What's New with AERmodels

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The development of AERmodels (previously ERCBmodels) for flaring and incineration follows (note, several internal versions were developed but not necessarily released):

AERflare-incin.xlsm

AERflare-incin Version V2.10.180517
- Corrected, again, the run flags displayed on oAERSCREEN. The flags are written upon completion of the calculations for each of the six run cases.
- Add maximum limit to fire ball radiation emissivity
- Adjusted significant digits on BlowDown page for better viewing

AERflare-incin Version V2.10.180413
- Corrected write to iBATCH of the iTERRAIN output elevations. The first point was missing. CAUTION: This correction shifts the data in the iBATCH at the iTERRAIN location.
- Added MDEBUGDUMP_HBH on the iSTART page. This creates a dump of the raw data during the meteorological processing for HBH analysis. A new workbook is created but is not saved.
- Added MDELTAT to allow flares to use the AERMOD delta-T method where the flare temperature is relative to the ambient temperature
- Added MNOSTD=1 to allow forcing of EPA, ONT and BC pseudo-source parameters to be correctly adjusted for stack tip downwash
- Corrected processing for screening mode when terrain is not provided/available. In this case, only the elevation is used on the iFACILITY page. Set the iSTART page MFORCETERRAIN=1 (parallel only). Set the iFACILITY "Screening Land-use Characterization" to a setting that represents the site-specific conditions.
- Added setting MFLAMEOUT=0 for normal flaring modelling. MFLAMEOUT=1, for flare sources, this setting uses source conditions based upon non-combusted gases venting from flare stack top. Use MyRUN cases for H2S only. NOSTD is not used.
- Corrected source for Beta settings for MPSEUDO for EPA, ONT and BC, the NOSTD is not used.
- Added solver buttons on iSOURCE page next to the Fuel gas. "Adjust for 98%" button will determine the FGR for Qmax, Qave and Qmin such that the conversion efficiency is 98%. The "Adjust 20 MJ/m3" will determine the FGR for Qmax, Qave and Qmin such that NHV is 20 MJ/m^3 for each scenario.

AERflare-incin Version V2.10.180319
- Corrected improper read of run flags. The default setting of the run flags all blank or all set was not read correctly, and a run with all blank was returned without running any met conditions.
- BETA: Added processing of EPA, British Columbia and Ontario flaring source pseudo-parameters. The methods are selectable using the iSTART page and the mpseudo.
- Updated the RBC criteria to 99.9087% from 99.9% to better match the 8760 hours. The 99.9087% is equivalent to the 9th highest.
- Updated the land classification processing to change from point sample methodology to more precise land use area calculation method. This changes the processing from point-wise sub-sampling of a grid cell N-

times to determine the average LCC codes; and instead, determines the polygon area of each LCC type within a cell.
- Added optimized sorting algorithm to speed up post-processing and meteorological processing
- Corrected bad write of data to parallel assessment on oAERSCREEN with zeroes. This corrects a false warning message of apparent minimum data requires on the oSUMMARY page

AERflare-incin Version V2.10.180205
- Corrected/adjusted warnings and messages on the iSOURCE and oSUMMARY page to match the change in output method (text YES/NO/PASS/FAIL vs radio buttons). Several messages adjacent to PASS/FAIL results on oSUMMARY were not displayed appropriately resulting from previous changes in buttons and may have caused some confusion. Sorry. Added highlights for faster review of issues that may require further documentation for applications.
- Added the display of potential issues raised on oSUMMARY to general red flags
- Added default notes to the iNOTES page.
- Added Run flags and source orientation to the recalculation required lists on oAERSCREEN
- Set the axis divisions to auto on the figure on oBLOWDOWN so that the figure adjusts to all sorts of inputs
- For permits, added a new figure page to display the AER_FIGURE4 flow chart with decision points from the entries.
- Corrected UTM zone bug when entering Geographical coordinates on iSOURCE page then making calculations on iTERRAIN or iUSERTER pages
- Changed coding to avoid false-positives of malicious or suspicious activity during virus scanning when sending by eMail to AER. Removed dead code. Changed coding practice of saving settings to registry to a method that saves settings to a file on windows temp folder. A file "AERTOOLS_Settings_AERflare.ini" is created to save inter-session settings such ViewTechnicalPages, iBin Settings, etc. Each time you open a spreadsheet, it will check if the INI file exists, and if so, it will refresh the settings in the workbook being loaded. If the INI file does not exist, then the workbook will create the file as required to save your settings.
- Changed the name of the oCALCULATIONS page to oCALCFLARE.
- Added warning flags to the top of oBLOWDOWN page
- Corrected auto-scaling issues on oBLOWDOWN figure 1
- (Beta Testing) Unlocked the ONT MOE variable radiation heat loss method (see mvarrad on iSTART) which uses the Ont. MOE method to adjust heat loss as a function of flared gas molar mass.
- (Beta Testing) Unlocked the oFOLIAGE processing page. This page is used for analyzing SO2 damage to foliage as part of MOE BC assessments. This page works with saved data and is a post-processing option.
- Added orange shading (warning) to fields on oSUMMARY page. Highlighted the Number of potential issues raised and number of non-default settings (top right of page) for reviewers.
- Corrected incorrectly dimensioned matrix when loading sources.csv and creating a receptor grid.
- Corrected mismatched receptor grid when loading sources.csv file.
- Adjusted entry of HEATER/BOILER efficiency entry; entered on iSOURCE page. Stack losses for heaters and boilers may be calculated on iENGINE page but is manually entered on the iSOURCE page
- Added POINT, POINTCAP, POINTHOR stack types to iSOURCE input page for incinerators, boilers, heaters, engines

- Adjusted Engine energy balance exhaust calculations. Calculations now use the engine specs as a starting point for heat loss at end of engine (may include muffler) and then adds 15% heat loss through stack.

AERflare-incin Version V2.09.171214
- Updates the percentile default from 99.9th to 99.9087th. This change will match the 9th highest result to the corresponding percentile for a dataset with exactly 8760 hours.

AERflare-incin Version V2.09.171213
- Corrects issue for receptor files with folder names that include a space(s)

AERflare-incin Version V2.09.170915
- Corrects external link error "Personal.xlam"

AERflare-incin Version V2.09.170914
- Corrects output for H2S for RBC and Climit; which always returned 100th value. This bug was introduced as part of the 170801 version.
- minor cosmetic fixes

AERflare-incin Version V2.09.170802
- Corrects 'Function not available to you' message when selecting Permit/Application or Flare/Incinerator on the iSTART page

AERflare-incin Version 2.09.170801.zip
- Corrected broken link

AERflare-incin Version 2.09.170801
- Corrected issue relating to the appearance of a virus (there wasn't a virus)
- Added option for batch mode operation to export the plottable data results from oAERSCREEN page
- Added processing to the oPROCESSING page to 'Add' a secondary modelling results to the the flaring. When modelling flares, the control setting NOSTD must be used when using the pseudo-parameters. For other sources NOSTD should not be used. Therefore, flares must be modelled separately from other sources. In Alberta, non-routine, upset and emergency flares are not modelled with other cumulative emissions. For routine flaring, flare emissions should be included with other emissions. If the dispersion modelling uses the same receptor grid, the output POSTFILE data time series can be added. The 'Add' switch allows the user to specify a POSTFILE output results for other sources which is added during run-time processing to form a cumulative concentration.
- Updated oMODELLING page to list real-source parameters and pseudo-source parameters. Added emission factors and emission rates of non-sour components.
- AERflare-incin now uses the newer format GeoTIFF for DEM rather than the older CDEM (no longer supported). The iBIN page is updated with the link to the new downloads. The GeoTIFF files are larger but processing them is a little bit faster.
- Bug fixes for Emissions Factors
- Bug fixes for Engine/Boiler/Heater calculations
- Updated code for downloading from the internet
- Added BC MOE foliage damage post-processing calculations
- Added Ont. MOE methodology for variable heat radiation losses with changes in flared gas MW.
- Added daily 1h maximum calculation as an alternative to maximum hourly average concentration.
- Added 24h and annual average calculations
- Added high-pressure fuel flare-assist. This flare-assist adds fuel additional fuel at high co-flowing momentum

- Updated the flare air-assist calculation to account for air required. Thus air-assist is assumed to replace stoichiometric air until satisfied. Air-assist greater than stoichiometric will then degrade combustion.
- revised presentation of oSUMMARY to avoid broken links issues.
- Small bug fixes

AERflare-incin Version 2.06.161101
- Corrected broken links on oSUMMARY page

AERflare-incin Version 2.06.161028
- Corrected printout on iTERRAIN, where Row 80 of the page could be over-written if the contour interval was low.
- Corrected printout on iTERRAIN of xyz-distance, where the start index in the contour data array could be calculated incorrectly depending upon the final contour interval
- Corrected iBATCH save of DEM_OUT (rows 56-80, exclusive of flare 0,0), instead of (rows 55-79, inclusive of flare 0,0).

AERflare-incin Version 2.06.161027
- Windows 10 Update KB3199209 leads to crash of Excel when AERflare-incin is loaded. Changed names of internal variables and VBA forms using the word "PASSWORD". This seems to avoid the crash.

AERflare-incin Version 2.06.160922
- Corrected over-writing
- Corrected missing calculation for Qmin flammability check for air assisted flaring.
- Corrected bug affecting selection of Incinerator source type dropdown and creating an error message "cannot write to protected area".

AERflare-incin Version 2.06.160912
- Updated the iBIN page with new location of LCC data
- Corrected a module bug causing a compile error message when the Get LCC data was pressed.

AERflare-incin Version 2.06.160906
- Updated the iBIN page with the new URL of the DEM data. The field has been change from write protected to user editable.
- oAERscreen page, the button for "Export Adjusted" for limit2 data renamed "Export Limt2 Adjusted" and correctly references the Limit2 data.
- Updated the H2S conversion calculation for incinerators to use Sulphur Experts (2005) correlation. iSTART page include incinerator kinetic design factor, with a default value of "1", and the user must provide justification for higher mixing rates.
- Corrected load from batch file initialization of pages and hiding of unused pages
- Small bug fixes

AERflare-incin Version 2.05.160608
- Corrected conditional formatting on iSOURCE when transient blowdown is selected. The minimum orifice diameter and discharge coefficient are not required if the override QMAX and QTOTAL are entered.
- Corrected oBLOWDOWN. Steps of equal volume were not displayed properly with override QMAX and QTOTAL are selected.

AERflare-incin Version 2.05.160607
- Corrected bug on iUSERMET page. When GetLCCData button is pressed, it erased the wrong cells range.

AERflare-incin Version 2.05.160601
- Bug fixes

AERflare-incin Version 2.05.160516
- New Feature: flare/incinerator types are now divided into flare and incinerator/engines/heaters. Stack heat losses are estimated for

incinerators/engines/heaters or is entered as 10% (old method). A new page has been added iENGINE for entry of non-flare type sources. Properties page rENGINES has been added for source information on standard/typical engines from GPSA.
- New Feature: emission estimates based upon AP42 for heaters, engines, boilers
- New Feature: a simple contour of terrain and/or concentration is available using required user downloads of GNUPLOT (freeware software) and GAWK (freeware software). This feature allows a simple figure to be created for users without purchasing Golden Software Surfer(TM).
- All inputs and outputs are saved on the iBATCH and oBATCH pages for a complete restore of all inputs and outputs on all pages
- Bug correction to input entry of surface location in lat-long
- Bug corrections

AERflare-incin Version 2.03.151102
- Limited the message to the status to be max allowed length of 255 characters. For systems, with long path names, the SetStatusBar routine could cause a non-fatal error message.
- added file name checking for invalid characters. Invalid characters are replaced by "_"

AERflare-incin Version 2.03.150804
- Incorporated changes for AERMOD/AERMET 15181 including new LOWWIND3 option.
- Added save and read to oBATCH for all outputs from oAERSCREEN, oFIGURE1, oFIGURE2 and oMATRIX pages. The change allows the batch processing to run, and the full outputs for each run are saved and retrievable.

AERflare-incin Version 2.03.150722
- Updated AP42 2015 emission factors for flares

AERflare-incin Version 2.03.150711
- Corrected logic on oSUMMARY. Logic for Flare Thermal Radiation had broken link. Logic for Acceptable velocity had broken link.
- Corrected logic on oBATCHVIEW. Several Yes/No fields had broken form controls.

AERflare-incin Version 2.04.150408
- Changed logic on oSUMMARY I,J,K86 and I,J,K90 to reference oAERSCREEN output for worst case terrain instead of flat terrain. For oMODELLING 1,2,4,5 output for each scenario is providing in oAERSCREEN in both flat terrain and elevated terrain. For oMODELLING 3,7 output is provided in elevated terrain only. Therefore, oSUMMARY needs only to check the elevated terrain to ensure that all three flowrates for SO2 and H2S have been performed.

AERflare-incin Version 2.03.150327
- Corrected missing update oAERSCREEN reference to domain size from a fixed 10km to iSTART:rMaxDist.
- Added physical exit velocity display to oMODELLING and oBATCH. oBATCHview now displays both physical flare stack parameters and pseudo-stack parameters.
- The scenario name is used as a base for filenames during automation. However, some characters may produce invalid filenames. The scenario name is now preprocessed to remove illegal or problematic filename characters.
- Formatting of cells on the iBATCH and iNOTES pages has been enabled.
- Added the user selection of Pollutant on the iSOURCE page. The default setting is SO2, but selection of NOx, CO, THC, PM2.5 or user can be used. The NOx, CO and PM2.5 emissions are based upon the US EPA emission rates as listed on the PROPERTIES page. The results are

presented in two streams: hot and cool. The SO2, NOx, CO, PM2.5 and THC are modelled as 100% of the emission rates following the hot stream. Using the same flare inefficiency methodology, a fraction of the H2S and THC components are emitted in the cool stream.
- A concern was raised that AERflare-incin was creating AERMOD input files that differed from AERMAP. AERflare-incin used a sub-sampled topography to reduce numerical effort when looking for hillheight scales with a resolution of 200m as opposed to the user's data with typical resolution of 30m. The default setting for HHDX has been changed from 200m to -1m. A setting of -1m forces AERflare-incin to use the native resolution of the provide dem data.
- Adjusted again, the minimum exit velocity algorithm. For very low exit velocities, the minimum pseudo velocity is 1.e-5 m/s; and, the pseudo-temperature is not adjusted to compensate. There will be a small over-estimate of buoyancy flux.

AERflare-incin Version 2.03.141128
- Corrected function in oMODELLING: Compliance with Objective, MINA() function to MIN(). The MIN() correctly removes the blanks from the calculation.

AERflare-incin Version 2.03.141125
- For blowdown transient scenarios, if the spreadsheet is uses steps of equal mass, the entry for step size of equal duration is greyed out. If there is a value entered in the step of equal duration (and greyed out) the oBLOWDOWN page calculations used the entry. The logic on oBLOWDOWN has been corrected to not use the greyed out entry.
- Corrected logic error on oCALCULATIONS making use of MMINDIALOC (which source temperature to use for blowdown calculations).
- Changed the minimum pseudo velocity from 0.1 m/s to 1.e-5 m/s to be consistent with AERMOD. This change avoids the creation of very large pseudo-temperatures for conditions when the velocity is clipped at 0.1m/s.

AERflare-incin Version 2.03.141031
- Corrected calculation of required fuel gas to meet minimum requirement (20MJ/m3) on the oCALCULATIONS page. This impacts the displayed fuel gas requirements on the iSOURCE page.

AERflare-incin Version 2.03.141010
- Incinerator residence time and stack top temperature are displayed on the oSUMMARY page.
- Changed the source characterization numbers on the oMODELLING. The numbers were displayed with rounded to 3 significant digits causing potential inconsistencies between numbers used for modelling.
- Added the ability to name the flare/incinerator source the non-Default selections. This allows the user to create multiple source files for modelling several sources at the same time. The hourly source files can be combined using external processing such as AWK or PERL.
- Bug fixes

AERflare-incin Version 2.02.140903
- Flare Assist selection contained bug related greyed-out for selection of yes instead of no.
- Batch page operation of the source type Incinerator contained a bug(s) that prevented batch page operation. This has been corrected.
- On the iTERRAIN page, the 'Get DEM Data' is used to extract get DEM and determine worse case terrain heights automatically, as opposed to the older manual method. AER now recommends the automatic method as the default methodology, and therefore the location (X,Y) of the worse-case contour levels, heights and distances are now saved to the batch page.

The listed results have been moved into the main-stream listing (left side of worksheet).

- Changed the extraction of DEM and LCC zip files. On user computers, if the Windows Explorer option to 'hide file extensions of known file types' is selected (the default Windows configuration), then extraction of files will not return the expected listing if ".shp" files are not associated on the user computer. The logic has been changed to avoid the bug.
- Added flag and entry of user defined fenceline to the creation of a receptor grid on iUSERTER. A comma separated file (no header) can be used to enter X,Y utm coordinates of the fenceline. The fenceline is charted on the iUSERTER page for reference along with the flare stack location. All receptor points within the fenceline are erased, see also below fill resolution.
- Added flag and entry of a sources.csv file. The file is a comma separated file containing X,Y,name of sources or points of interest. The receptor grid is created by adding a 50m resolution receptors grid within 500m of each point. This grid better represents the ESRD modelling guidelines when fenceline(s) is large and/or the number of sources within the fenceline are distributed. This feature can also be used to assist in capturing the worst case ground level predictions.
- Added a flag and entry for a receptor grid fill resolution within a fenceline. Predictions within a fenceline may be of interest for occupational health.

AERflare-incin Version 2.02.140711

- Added two more contour intervals 100 and 500 to capture VERY rough terrain and poor initial guesses on elevation. This corrects a potential bug if a user inputs a poor initial guess of the site terrain (say 0m) in very rough terrain (peak terrain elevations >2500m), then the number of contours at the maximum interval setting may exceed the maximum space allowed (25 contour levels). Added 200m and 1000m contour levels to prevent and capture possible issues.
- Changed the minimum flare stack height on iSOURCE from 12.2m to 12m to match D060.
- Added an option on oFIGURE1 page to display concentration output using/not using the duration correction for sub-hourly events.
- Added distances, ws and PG output for 100% concentration predictions from oMODELLING to oBATCH and oBATCHVIEW.

AERflare-incin Version 2.02.140711

- Updated the Temperature ranges used for the creation of the SCREENING and SCREENING+ meteorological data sets based upon a broader number of meteorological stations and including Alberta, British Columbia and Saskatchewan. Added the temperature ranges to iSTART page to facilitate other application areas.
- Adjusted the assigned roughness, albedo and bowen ratio for the creation of the screening meteorological datasets from the default AERMOD to the default AERSCREEN settings. This change makes the screening met datasets consistent with SCREENING+ and refined data sets created in AERflare-incin.
- Corrected assignment of 'mixed forest' and 'shrub' land classification from 'crop land' to 'deciduous forest', being the most representative.
- Added calculation of compliance with ambient objective calculation. This calculation estimates the likelihood of the (yearly) maximum concentration being less than the objective.
- Added batch mode dump of output data on bottom of oAERSCREEN page using MEXPORTOUT technical setting. MEXPORTOUT forces the MKEEP and MKEEPOUT settings. On the iBATCH page, the MKEEP output path/filename setting

is used to define the basename for the MEXPORTOUT. If MKEEP output path/filename is blank, then the current folder is used and the scenario name is used as the basename. If MKEEP output path/filename is a folder, then the basename is application default name of 'AERflare-incin' and all folders will have similar filenames for simplicity in automation(s). MKEEP and MKEEPOUT are adjusted during run-time, and reset back to their initial settings upon completion of the batch run; errors during batch runs may leave these settings in an altered state.

- Change the flag name from 're-calculation required' to '*** REMODEL*** INPUTS DON'T MATCH OUTPUTS'. This message is also displayed on the ABOUT page
- Changed the 'recalculate' button to 'remodel'
- When the 'Save to iBATCH' button is pressed, the save processes checks if the RECALC_REQD flag is set. If so, then the inputs are copied to the iBATCH page and the user is prompted yes/no/cancel before copying the outputs. This allows the results to be kept following an inadvertent change in inputs. The oBATCH preserves the RECALC_REQD flag setting.
- Added footnote comment to bottom of oMODELLING page that the concentration results presented on this page DO NOT INCLUDE rounding. Added footnote comment to bottom of oSUMMARY page that the concentration results INCLUDE rounding for comparison to regulatory limits.
- Corrected reference to external library for use with 64-bit operating system in module utils2
- Corrected reference of LIMIT1 to LIMIT2, on oPOSTPROCESS and oAERSCREEN dump data column descriptions.
- Corrected oPOSTPROCESS page with incorrect dump of the xyz data to LIMIT2 area
- Added comment on oPOSTPROCESS page for n'th highest and percentile summary table, when N<mnDATA. Changed the summary to display the statistic instead of zero, but provide the comment feedback
- Added calls to the clearstatusbar before operation of getdem and getlcc. Changed the clearstatusbar routine to include clearing clearstusbarti.

AERflare-incin Version 2.02.140702

- Added Incineration as an alternative source type. Name change from AERflare to AERflare-incin. The iSTART page now begins with the selection of flaring or incineration. Source information is entered on the iSOURCE page (previously called iFLARE page). Detailed calculations for flaring are performed on the oCALCULATIONS page and for incineration on the oCalcIncin page.
- Flaring (and incineration) emissions have been added as per USA EPA and are listed on the oCALCULATIONS and oCALCINCIN pages.
- The AERSCREEN page includes export of plottable data suitable for SURFER mapping for RBC and LIMIT1 data. The AERSCREEN page contains the data for the maximum of years included in the meteorological period. Either the raw data can be exported or the adjusted data can be exported. The raw data does not include flare duration adjustment for sub-hourly time average nor transient blow down effective hourly time average. The adjusted export data account for sub-hourly time averaging and transient blow down. The effective transient blow down derived from the AERSCREEN page is a worst case screening calculation since it uses the worst case concentration for each of the Qmax, Qmid and Qlow emission rates as opposed to the concentration prediction for

the same hour for each Qmax, Qmid and Qlow emission rates. The oPOSTPROCESSING calculations can be used for that purpose.
- The oPOSTPROCESSING results can be exported for either the RBC or the LIMIT1 data. These data include sub-hourly time duration or transient blow down sequencing on an hourly basis.
- The iUSERMET page has been re-arranged into logical order for recommended assessment. Users can create a SCREENING+ data set or a REFINED data set.
- Batch processing has been added for SCREENING+ data sets. The SCREENING+ data set only requires the source location. On the iBATCH page a column group for iUSERMET has been added. The batch processing for iUSERMET only requires the source location from iFACILITY and the output file name as specified on the iBATCH page. The regular iBATCH processing is independent of the results for iUSERMET batch outputs. Therefore, the batch processing can be performed in sequence without disturbing the results of the other. Also, batch processing for iUSERMET SCREENING+ can be recalled so that the determination of LCC statistics doesn't have to be repeated if a REFINED meteorological data set is later created.
- Bug fixes/spelling

AERflare Version 2.02.140302
- Added int() to the receptor iUSERTER page calculations for the display of the number of receptors for each grid spacing
- Corrected shift in the index numbering of screening meteorology. This affected the selection of grasslands being assessed as deciduous tree areas.

AERflare Version 2.02.130919
- Added path name to run.bat shell command so that if the shell default location is redirected from the current folder, the run.bat command is still executed. Within the run.bat file, the drive is reset to the current folder, and the CHDIR command is used to change the folder to the current directory

AERflare Version 2.01.130114
- Major revisions throughout.
- Removed ERCB_SCREEN3 and replaced with AERMOD.
- Added automatic terrain processing using download from Canada website for DEM.
- Added automatic land use classification processing for determination of site specific meteorological data files

AERflare Version 2 to 2.01
- Bug Fixes and look-feel updates
- Added explicit gas composition of air using GPSA 13th Edition, SI. The molar mass for air is based upon: N2 78.12%; O2 20.96% and Ar 0.92%.
- Added argon (AR) to gas composition inputs.
- Added MPOSTBAT setting on iSTART page. The MPOSTBAT allows an advanced user to create a command line batch or script file to be inserted in the run stream during batch processing. The MPOSTBAT file is inserted after each batch run job.
- Added MMETUSTAR, MLOWWIND1 and MLOWWIND2 advanced switch settings. These settings are used to control how the AERMET meteorological processing and AERMOD processing for low wind speeds is conducted. See also the associated user adjustable SVmin and WSmin settings.

- Allow UTM entry for world UTM locations. Land use classification processing, however, remains available only for Canada. DEM processing for world locations available through generic file (XYZ) inputs.
- Added 'Read User Receptor Grid' option to the iUSERTER page. When selected the user is prompted for a generic XY file containing space or comma separated receptor grid points. The terrain processing will determine the elevations from DEM data.
- Removed the 're starting' and 're ending' controls from the user terrain files created by AERflare to be compatible with typical AERMOD insert files.
- Added options for radius for roughness (rrough) and radius for albedo (ralbbow) for AERsurface meteorology. rrough is set to the older AERsurface 3 km methodology rather than the new 1 km methodology as a balanced compromise between near-field and far-field turbulence effects. ralbbow is set at the AERsurface default of 5 km.
- Added the option for flag pole receptor heights.
- Added the option for nsources, the number of virtual sources used to model a time varying flare source in AERMOD. The default is nsources=9 with a maximum of 20.
- Added the option for flagging the minimum number of data points representing a valid dataset to use risk based criteria. In concept, a single year of meteorology is required with 8760 hours. However, regulations allow for a percentage of these data to be missing or calibration. Therefore, AERflare allows risk based criteria use for data sets with a minimum of 7884 points.

ERCBflare Version 1 to 2

- Added annual and monthly air dispersion modelling predictions. The monthly predictions are based upon the month of the proposed flaring plus the month before and after. Using a 5-year data set, this allows for N>8760 and thus the Risk Based Criteria can be applied.
- Added inefficiency by-products stream for air dispersion modelling impacts of products of inefficiency. These products are modelled as raw H2S whereas combustion products are modelled SO2. The H2S source differs from the SO2 source; the H2S has a lower heat component based upon convective stripping of energy from the flame and momentum is calculated from the mass flow not combusted.
- Added lift gas stream effects to combustion calculations.
- Added flare assist streams for air and/or steam flaring assist. The flare assist streams impact the combustion calculations by adding momentum, energy and reducing the combustion efficiency of the flare.
- Added conversion of sub-hourly emissions predicted concentrations to hourly average concentration.
- Added transient blowdown calculations. The spreadsheet prompts for volume, pressure and temperature of vessel to blowdown and calculates the exponential blowdown curve for the inputs. The curve is divided into three steps for modelling. The modelling predictions determine the maximum hourly concentration from the curve based upon the duration of each step and the maximum predicted concentrations for each step.
- Added oFIGURE 1 page to display in a graphical format the predictions as a function of distance from the facility. The graphic shows max concentration, wind speed producing the maximum concentration, PG atmospheric stability leading to maximum concentration as a function of distance.
- Added oFIGURE 2 page to display in a graphical format the statistical summary of emissions and combustion efficiency for hour-by-hour flaring analysis

- Added a DEFINITIONS reference page as per D060
- Added a LAHEE reference page. Linked the Lahee reference page to the flaring inputs for the determination of the maximum flaring volume allowance as per D060.
- Changed the summary page to reflect the numerous changes below. Also added a check-list style table at the top of the page to summarize how the inputs compare to D060 requirements for approvals.
- Changed the ATTACHMENTS page to iNOTES page. iNOTES page has specific prompts for questions that AER approval reviewers may consider in the review of the application.
- Added iBATCH and oBATCH pages for batch operation of spreadsheet. Users can save the input page to the batch page. Inputs and outputs are saved. Added oBATCHVIEW to review modelling results.
- Added NON-DEFAULT flag for all output pages when a non-default setting is selected.
- Added iSTART page for the selection of type of assessment, advanced program operations and non-default settings
- Non-routine flaring uses the hour-by-hour variation in source parameters. This is implemented in AERMOD using a time varying emissions file and a co-located source. Nine sources are defined based upon an estimate of the final rise of the hourly variation.
- Routine flaring uses the average meteorological wind speed and temperature.
- Added the prediction of concentrations based upon the non-routine flaring Risk Based Criteria.
- Added distinction between non-routine flaring and routine flaring. Both are modelled at 9-emission rates. Non-routine flaring results are compared to risk based criteria and routine flaring results are compared to ESRD established modelling objectives.
- Added AERSCREEN/AERMOD air dispersion modelling. Associated with this change are the following additions:
- added 8-screening meteorological data sets corresponding to the 8-land use types in the Alberta Air Quality Model Guideline. The meteorological data sets represent 100% land cover for the respective land cover type.
- added a mapping of Alberta, British Columbia and Saskatchewan for land cover reduced to the 8-land use types. The spreadsheet prompts for a location and the nearest land cover cell value is used to represent the air dispersion modelling.
- allowance for coordinates in geographical coordinates, UTM zones 8,9,10,11,12,13 and 10TM
- air dispersion modelling is performed for the parallel air-flow and elevated terrain from 100m to 10km. The spreadsheet prompts for terrain elevations from the base elevation to the maximum terrain elevation.
- Screening assessment using the AERSCREEN approach with the 8-screening meteorological data sets is intended for rapid assessment.
- Added AERMOD air dispersion modelling for refined analysis. Following a step-wise progression from screening to refined analysis, AERflare can create a refined dispersion modelling input files for AERMOD, run AERMOD, and post-process the results for non-routine, routine and blowdown sources.
- Removed SCREEN3; removed the 99% percentile concentration prediction based upon ISCST3 air dispersion modelling; fuel gas log; and minimum fuel calculation based upon the 99% concentration.
- Added digital terrain processing for inputs to the iTERRAIN page. Digital elevation data (DEM) is downloaded from the internet site

automatically or pulled from a user's local library. The terrain processing extracts worst case terrain contour elevations as would be done if performed manually; therefore, manual entry of worst case terrain remains an applicable option.
- Added iUSERMET page to develop a site specific meteorological data set suitable for refined dispersion modelling using AERMOD. The meteorological data set is composed of data from the ESRD MMEU Meteorological Processor extraction of MM5 data for the province of Alberta. The iUSERMET page processing also downloads land use classification code (LCC) files for Canada from the internet or the user's local library. The LCC files are processed using AERSURFACE methodology to determine an average Bowen Ratio, albedo and surface roughness for the user's assessment site. The AERMET processor is subsequently used to create a site specific meteorological file.
- Added iUSERTER page to develop a site specific receptor grid suitable for refined dispersion modelling using AERMOD. Digital elevation data (DEM) is downloaded from the internet site automatically or pulled from a user's local library. The user can create an ESRD standard assessment grid or modify the receptor spacing. Terrain and hill scale factors are determined from the DEM data and output to an AERMOD formatted insert file.
- Added oPOSTPROCESS page to post process external AERMOD output for the determination of AER D060 risk based criteria. Similar to the post-processing provided by the AERflare spreadsheet automated assessment, the oPOSTPROCESS page allows a user to process output created external to the AERflare interface. The oPOSTPROCESS page allows for advanced statistics for graphical presentation or in-depth analysis.

ERCBflare Version 1.05.004, March 24, 2010
1. Updated programming to reflect EUB to ERCB name change ERCB_Screen3.

ERCBflare Version 1.05.002, March 1, 2010
1. added CO and NH3 as input components of flared gas
2. ambient temperature of 5 C used to reflect average Alberta conditions
3. flared gas (raw gas + fuel gas) temperature set to ambient temperature
4. pseudo temperature estimated at Lower Flammable Limit
5. used estimated temperature to calculate pseudo diameter and pseudo velocity based on buoyancy and momentum flux balance
6. average wind speed of 3.5 m/s is now used for flare efficiency and effective height calculation
7. corrected flame height calculation routine that occasionally failed to solve properly
8. stack tip downwash based on flare tip diameter using actual exit velocity and 99th percentile wind speed at flare tip
9. 99th percentile wind speed in Alberta set at 10 m/s
10. radiation loss set at 25% of converted energy (input*combustion efficiency)
11. user input fuel gas to raw gas ratio for maximum, average and minimum rate
12. provided clarity to small volume approval exemption requirements
13. highlighted required inputs for dispersion modelling

EUBflare Version 1.01.001, December 11, 2006
1. formatting revised
2. temporary flare permit application information revised
3. used U of A Flare Efficiency model for conversion and combustion efficiency

4. revised source parameters to include momentum and energy balance
5. pseudo temperature specified then diameter and velocity calculated to balance buoyancy and momentum flux
6. pseudo temperature specified at calculated stoichiometric value to minimize errors by keeping temperature constant while changing the ambient temperature
7. buoyancy flux still dominated by energy released to plume but includes minor corrections for plume molar mass and specific heat being different then air
8. new dispersion models such as AERMOD and CALPUFF use the initial trajectory of the plume for gradual rise, which is dominated by momentum in the near-field
9. effective stack height based on Brzustowski flare model and is sensitive to exit velocity of flared gas compared to wind speed
10. stack tip downwash based on flare tip diameter using actual exit velocity and average wind speed at flare tip
11. ambient temperature of 15 C assumed
12. flared gas temperature of 15 C assumed
13. average wind speed of 3.42 m/s is used based on Alberta average
14. added ERCBSCREEN3 to predict maximum SO2 concentration for parallel airflow (flat) and complex terrain
15. added H2O as input component of flared gas

EUB-WellTest Version 1, February 6, 2001

1. initial release using energy balance only for source parameters
2. pseudo temperature and velocity specified then diameter calculated to balance buoyancy flux
3. similar to US EPA but with actual exit velocity at flare-tip instead of arbitrary 20 m/s
4. Version 1.01 did not conserve momentum, only energy; but this was acceptable for input to SCREEN3 and ISC3 models which takes the larger of momentum and buoyancy rise (and buoyancy always dominated)
5. buoyancy flux is at site atmospheric pressure based on input stack base elevation
6. assumed 98% conversion and combustion efficiency
7. radiation loss set at 25% of input energy
8. predicts 99th percentile SO2 concentration based on nomographs for parallel airflow terrain
9. user inputs worst case terrain for comparison to complex terrain criteria to determine if complex terrain modelling required

ERCBincin.xls

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AERflare-incin Version 2.02.140626

- ERCBincin is now merged into AERflare

ERCBincin Version 1.05.004, March 24, 2010

1. Updated programming to reflect EUB to ERCB name change ERCB_Screen3.

ERCBincin Version 1.05.002, March 1, 2010

1. corrected minor errors
2. added CO and NH3 as input components of raw gas

3. ambient temperature of 5 C used to reflect average Alberta conditions
4. raw gas and fuel gas temperature set to ambient temperature
5. radiation loss now stack heat loss and remains at 10% of input energy
6. buoyancy flux dominated by energy released to plume but includes minor corrections for plume molar mass and specific heat being different then air
14. used estimated temperature and velocity to calculate momentum flux
15. used estimated velocity to calculate pseudo diameter and pseudo temperature based on buoyancy and momentum flux balance
7. user input fuel gas to raw gas ratio for maximum, average and minimum rates
8. user input excess air for maximum, average and minimum rates
9. provided clarity to small volume approval exemption requirements
10. highlighted required inputs for dispersion modelling

EUBincin Version 1.01.001, December 11, 2006

1. temporary incineration approval request form
2. initial release used material and energy balance for source parameters
3. pseudo temperature based on calculated velocity and specified diameter to balance buoyancy flux
4. radiation loss set at 10% of input energy
5. used Western Research Incineration Kinetics model for H2S conversion efficiency to SO2
6. ambient temperature of 15 C assumed
7. raw gas temperature of 15 C assumed
8. ERCBSCREEN3 used to predict maximum SO2 concentration for parallel airflow (flat) and complex terrain
9. user input single fuel gas to raw gas ratio for all rates
10. user input single excess air for all rates