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U.S. EPA, USER'S GUIDE FOR LEAD: A PC SOFTWARE APPLICATION OF THE UPTAKE/ BIOKINETIC MODEL VERISION 9,50, PREPARED BY SYRACUSE RESEARCH CORP FOR ENV. CRITERIA AND ASSESSMENT OFFICE, CINCINNATI, OH - (USED AS A REFERENCE IN OU 5 RI REPORT)

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

HALLIBURTON NUS Technical Library
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AUG 16 1991

SUBJECT: Technical Support Document on Lead and "User-Friendly" Software (Lead 5) Package with Users Guide

FROM: Terry Harvey, D.V.M.
Director

TO: Addressees

THRU: William H. Farland, Ph.D.
Director
Office of Health and Environmental Assessment (RD-689)

On behalf of the Agency-wide oversight committee, we are transmitting the most recent revisions of the Technical Support Document (TSD) on Lead and "User-Friendly" software package with User's Guide for your use, review and comments. This draft of the TSD on lead has been revised to incorporate the comments received from the external and Agency-wide reviewers on the previous draft.

The "User-Friendly" software package has been enhanced to reflect: 1) non-linear GI uptake algorithm, 2) provisions for multiple model runs of an inputted media which can be saved for review, 3) expanded "age-range" analyses and 4) blood lead vs. associated specific media, which allows the model to predict specific media concentration associated with inputted blood lead.

In the meantime, the Office of Solid Waste and Emergency Response is evaluating Lead 4 model at different Superfund sites which will allow further insight into the site-specific GSD and GI absorption resulting from different forms and sources of lead. Periodic updates will be provided as our insight into the range of model parameters continues to mature.

We would appreciate receiving review comments/or contributions at your earliest convenience. Thank you in advance for your time and effort in the further development of this approach.

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Attachment

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Table 1
Summary of Revisions to Lead Uptake Biokinetic Model Software

Parameter or Feature	Lead 0.40 (September, 1990)	Lead 0.50 (December, 1990)
Non-linear GI Absorption Model	Volume of GI-tract calculated, $V_{GI} = (v_{GI})/(CF)$; where v_{GI} is the adult GI-tract volume (liters) and CF is the age-dependent allometric scaling factor (CF < 1 for children). Default value for Km, 100 ug/L.	Volume of GI-tract calculated, $V_{GI} = (v_{GI})(CF)$. Default value for Km, 100 mg/L.
Age Range Selection	Menu specified selection.	User designated option allows user to specify any designed age range from 1-7 years.
Multiple Runs	Multiple model runs are made manually; i.e. the user specifies input for each run, and saves output in Results Out file.	Allows user to input a range of lead values for one medium (air, diet, drinking water, dust or soil), and make a series of model runs in which lead levels in the specified medium are varied over the specified range.
X-axis Scaling	Fixed by program.	Allows user to set scaling of X-axis of probability density function and probability percent graphs manually.
Overlay Graph Files	Not available; graphs of individual model runs can be displayed and/or printed.	Allows user to save graph output (i.e. probability density function or probability percent graphs) from multiple runs to an file and print output of multiple runs on a single graph.
Text Files	Data from individual model runs can be saved to a file.	Allows user to save the data output of individual or multiple model runs, in user specified ASCI text files; these files can be reviewed and printed in Lead and/or imported into a word or processing program after exiting from Lead.
Blood vs Media Concentration: Model Runs (Graph Output)	Not available.	Allows user to input a range of lead values for one primary medium (air, diet, drinking water, dust or soil), and produce a series of model runs in which lead levels in the specified medium are varied over the specified range. The output of each run is captured in an X-Y plot of mean blood lead vs medium lead.
Blood vs Media Concentration: Find	Not available.	Calculates a lead level in the user-specified medium that is associated with a specified mean blood lead.

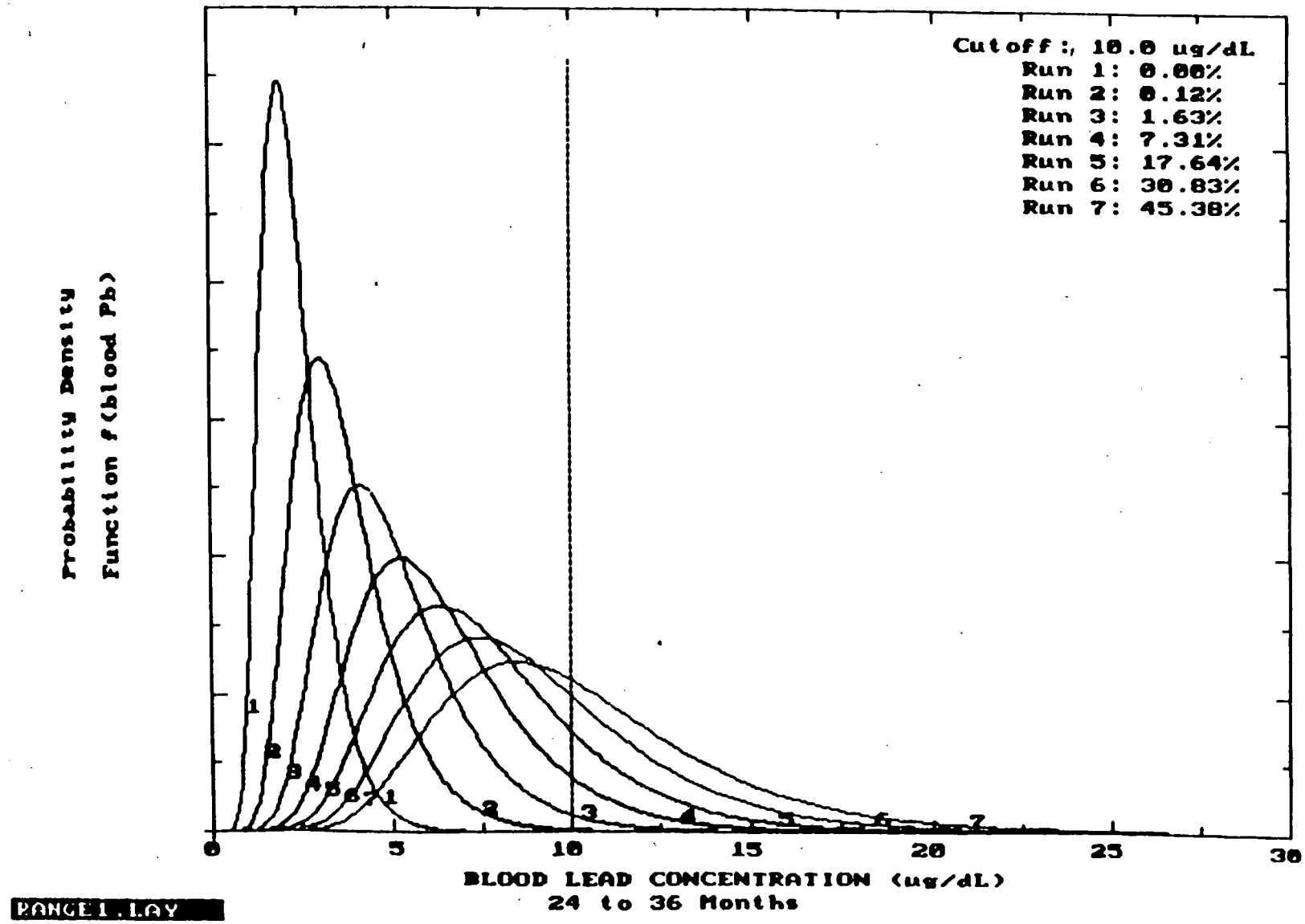

Figure 1. Lead 0.4 probability density functions for blood lead in 2-3 year old children exposed to soil lead levels ranging from 0 to 2000 ppm. Each run (1-7) represents a different soil lead; run #1 is 0 ppm, run #7 is 2000 ppm.

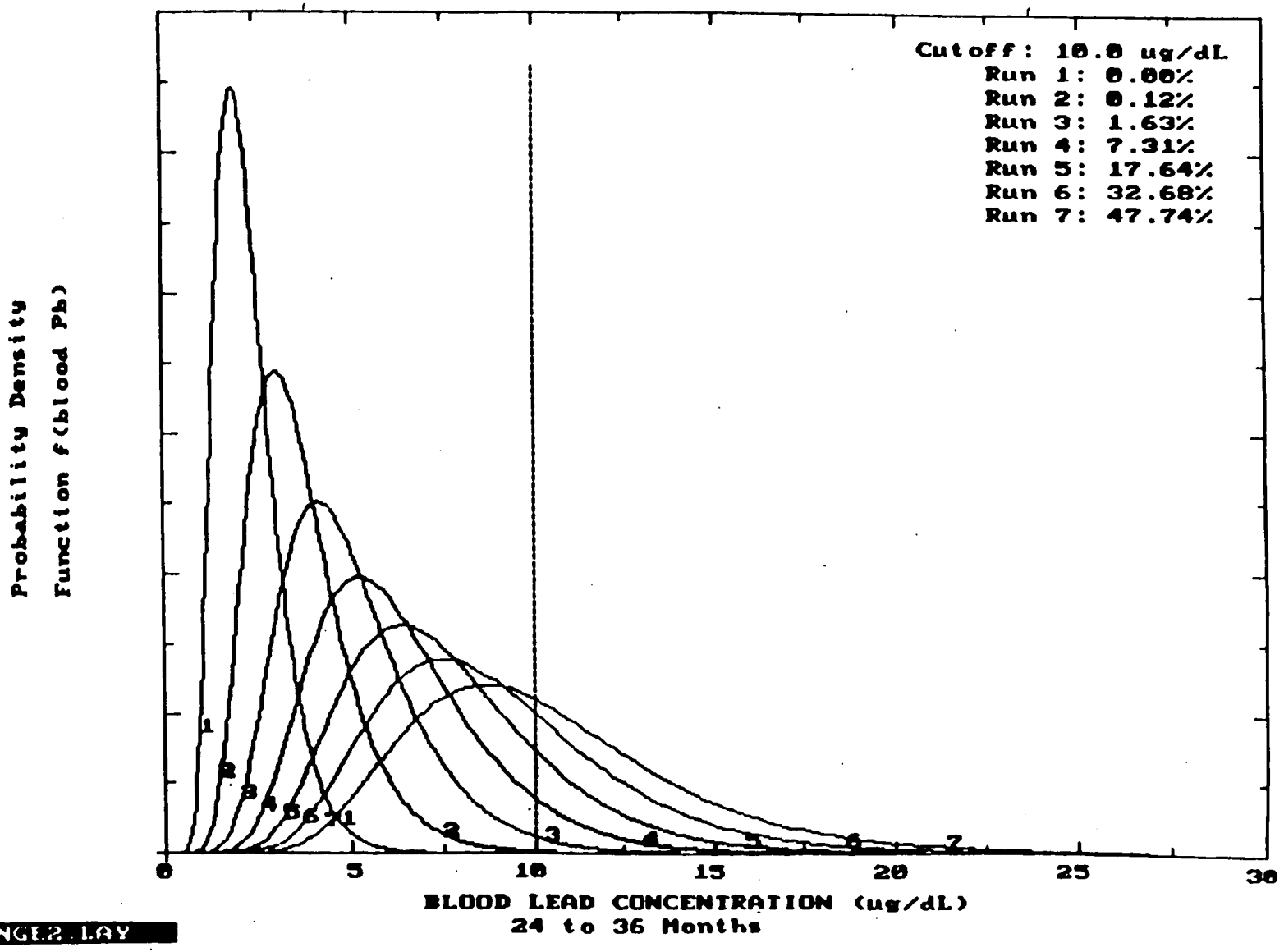

Figure 2. Lead 0.5 probability density functions for blood lead in 2-3 year old children exposed to soil lead levels ranging from 0 to 2000 ppm. Each run (1-7) represents a different soil lead; run #1 is 0 ppm, run #7 is 2000 ppm.

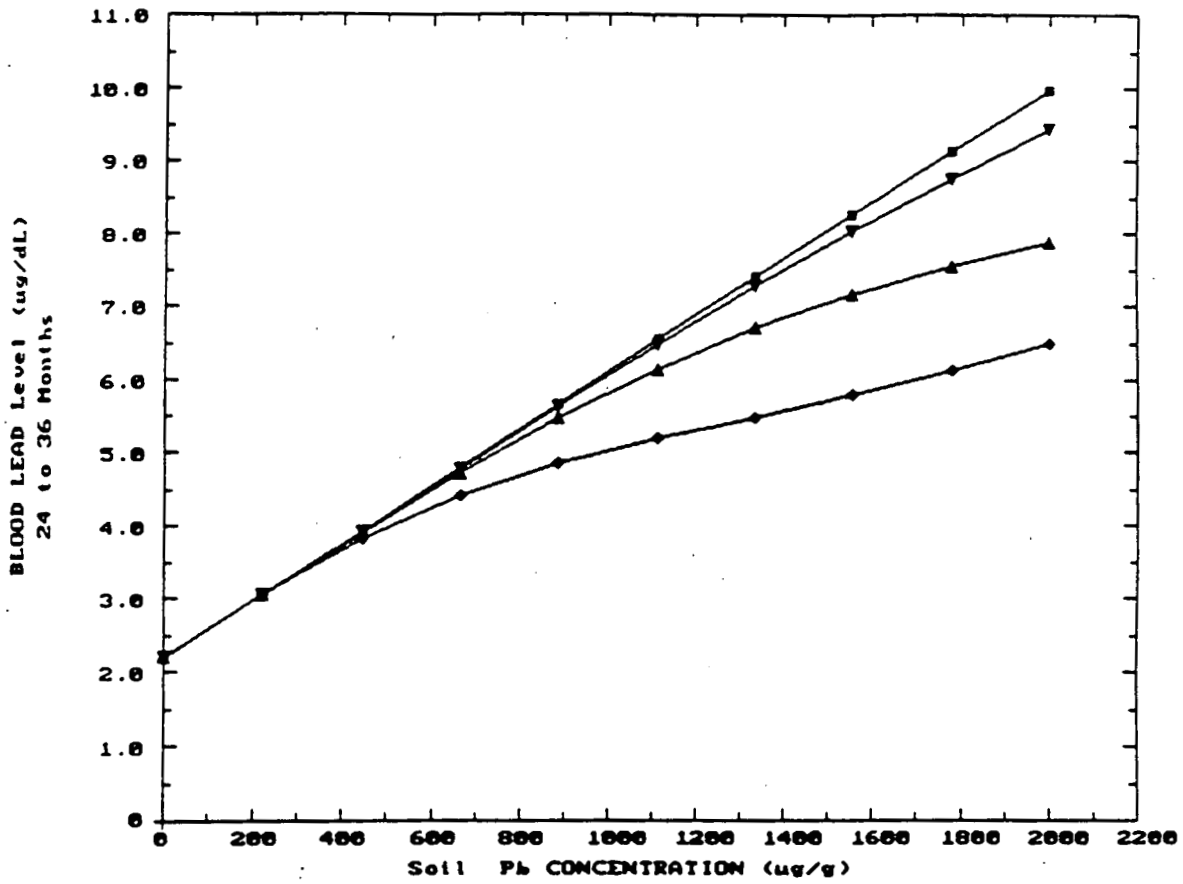

Figure 3. Lead 0.5 plots of mean blood lead level vs soil lead level in 2-3 year old children. Each plot represents a different value for the Km for GI-tract absorption: squares, 100 mg/L; down triangle, 1000 µg/L; up triangle, 500 µg/L, diamond, 250 µg/L.

Issues:

1. Adult Biokinetic Model needs to be fully developed

2. Sensitivity Analysis

   This will help in the validation of the model. (See 3 and 4 below).

3. Data from Bunker Hill, Marjol and Baltimore sites suggest GSD of 1.7 or higher for area sources of lead vs. the default GSD of 1.42 based on point sources.

4. Regional/site-specific food lead

   Currently, the FDA 1988 market basket data inputed into the model indicates a significant drop in food lead (about 75%). However, this is based on national average and may under predict site-specific food source of lead. (Region III has their own Regional dietary lead defaults).

5. Guidance need for site-specific data collection.

   A. Why and when blood lead levels should be collected by Regions and by whom?

   B. How, when, why and what site-specific data need to be collected.

      [Paul White has volunteered his involvement for data collection/protocol development (including site-specific sampling)].