**Overview of the AALM:**

The AALM predicts blood and tissue Pb masses (µg) and concentrations (µg/g) resulting from exposures to Pb in air, drinking water, surface dust, food, or miscellaneous Pb ingestion pathways. The AALM exposure module allows the user to simulate multi-pathway exposures that are constant or that vary in time increments as small as one day; and that occur at any age from birth to 90 years. The user can select to run a Pb biokinetics simulation based on either the Leggett (AALM-LG) or O’Flaherty (AALM-OF) biokinetics models. The ICRP human Respiratory Tract Model (HRTM) deposition and absorption parameters are used in both the AALM-LG and AALM-OF. The user can select gastrointestinal absorption fractions for any age values as well as values for relative bioavailability (RBA) of Pb from all ingestion pathways.

**Required Files to Run AALM:**

Files required to run the AALM are listed in Table 1.

**Installation of AALM:**

AALM-LG and AALM-OF can be run from separate or the same acslX workspace. Having both models in the same workspace is recommended if the user intends to switch back and forth between the AALM-LG and AALM-OF models. In either case, all of the files listed in Table 1 that run either model must be included in the same file directory. Figure 1 shows the recommended file architecture for implementing both models within a single acslX workspace.

**AALM Data Flow:**

The data flow for AALM simulations is shown in Figure 2. The AALM simulation is implemented in acslX with AALM\_LG.csl (or AALM\_OF.csl). Input parameter values are selected by the user in an INPUT&OUTPUT Excel file (.xlsm). Macros in the INPUT&OUTPUT Excel file pass the input parameter values to a comma-delimited (CSV) text file (INPUT.DAT). Data in INPUT.DAT are imported into the AALM acslX program with acslX m-file scripts. Output variables from the simulation are passed from acslX to a CSV file (OUTPUT.DAT) and are read into the INPUT&OUTPUT Excel file with Excel macros.

**AALM Inputs and Outputs:**

AALM inputs and outputs are controlled and recorded in the INPUT&OUTPUT.xlsm workbook. This workbook has several functions:

1. Allows the user to set input parameter values for AALM simulations
2. Macros in this workbook are used to pass data to and from acslX
3. Allows the user to plots AALM output data
4. Provides a complete record of input values and results of each AALM simulation

Table 2 summarizes the function of each worksheet in the INPUT&OUTPUT.xlsm workbook.

Data are entered into the yellow highlighted cells of each worksheet. Do not edit cells that are highlighted in grey or add or delete or columns to any worksheets, as this will result in errors in model simulations. The only exception to this is the PLOT worksheet, which can be modified as needed to produce plots of interest.

**Running AALM Simulations:**

The sequence presented below is for running an AALM-LG simulation. The identical sequence would be used for running AALM-OF with the corresponding files.

1. Open acslX AALM workspace
2. In acslX, set AALM\_LG as active project
3. Open AALM-LG INPUT&OUTPUT.xlsm
4. In the SUMULATION CONTROL worksheet, enter:

* address of the OUTPUT.DAT file
* name of INPUT&OUTPUT file
* last day of simulation
* communication interval for data output

1. Enter exposure parameter values for AIR, DUST, WATER, FOOD, OTHER
2. Enter biokinetics parameter values for RBA, LUNG, SYSTEMIC and GENDER (only if user intends to modify the biokinetics model)
3. Save the AALM-LG INPUT&OUTPUT.xlsm file (you do not have to close the file for the model to run)
4. In the SUMULATION CONTROL worksheet, click the CLEAR DATA macro button (this clears data from the OUTPUT worksheet and is an optional step)
5. In the SUMULATION CONTROL worksheet, click the EXPORT DATA macro button (this exports data from the EXPORTDATA worksheet to the acslX simulation file AALM\_LG\_INPUTDATA.DAT)
6. In acslX, run AALM\_LG\_RUN.m (right click on file name and select RUN)
7. In the SUMULATION CONTROL worksheet, click the IMPORT DATA macro button (this imports output data from the acslX simulation file AALM\_LG\_OUTPUTDATA.DAT to the OUTPUT worksheet of AALM-LG INPUT&OUTPUT.xlsm)
8. View output data in OUTPUT worksheet and plots of output data in PLOT worksheet
9. Save the workbook to have a record of the simulation inputs and outputs

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| **Table 1. Required Files to Run AALM** | | |
| AALM-LG | AALM-OF | Function of File |
| AALM-LG INPUT&OUTPUT.xlsm | AALM-OF INPUT&OUTPUT.xlsm | * Sets and records simulation control, exposure and biokinetics inputs * Export inputs to acslX * Imports and records outputs from acslX * Plots outputs |
| AALM\_LG.csl | AALM\_OF.csl | Runs acslX simulation (model source code) |
| AALM\_LG\_IN.m | AALM\_OF\_IN.m | Loads data from INPUTDATA.DAT into acslX simulation |
| AALM\_LG\_OUT.m | AALM\_OF\_OUT.m | Writes output from acslX simulation to OUPUTDATA.DAT |
| AALM\_LG\_RUN.m | AALM\_OF\_RUN.m | Starts acslX simulation |
| AALM\_LG\_INPUTDATA.DAT | AALM\_OF\_INPUTDATA.DAT | Receives input data from INPUT&OUTPUT.xlsm |
| AALM\_LG\_OUTPUTDATA.DAT | AALM\_OF\_OUTPUTDATA.DAT | Receives output data from acslX simulation |
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| **Table 2. Worksheets in the INPUT&OUTPUT.xlsm Workbook** | |
| Worksheet | Function |
| SUMMARY | Displays a selection of input and output parameter settings for simulation |
| SIMULATION CONTROL | Sets parameter values for macros (OUTPUT file address and INPUT&OUTPUT file name)  Sets parameter values for end time of simulation and output data communication interval  Activation of data processing macros (EXPORT DATA, IMPORT DATA, CLEAR) |
| AIR | Sets parameter values for discrete and pulsed air Pb concentrations and ventilation rates |
| WATER | Sets parameter values for discrete and pulsed drinking water Pb concentrations and drinking water intake rates |
| DUST | Sets parameter values for discrete and pulsed surface dust Pb concentrations and dust intake rates |
| FOOD | Sets parameter values for discrete and pulsed food Pb intake rates |
| OTHER | Sets parameter values for discrete and pulsed Pb intake rates for other Pb sources |
| RBA | Sets parameter values for absorption fraction and RBA for Pb in dust, water, food, other, and Pb ingested after inhalation |
| LUNG | Sets parameter values for ICRP Human Respiratory Tract Model |
| SYSTEMIC | Sets values parameters that control the systemic biokinetics model |
| GENDER | Sets values for gender parameters that control growth simulations |
| OUTPUT | Displays values for output variables |
| PLOT | Plots values for output variables in the OUTPUT and COMPARISON DATA worksheets |
| COMPARISON DATA | Displays output values for comparison simulation (these are copied and pasted into this worksheet from a previously run simulation) |
| EXPORTDATA | Records input parameter values to be exported to acslX when EXPORT macro is run |
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