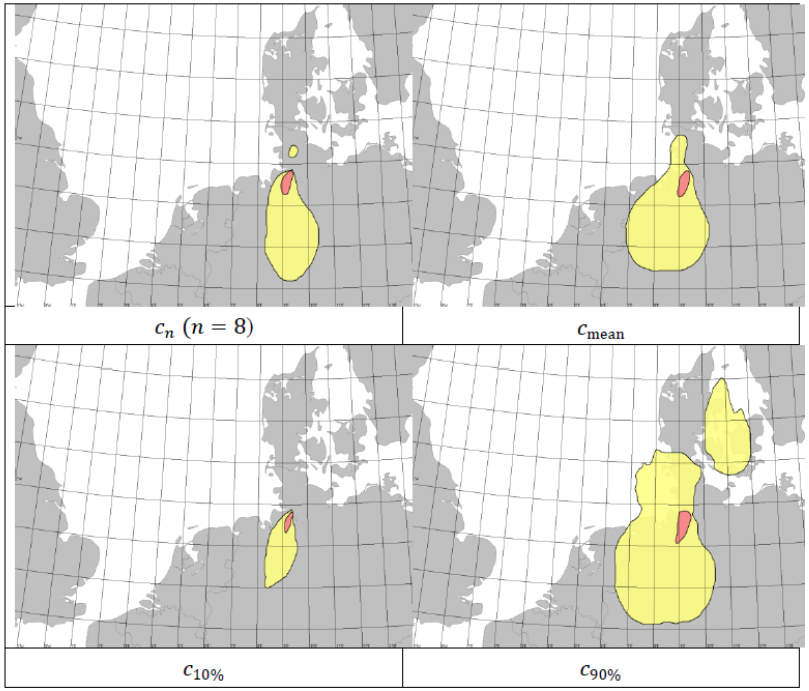


**Figure 17.** Ensemble of atmospheric dispersion model calculations. Total accumulated deposition of Cs-134 corresponding to a release from Brokdorf on 2011-05-23, 00 UTC.

# Uncertainty in numerical weather prediction (NWP)

- Presentation of statistical data
- 25 dispersion calculations resulting in a statistical envelope.
- Not physical Correct
- NKS(.org) financed project
- Fukushima test case.

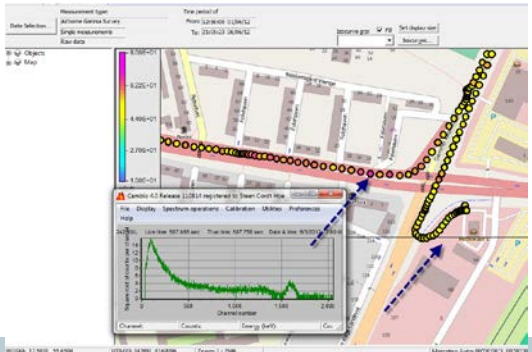


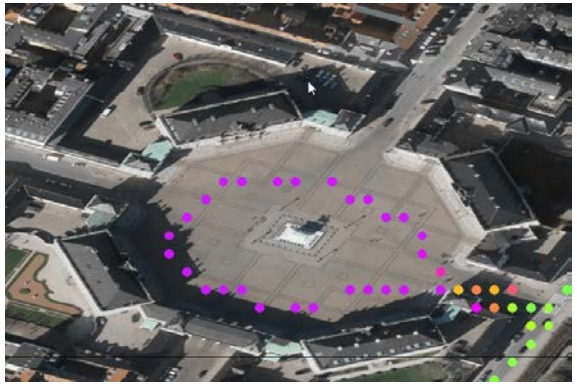


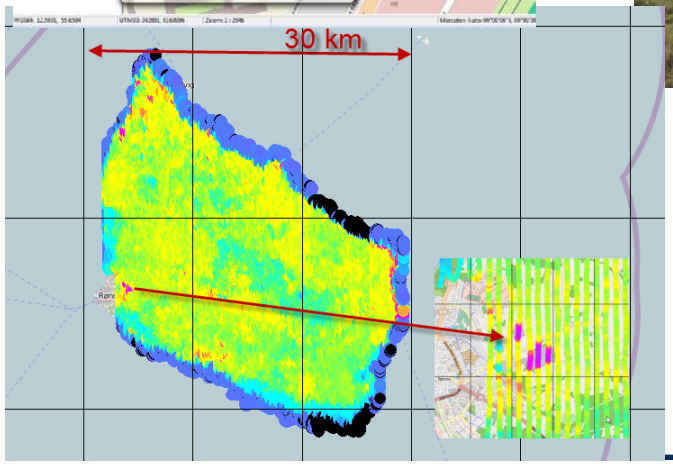

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Monitoring after plume for model use

- **Nuclide specific deposition** input from AGS and CGS system in raw 4242 format,
- Dose rate can be converted with a Nuclide Vector










Map from Danish Geodata Agency and Open Street Map

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Dose and Countermeasure modelling

- Danish Implementation
  - Urban dose modelling with ERMIN on 100m grid
  - Food Dose Modelling with AgriCP on 5 km Grid

# Urban Dose and Countermeasure modelling

- ERMIN (The European Model for Inhabited Areas)
- Input from Atmospheric dispersion or monitoring
- Dose calculation, counter measures
- Waste, Worker dose



DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# ERMIN model description

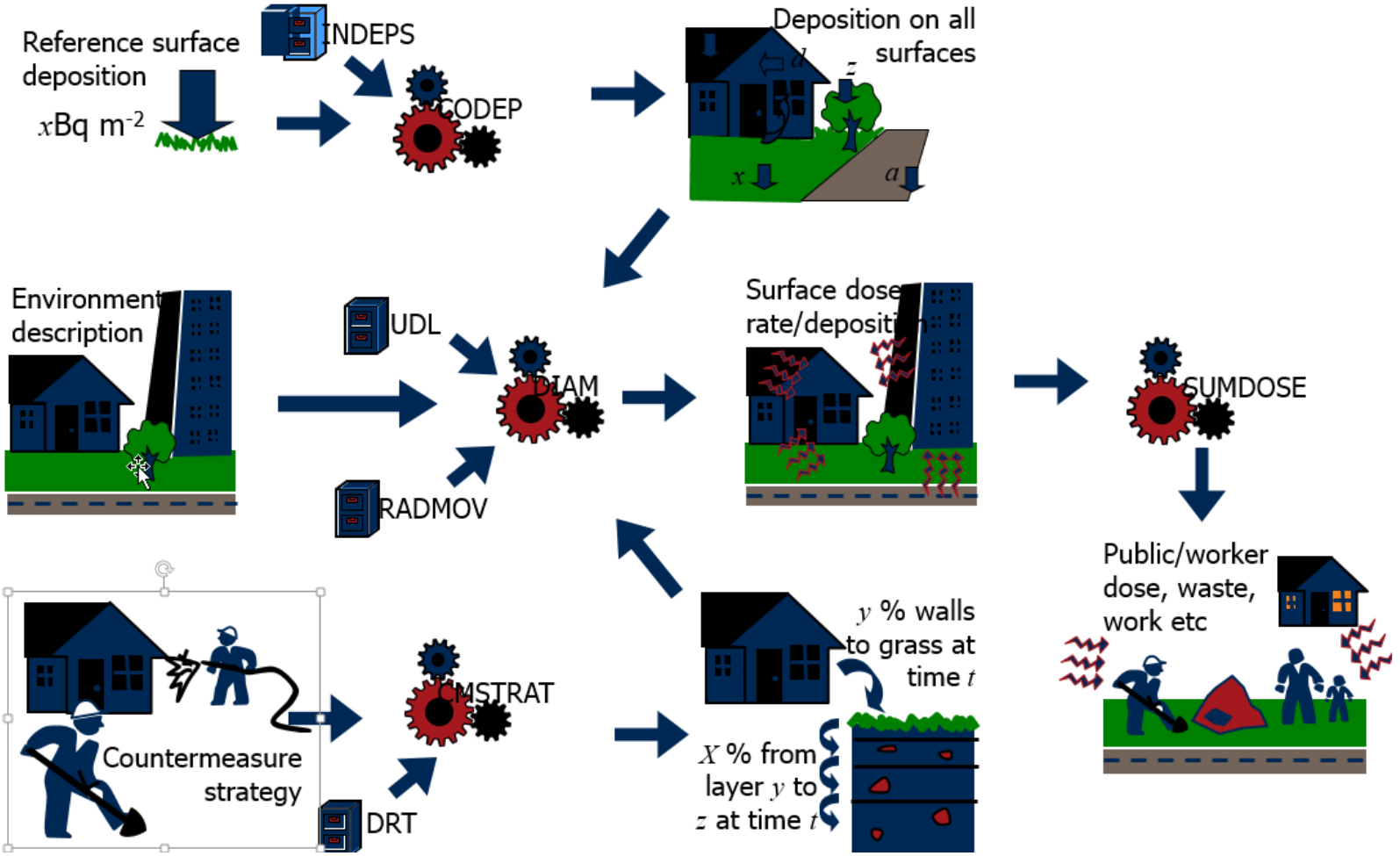
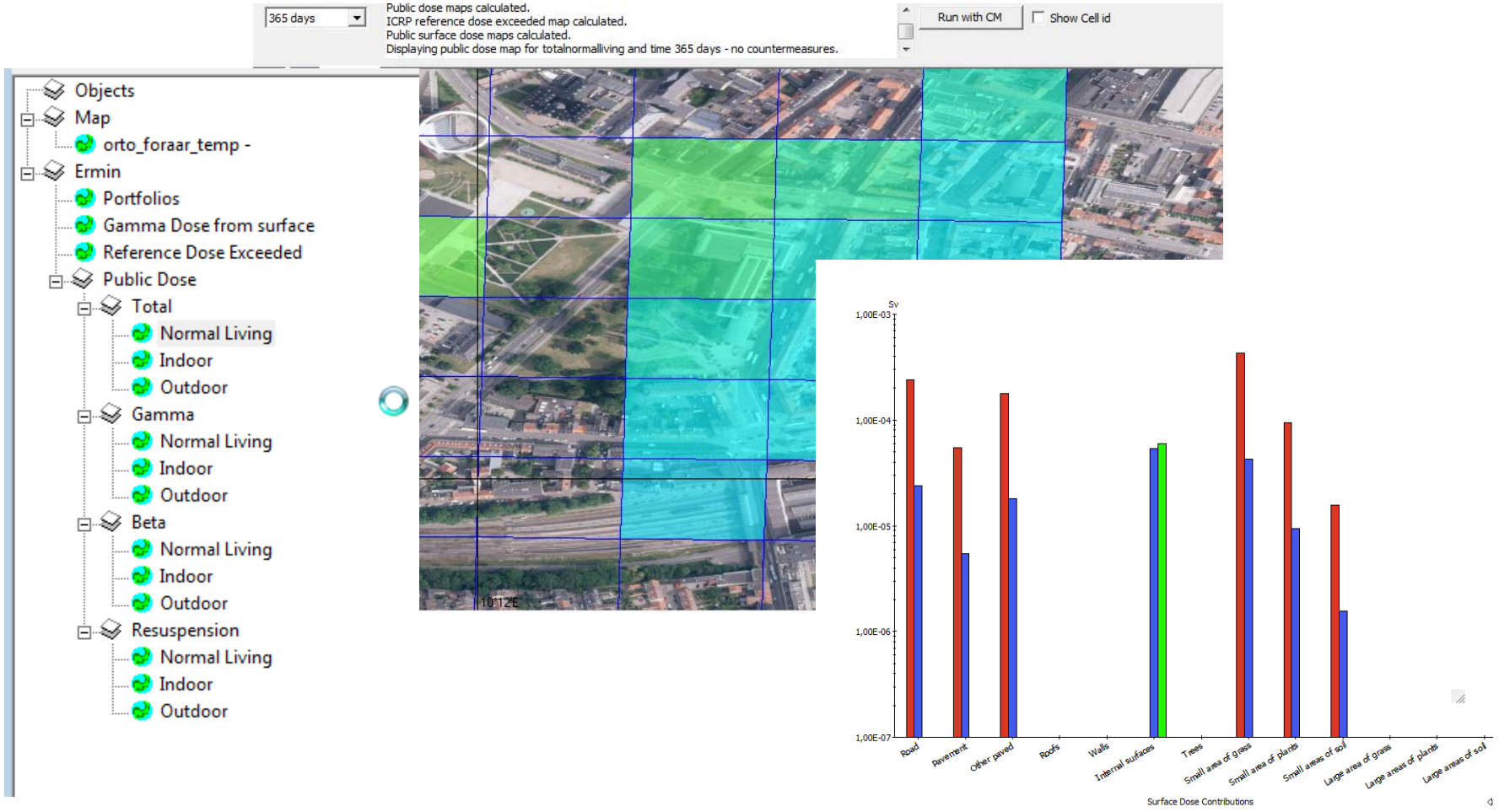



 Illustration from Tom Charnock (HPA, UK) presentation

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Dose and Countermeasure modelling in URBAN areas – ERMIN display

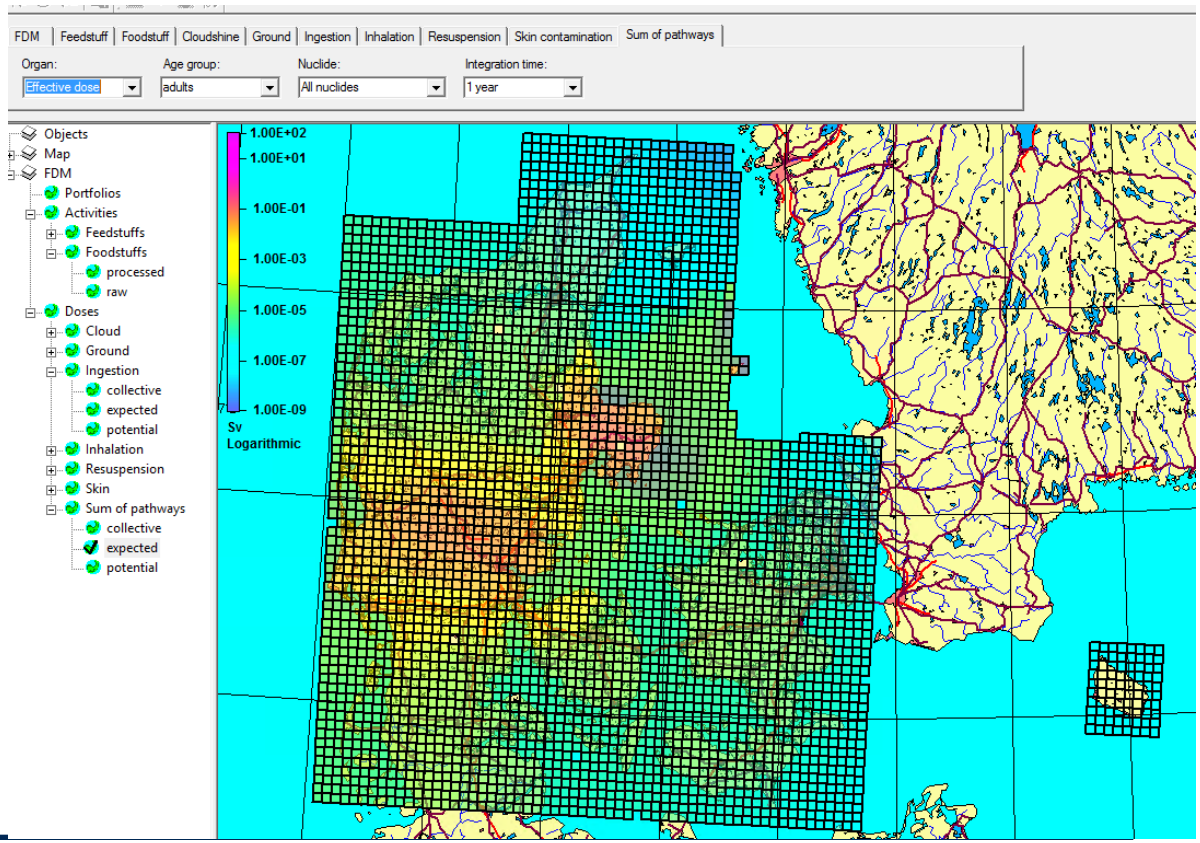





DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Food Dose and Countermeasure Modelling

- First version of the implementation was based on municipalities but they became to large. In 2015 the basis was changed to 5 km grid (part of the Danish National Grid).

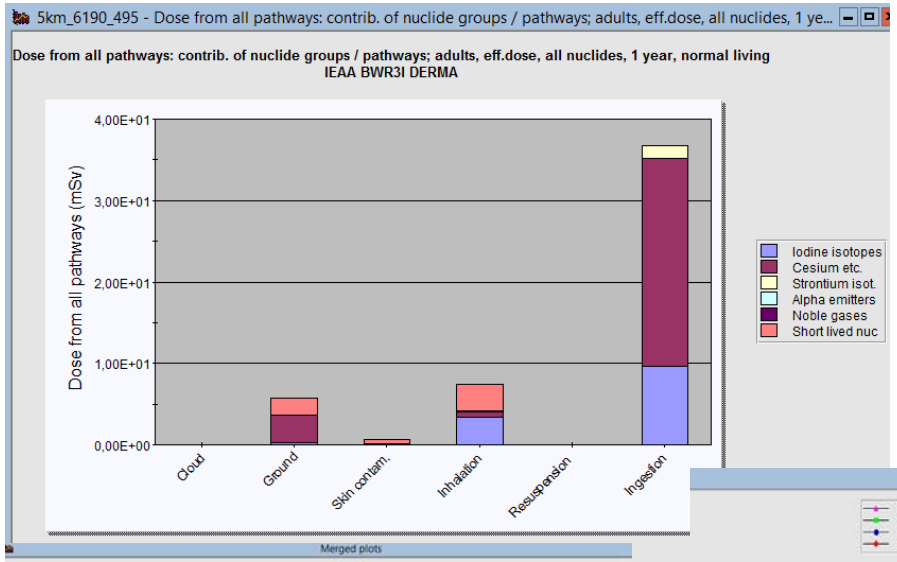


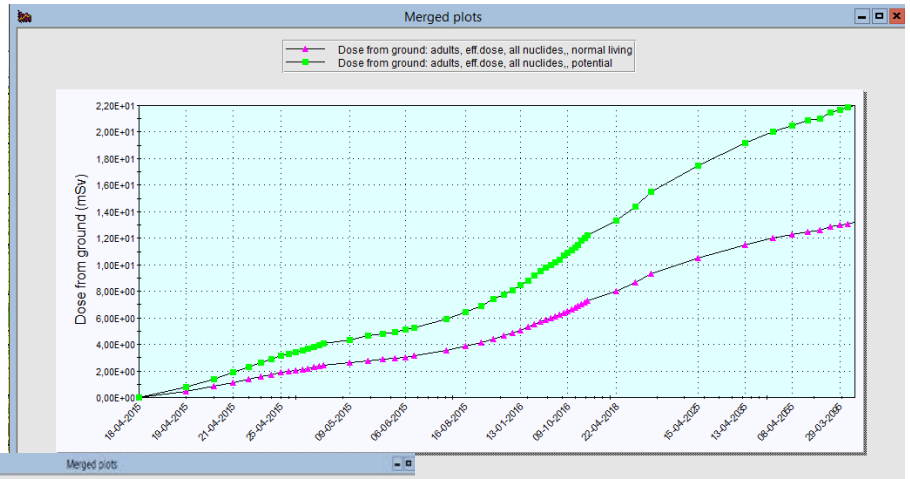


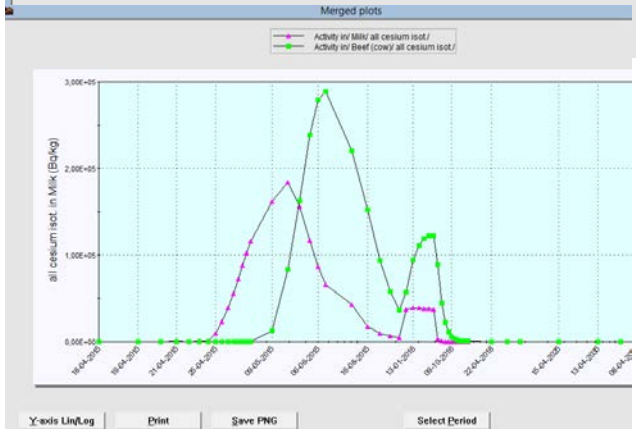

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

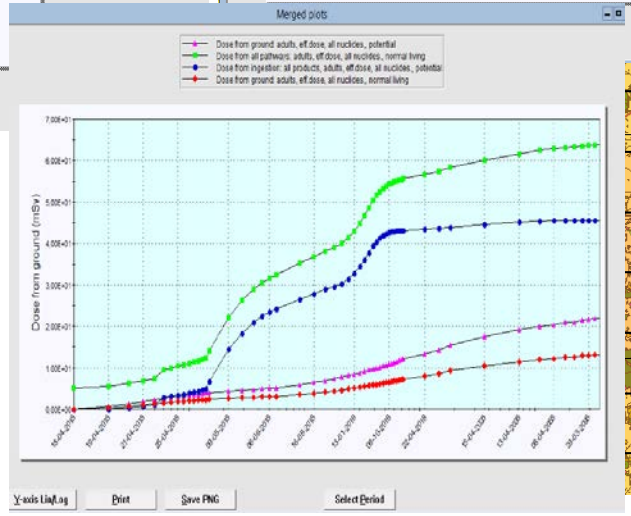
# Food Dose Modelling

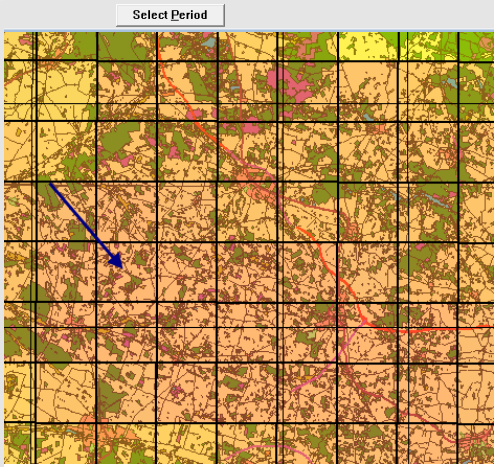
- ARGOS will list areas where the max food levels is exceeded






No countermeasures applied

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# Countermeasure strategy for URBAN or Food

***Countermeasures food:***

- Grass Cutting.
- Food ban.
- Evacuation.
- …….

***Countermeasures URBAN:***

- Evacuation
- Sheltering
- Tie Down
- Soil removel
- ……..

**Countermeasure Packages**

***Package A***

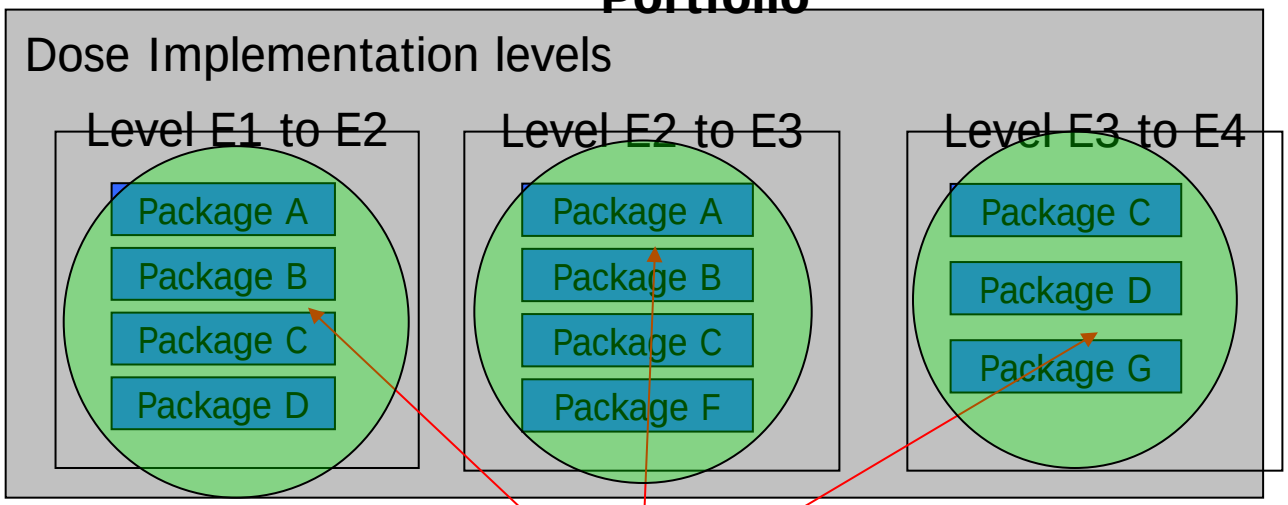
Countermeasure X from time t1AX to t2AX
Countermeasure Y from time t1AY to t2AY

***Package B***

Countermeasure X from time t1BX to t2BX
Countermeasure Z from time t1BZ to t2BZ

**Portfolio**

Dose Implementation levels




Outputs to VISA

**Strategy:**
Combination of Countermeasure Packages from the portfolio
(exactly 1 Package from every dose interval)

DEMA DANISH EMERGENCY MANAGEMENT AGENCY

# The near future for ARGOS

- Updated models with support for the new BSS's
  - ERMIN 2 and AgriCP is updated to include the new concepts from ICRP103/109.
  - ARGOS is a important tools for the implementation of the new BSS.
- Source Term for NPP will come later in the new EU-research FASTNET project.