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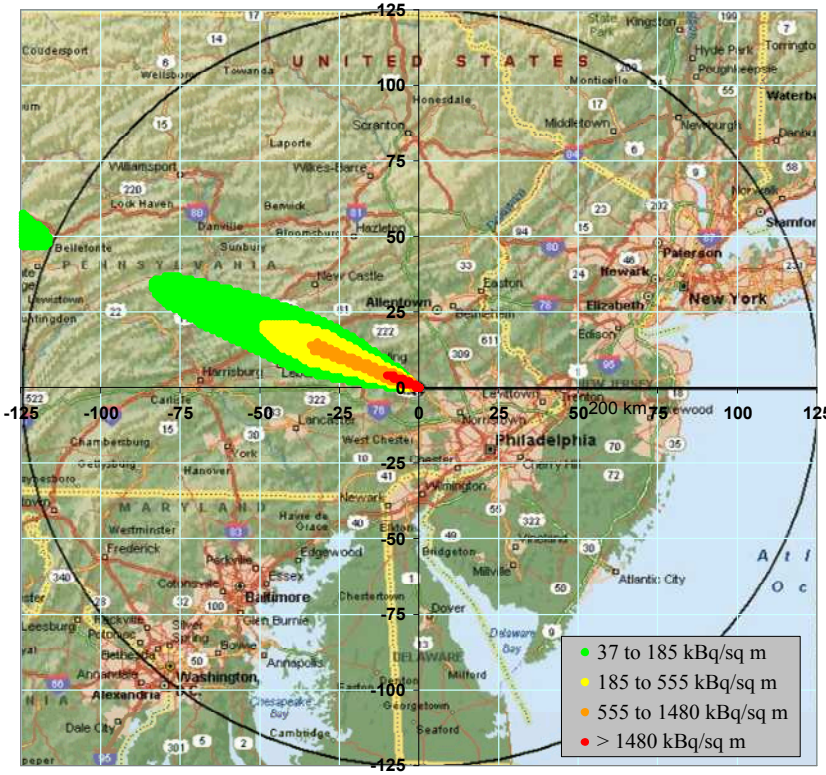

Brief Review of ATMOS Inputs

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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Objectives

- Review the categories of information required for the ATMOS module of MACCS
- Differentiate the portions of the inputs that are site or accident-scenario specific and those that are not

Functions of ATMOS

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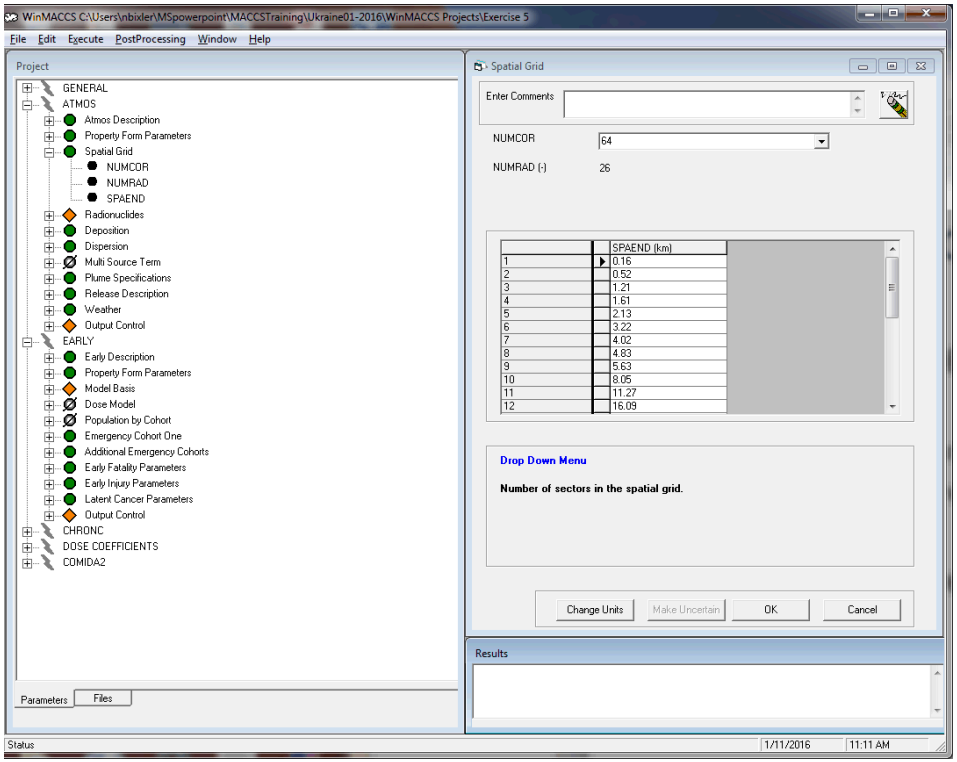
- Grid definition – often depends on site
- Choice of radionuclides to be modeled – depends on type of facility
- Atmospheric transport and deposition model options – usually independent of site or accident scenario
- Description of source term – highly dependent on facility and accident scenario being modeled
- Weather sampling definition – depends on location of facility

Grid Definition

- Up to 35 radial rings and 64 azimuthal sectors
- Considerations
  - Site exclusion boundary
  - Boundaries required for reactor licensing
  - Ect.
- Grid definitions are usually mostly the same between sites



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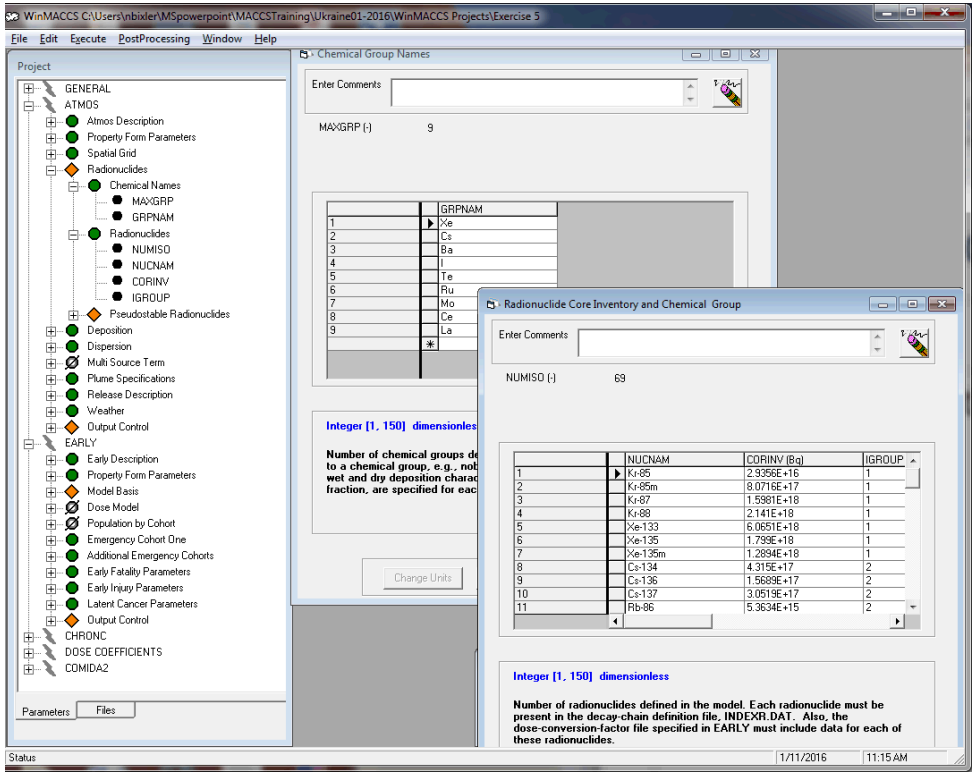
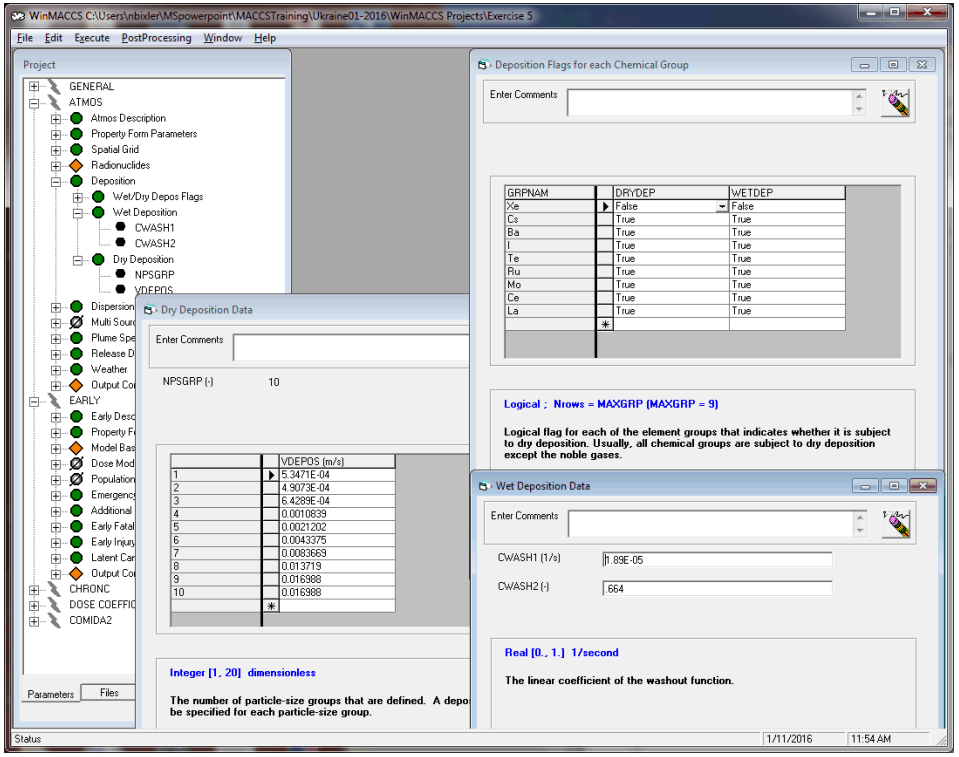
Choice of Radionuclides

- Definition of chemical groups (classes)
- Definition of radionuclides and their inventories belonging to each group
- Specification of decay chain terminators
- Consideration: ensure that important decay products are included in radionuclides list (e.g., Ba-137m)
- Radionuclide data depend mainly on type of facility



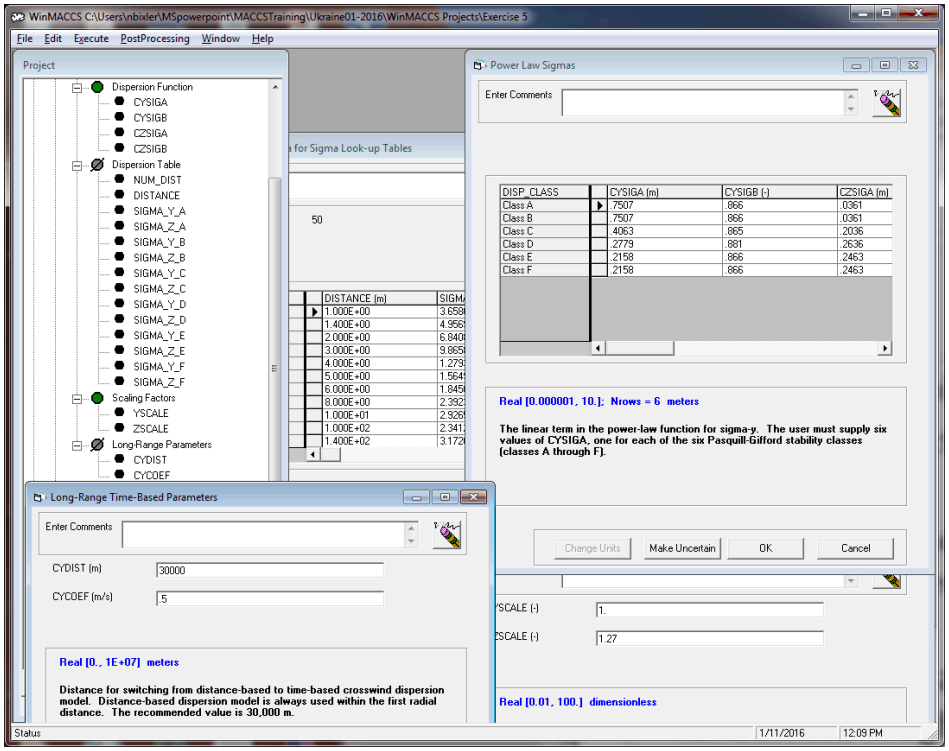
Deposition

- Definition of which chemical groups are affected by wet and dry deposition
- Definition of wet deposition parameters
- Determination of dry deposition velocities
- Dry deposition depends on surface roughness of site; wet deposition is site independent



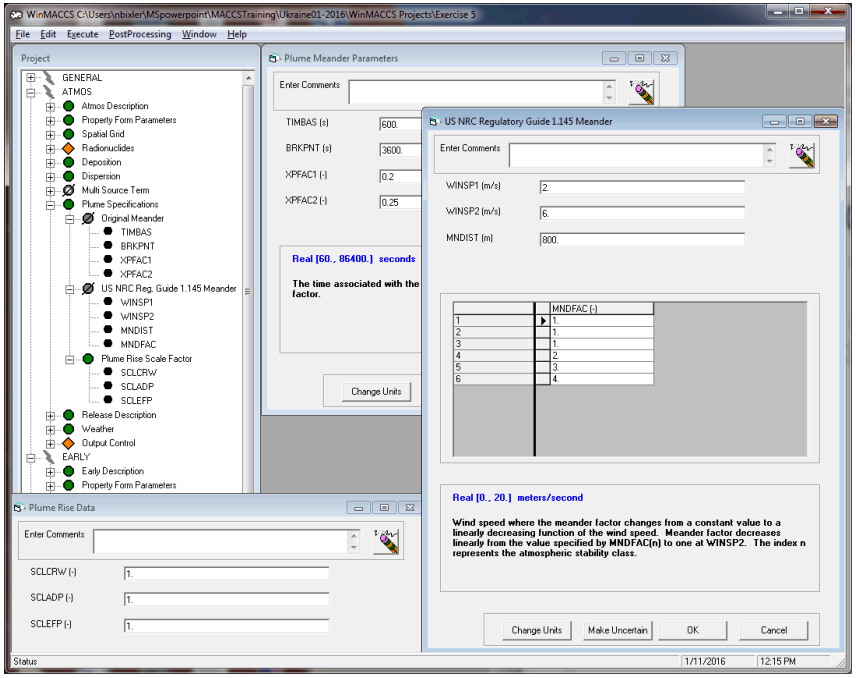
Atmospheric Dispersion

- Basic model choices
  - Power-law function
  - Lookup table
  - Time-based function beyond specified distance
- YSCALE used to account for surface roughness
- Only surface roughness is site dependent



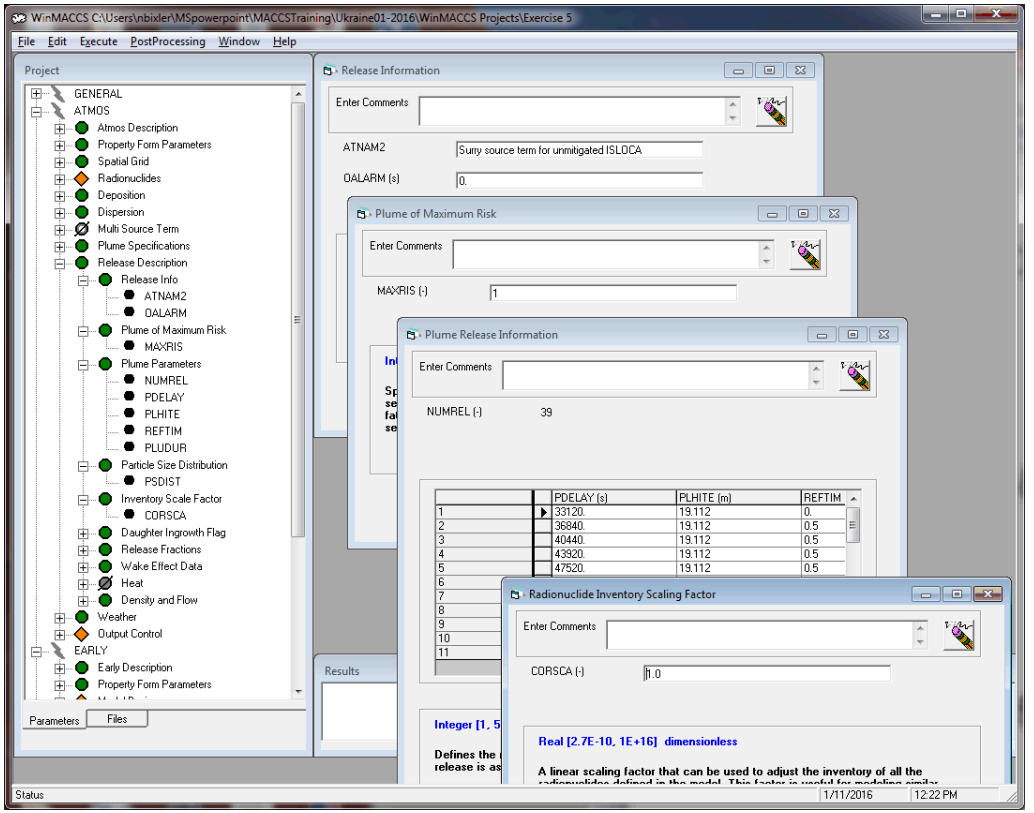
Plume Meander and Rise

- Plume meander options
  - Original meander model – duration of release
  - Reg. Guide 1.145 model – wind speed and stability class based on 1-hr plume segments
  - No meander
- Plume rise scale factors
- Parameters are independent of site and accident scenario



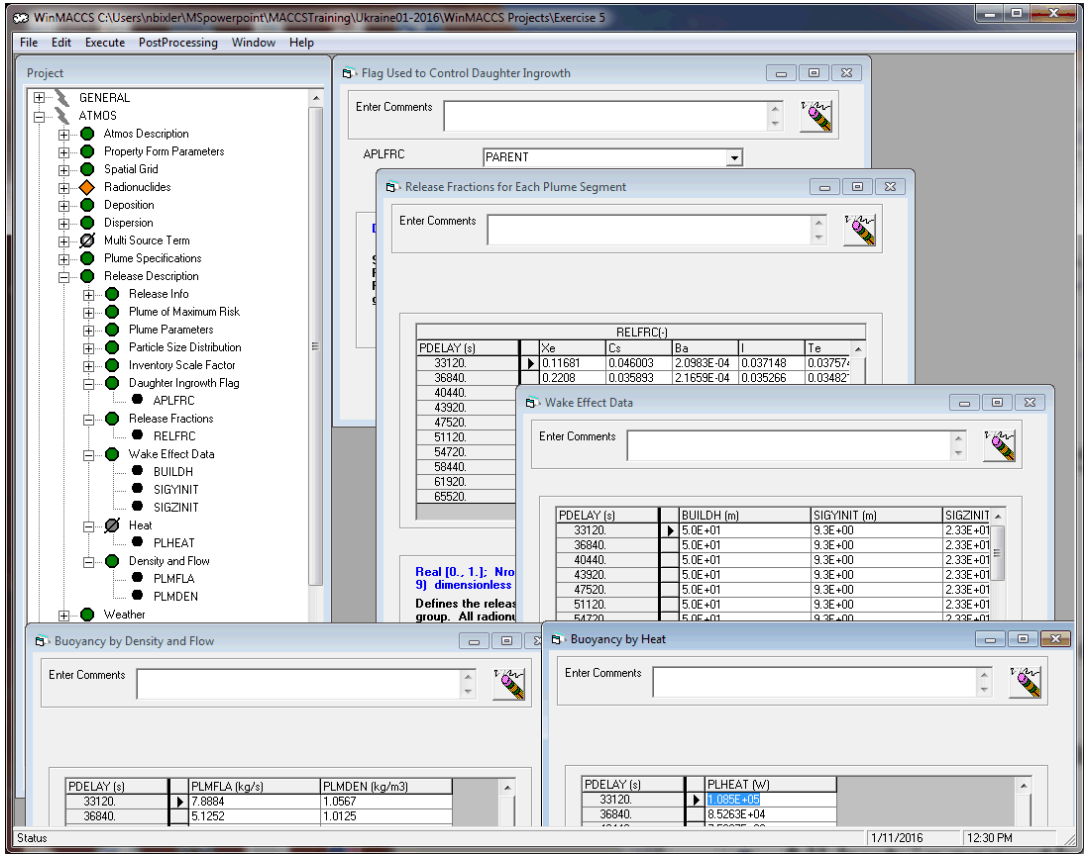
Release Description - I

- Alarm time – affects evacuation timing
- Maximum risk plume segment – affects alignment of release with weather
- Particle Size Distribution
- Inventory scale factor
- All of these choices depend on facility or accident scenario



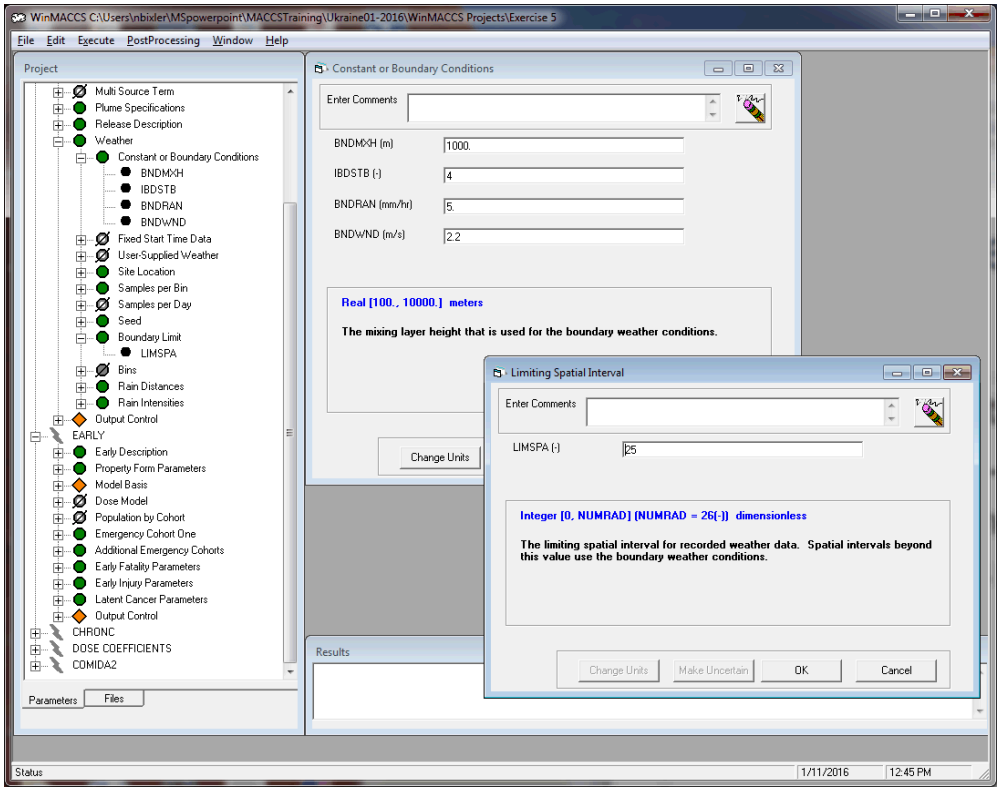
Release Description - II

- Ingrowth flag
- Release fractions
- Wake effects
- Buoyancy data
  - Rate of release of sensible heat
  - Plume density and flow rate
- All but ingrowth flag depend on facility or accident scenario



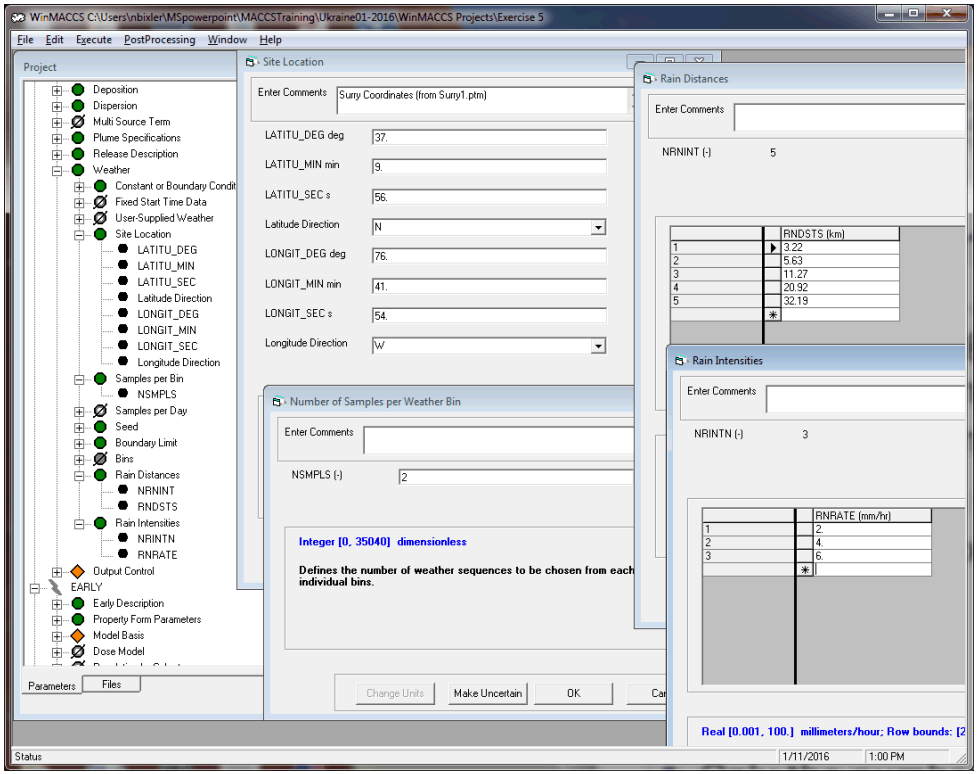
Boundary Weather

- Boundary conditions – constant weather used in outermost rings
- Boundary limit
  - Last ring where recorded weather data applies
  - Beyond this ring boundary weather applies



Weather Sampling

- Type of sampling method
- Number of samples
- Rain distances
- Rain intensities
- All but the sampling method may need to be reevaluated per site



Weather File

- A formatted (text) weather file is required for weather sampling
  - Weather data can be averaged over 1-hour, 30-minute, or 15-minute time periods
  - Wind direction, wind speed, atmospheric stability class, and precipitation rate must be supplied for each time period in a 365-day year (e.g., an hourly data point for 8760 hours)
  - The last line of the file must contain seasonal day and night mixing heights

Recent and Future Development

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- An alternative atmospheric transport and deposition model using Lagrangian particle tracking is being developed
- A multi-unit model has recently been developed and is supported in MACCS 3.10
- MelMACCS can be used to extract source-term data from MELCOR plot files
- A recent version of MelMACCS (2.0) supports multi-unit releases

Summary

- ATMOS models atmospheric release, dispersion, and deposition of radionuclides.
- Many of the ATMOS input parameters are facility (site) or accident-scenario dependent.
- Some of the ATMOS input parameters are insensitive to site and accident scenario.