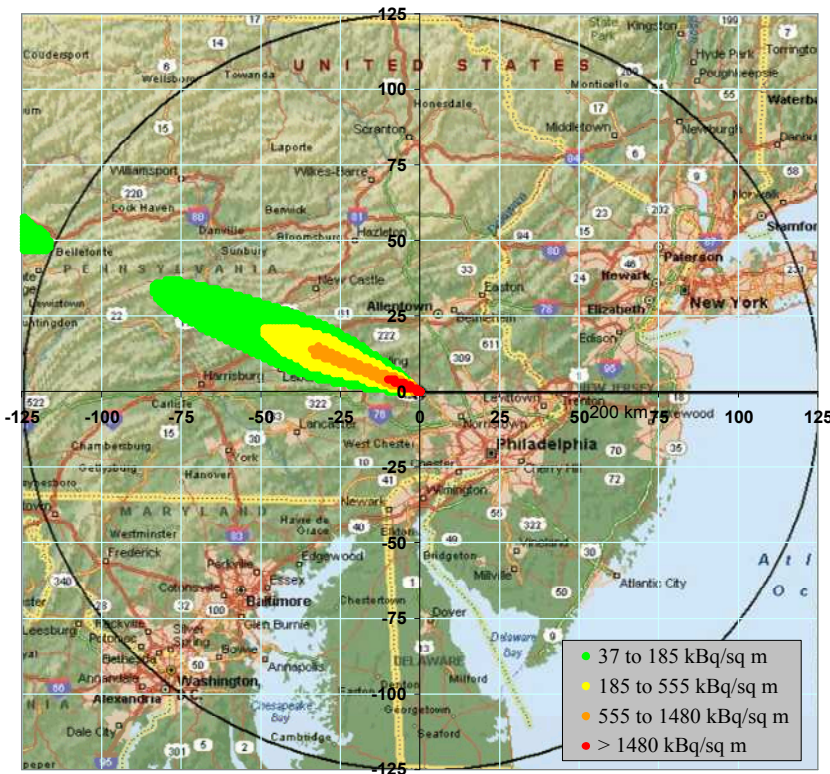


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Brief Review of ATMOS Inputs

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Objectives

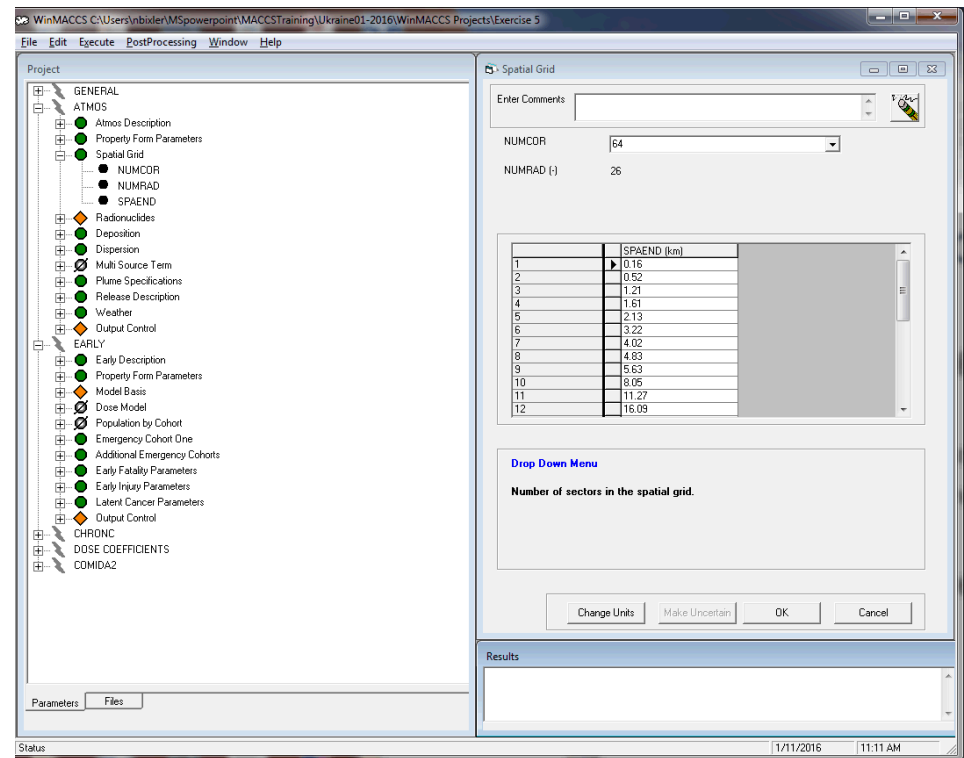
- Review the categories of information required for the ATMOS module of MACCS
- Differentiate the portions of the inputs that are site or accident-scenario specific and those that are not

Functions of ATMOS

- 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



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

The screenshot displays the WinMACCS software interface, specifically the 'Chemical Group Names' and 'Radionuclide Core Inventory and Chemical Group' windows. The left pane shows a project tree with categories like GENERAL, ATMOS, and EARLY. The 'Chemical Group Names' window shows a table for defining chemical groups, with columns for GRPNAME and a list of elements (Xe, Cs, Ba, I, Te, Ru, Mo, Ce, La). The 'Radionuclide Core Inventory and Chemical Group' window shows a table for defining radionuclides, with columns for NUCNAME, CORINV (Bq), and IGROUP. Below the table, there is a note: 'Number of radionuclides defined in the model. Each radionuclide must be present in the decay chain definition file, INDEXR.DAT. Also, the dose-conversion-factor file specified in EARLY must include data for each of these radionuclides.'

GRPNAME	Element
1	Xe
2	Cs
3	Ba
4	I
5	Te
6	Ru
7	Mo
8	Ce
9	La

NUCNAME	CORINV (Bq)	IGROUP	
1	Kr-85	2.9356E+16	1
2	Kr-85m	8.0716E+17	1
3	Kr-87	1.5981E+18	1
4	Kr-88	2.141E+18	1
5	Xe-133	6.0651E+18	1
6	Xe-135	1.799E+18	1
7	Xe-135m	1.2894E+18	1
8	Cs-134	4.315E+17	2
9	Cs-136	1.5689E+17	2
10	Cs-137	3.0519E+17	2
11	Rb-86	5.3634E+15	2

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

The screenshot displays the WinMACCS software interface, specifically the 'Deposition Flags for each Chemical Group' and 'Wet Deposition Data' windows.

Deposition Flags for each Chemical Group:

GRPNAM	DRYDEP	WETDEP
Xe	False	False
Cs	True	True
Ba	True	True
I	True	True
Te	True	True
Ru	True	True
Mo	True	True
Ce	True	True
La	True	True

Logical: Nrows = MAXGRP (MAXGRP = 9)

Logical flag for each of the element groups that indicates whether it is subject to dry deposition. Usually, all chemical groups are subject to dry deposition except the noble gases.

Wet Deposition Data:

Enter Comments:

CWASH1 (1/s): 0.08E-05

CWASH2 (-): .564

Real [0., 1.] 1/second

The linear coefficient of the washout function.

Dry Deposition Data:

Enter Comments:

NPSGRP (-): 10

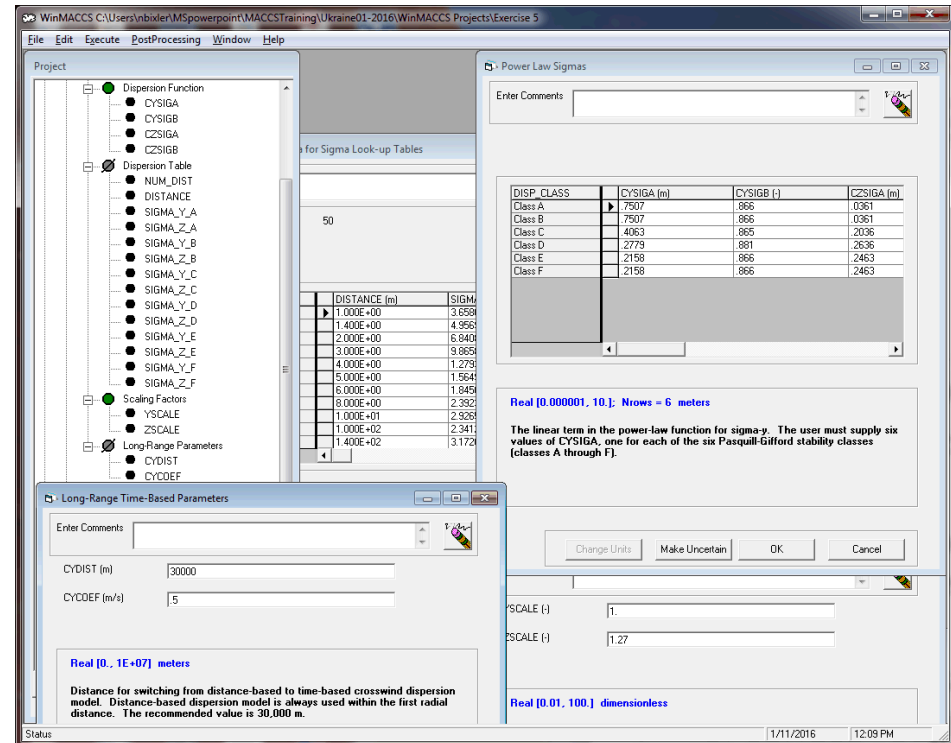
	VDEPOS (m/s)
1	5.3471E-04
2	4.3073E-04
3	6.4289E-04
4	0.0010839
5	0.0021202
6	0.0043375
7	0.0083663
8	0.013719
9	0.016988
10	0.016988

Integer [1, 20] dimensionless

The number of particle-size groups that are defined. A deposite must be specified for each particle-size group.

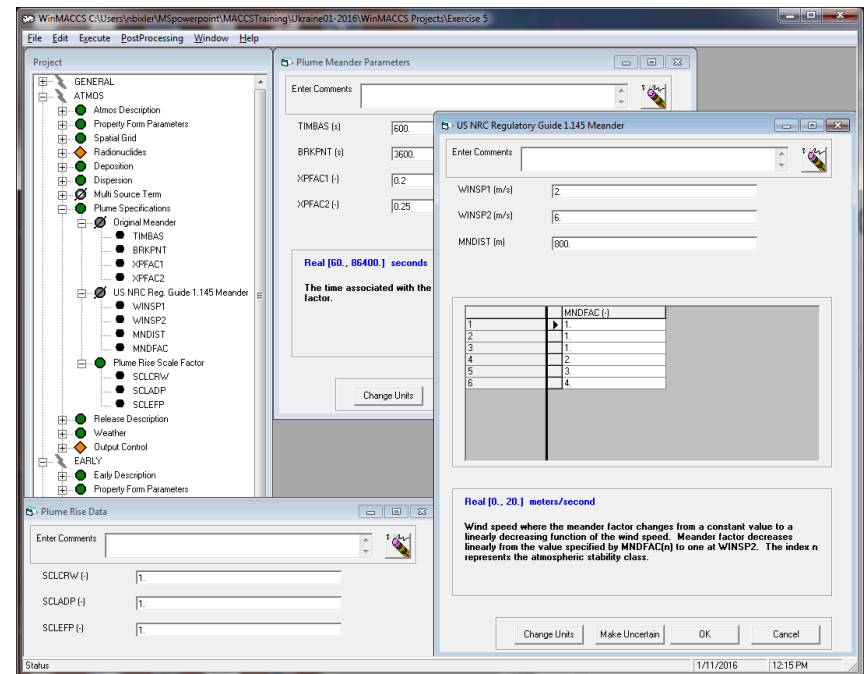
Atmospheric Dispersion

- 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



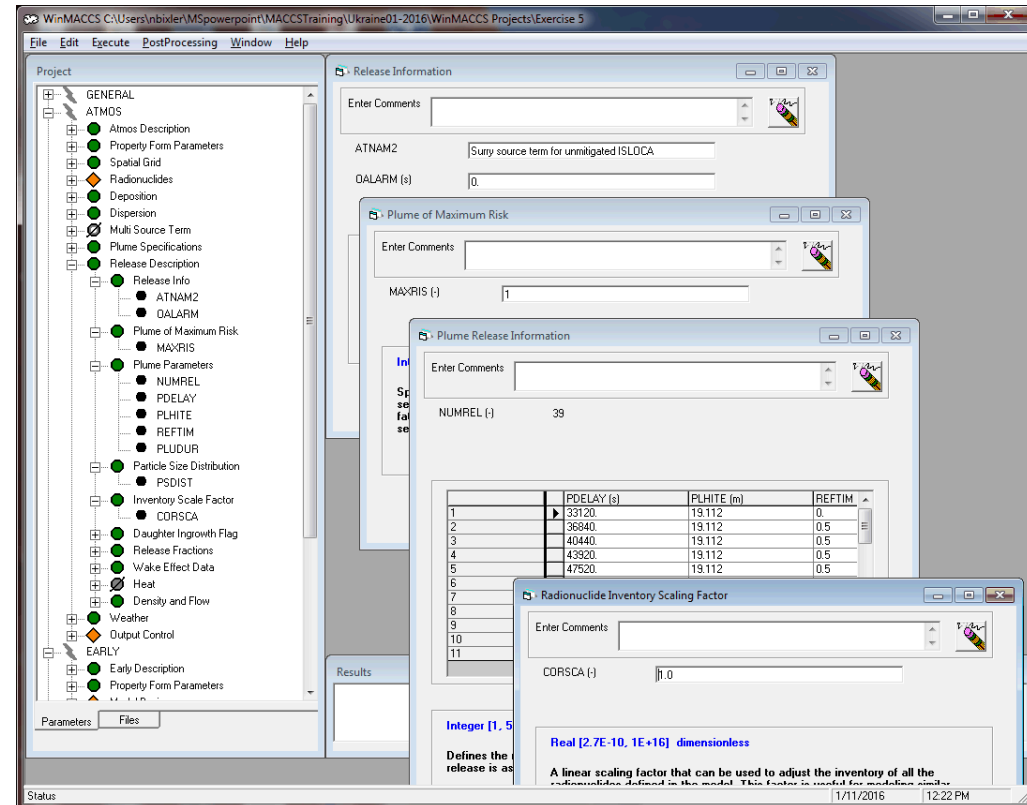
Plume Meander and Rise

- 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

The screenshot displays the WinMACCS software interface with several windows open for configuring release parameters. The main Project window on the left shows a tree view of the input structure, including sections for Atmos, Release Description, and Buoyancy. Overlaid windows include:

- Flag Used to Control Daughter Ingrowth:** A window for setting the APLFRC flag to PARENT.
- Release Fractions for Each Plume Segment:** A window with a table for RELFRC(-) parameters.
- Wake Effect Data:** A window with a table for WAKE parameters including BUILDH, SIGYINIT, and SIGZINIT.
- Buoyancy by Density and Flow:** A window with a table for PLMFLA and PLMDEN parameters.
- Buoyancy by Heat:** A window with a table for PLHEAT parameters.

Below is the data from the 'Release Fractions for Each Plume Segment' window:

PDELAY (s)	Xe	Cs	Ba	I	Te
33120	0.11681	0.046003	2.0983E-04	0.037148	0.037574
36840	0.2208	0.035893	2.1659E-04	0.035266	0.034827
40440					
43920					
47520					
51120					
54720					
58440					
61920					
65520					

Below is the data from the 'Buoyancy by Density and Flow' window:

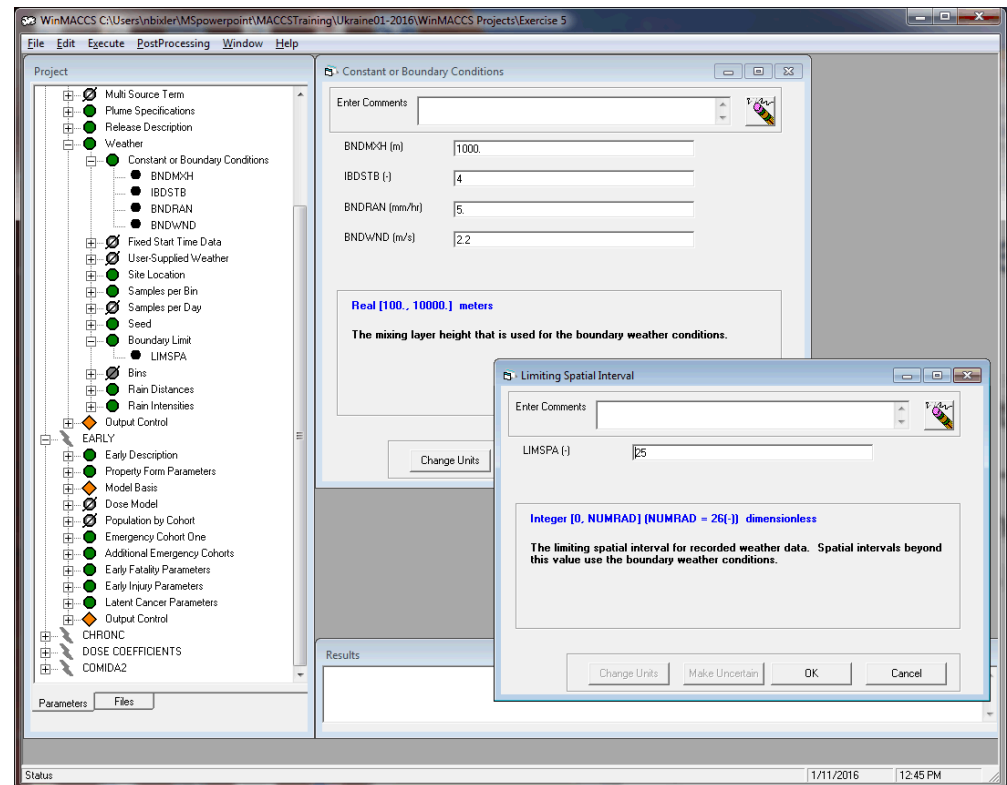
PDELAY (s)	PLMFLA (kg/s)	PLMDEN (kg/m3)
33120	7.8884	1.0567
36840	5.1252	1.0125

Below is the data from the 'Buoyancy by Heat' window:

PDELAY (s)	PLHEAT (W)
33120	1.0395E+06
36840	8.5263E+04

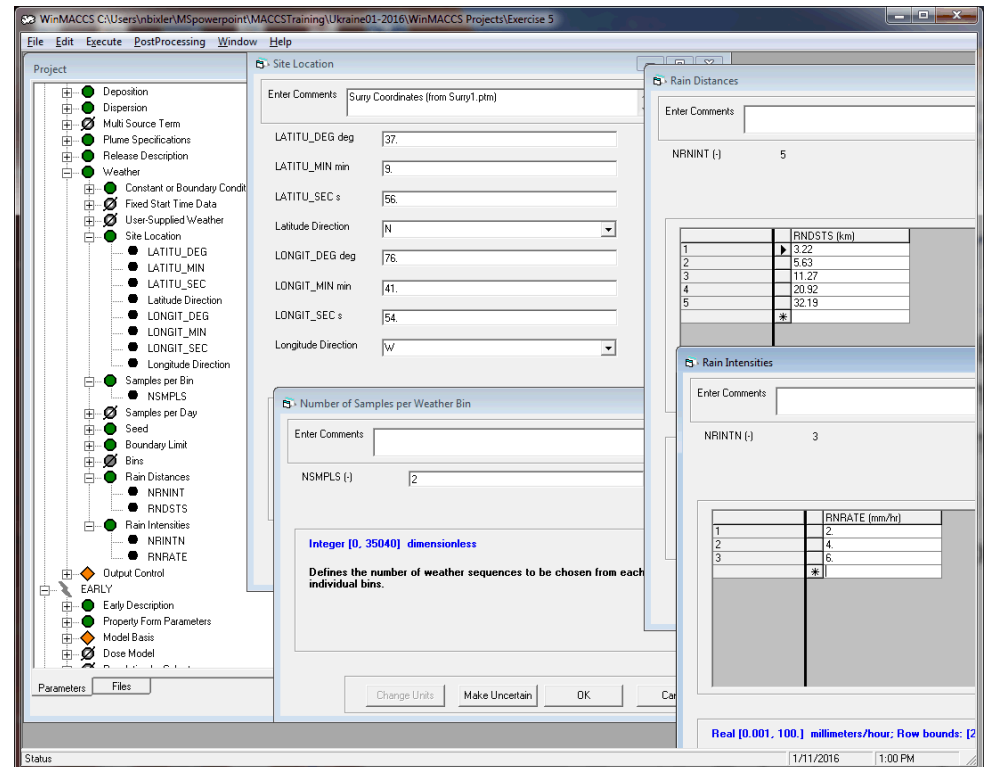
Boundary Weather

- 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



The screenshot shows the WinMACCS software interface with the following panels and data:

Project Tree:

- Deposition
- Dispersion
- Multi Source Term
- Plume Specifications
- Release Description
- Weather
 - Constant or Boundary Condition
 - Fixed Start Time Data
 - User-Supplied Weather
 - Site Location
 - LATITU_DEG
 - LATITU_MIN
 - LATITU_SEC
 - Latitude Direction
 - LONGIT_DEG
 - LONGIT_MIN
 - LONGIT_SEC
 - Longitude Direction
 - Samples per Bin
 - NSMPLS
 - Samples per Day
 - Seed
 - Boundary Limit
 - Bins
 - Rain Distances
 - NRINT
 - RNDSTS
 - Rain Intensities
 - NRINTN
 - RNRATE
- Output Control
 - EARLY
 - Early Description
 - Property Form Parameters
 - Model Basis
 - Dose Model

Site Location Panel:

Enter Comments: Sunny Coordinates (from Sunny1.ptm)

LATITU_DEG deg: 37.
 LATITU_MIN min: 3.
 LATITU_SEC s: 56.
 Latitude Direction: N
 LONGIT_DEG deg: 76.
 LONGIT_MIN min: 41.
 LONGIT_SEC s: 54.
 Longitude Direction: W

Number of Samples per Weather Bin Panel:

Enter Comments:

NSMPLS (-): 2

Integer [0, 35040] dimensionless

Defines the number of weather sequences to be chosen from each individual bins.

Buttons: Change Units, Make Uncertain, OK, Cancel

Rain Distances Panel:

Enter Comments:

NRINTN (-): 5

	RNDSTS (km)
1	3.22
2	5.63
3	11.27
4	20.32
5	32.19

Rain Intensities Panel:

Enter Comments:

NRINTN (-): 3

	RNRATE (mm/hr)
1	2
2	4
3	6

Real [0.001, 100.] millimeters/hour; Row bounds: [2

Status: 1/11/2016 1:00 PM

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

- 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.