1 Function of the EPA LCMRL Calculator in this Repository

This repository contains the code and instructions for using the LCMRL calculator. EPA defines the LCMRL as the lowest spiking concentration such that the probability of spike recovery in the 50% to 150% range is at least 99%. The programmatic background and history of the development of the statistical model for the LCMRL is given in EPA Publication EPA 815-R-11-001 (1).

As of May 2021, EPA is using source code written in the R Programming language and run in the R software environment (formally, *The R Project for Statistical Computing*) to distribute the LCMRL calculator. This method of distribution replaces the MatLab LCMRL Calculator, Version 2.0 (released 4-28-2010), formerly available from the EPA LCMRL webpage. The algorithms for determining LCMRLs are equivalent between the two versions. The reason for this change is that the Matlab version requires a compiler that is not compatible with PC operating systems more advanced than Windows XP. In addition, the R version can be run on Mac (Apple Computer, Inc.) operating systems.

2 Instructions for Use

To get started, please download the instructions (R LCMRL Instructions.pdf). Follow the steps in the instructions to download the R statistical computing environment and the required statistical packages. Verify proper function of the LCMRL calculator as instructed. (A test file containing LCMRL data is embedded in the LCMRL statistical package.)

Once tested, you can calculate LCMRLs for data generated in your laboratory. The experimental procedure for collecting LCMRL data meeting EPA study requirements is given in the instructions.

3 Contact for Questions

Will Adams Ph.D., U.S. EPA Technical Support Branch (Cincinnati, OH), Adams.William@epa.gov.

4 Credits

Author: John Carson, Ph.D., Neptune and Co. Inc. Developed the algorithms for determining LCMRLs and wrote source Matlab code in 2010 (Sect. 5.1) while employed by Shaw Environmental, Inc., now APTIM Federal Services, LLC (EPA contractor – Cincinnati, OH).

Contributor: Robert O'Brian, Retired. Mr. O'Brian wrote the R source code to duplicate the functionality of the Matlab code when employed by Shaw Environmental, Inc., now APTIM Federal Services, LLC (EPA contractor – Cincinnati, OH). Dr. Carson and Mr. O'Brian verified that the R code and the Matlab code produced equivalent answers using numerous data sets.

Contributor: Steve Winslow, Retired. Conceptual design and project management when employed by Shaw Environmental, Inc., now APTIM Federal Services, LLC (EPA contractor – Cincinnati, OH).

Contributor: Dave Munch, Retired. Conceptual design and project management as EPA Project Officer, U.S. EPA Technical Support Center (Cincinnati, OH).

Contributor: Steve Wendelken, Ph.D., Retired. Conceptual design and project management as EPA Project Officer, U.S. EPA Technical Support Branch (Cincinnati, OH).

Contributor: David Schiessel, Babcock Laboratories, Inc. (Riverside, CA). Created the LCMRL R packages incorporating the LCMRL calculator source code and test data input file (Sect. 5.2). For the 2020 version of the calculator (Sect. 5.1), added code to verify operation of the calculator using the test data file, to allow the data input file and working directory to be selected via a dialog box, to extract an input file template from the test data, and to annotate LCMRL graphs with the modelling parameters used.

Contributor: Alan Zaffiro, APTIM Federal Services, LLC (Baton Rouge, LA). Author of the R LCMRL Instructions and Readme file.

5 Version History

5.1 Source Code

U.S. EPA Original LCMRL Source Code for R, 5-18-2010
U.S. EPA LCMRL Source Code for R with data input and graphic output updates, Version No. 1.0.9, 12-18-2020
U.S. EPA LCMRL Source Code for R updated to allow multi-lab MRL scripts to run in RStudio, Version No. 1.1.0, 03-29-2021

5.2 LCMRL R Packages for Windows and MAC Operating Systems

Version No. 1.0.9 (12-18-2020); first public release of the LCMRL calculator for R
Version No. 1.1.0 (03-29-2021)

6 References

1. US EPA. *Technical Basis for the Lowest Concentration Minimum Reporting Level (LCMRL) Calculator*; EPA 815-R-11-001; Office of Water: Cincinnati, OH, December 2010.