NOVIGEN SCIENCES, INC.
International

**UNITED STATES**
1730 Rhode Island Avenue NW
Ste. 1100, Washington, DC 20036
T (202) 293-5374 F (202) 293-5377
info@novigensci.com

**UNITED KINGDOM**
75 Graham Road
Malvern, Worcs, WR14 2HR
T (+44) 1684-588444 F (+44) 1684-588445
info@novigensci.co.uk



# Calendex™: Calendar-Based Dietary & Non-Dietary Aggregate and Cumulative Exposure Software System

**by:**
Barbara J. Petersen, Ph.D.
Susan H. Youngren, Ph.D.
Cassi L. Walls, M.S.
Leila M. Barraj, D.Sc.
Novigen Sciences, Inc.
1730 Rhode Island Avenue NW
Washington, DC 20036

Stephen R. Petersen
Durango Software
Bethesda, MD 20817

**Presented to:**
United States Environmental Protection Agency (US EPA)
Office of Pesticide Programs
401 M Street, SW
Washington, DC 20460

**Presented to:**
FIFRA Scientific Advisory Panel (SAP)
Arlington, Virginia

September 27, 2000

# Table of Contents

# Table of Contents (Cont'd)



# List of Figures



# List of Appendices

**Calendex™: Calendar-Based Dietary & Non-Dietary Aggregate and Cumulative Exposure Software System**

The passage of the Food Quality Protection Act (FQPA) in 1996 has challenged the pest control industry and the scientific discipline of risk assessment. New tools are needed to conduct the analyses that are now required by FQPA, including aggregate and cumulative exposure assessments. These analyses, if conducted using default assumptions or simplistic methodologies, will generate "worst case" estimates that are extreme. The simplified approach does not permit any discrimination between risks that are likely to reflect risks that really exist and those that are truly hypothetical. Novigen Sciences' Calendex™ Model, using an innovative approach known as the *calendar model*, gives scientists the ability to evaluate aggregated exposure that is as realistic as the underlying data will permit. Calendex™ can compute exposure estimates that take into account the probability of treatment, probability of contact, timing of exposure, chemical degradation, and magnitude of the exposure. Calendex™ estimates exposures on each calendar day for the population(s) of concern and permits the exposure analyst to combine the daily exposures to estimate exposures over time periods that are most appropriate to the available toxicity information.

The purpose of this paper is to facilitate the peer review of this software by the EPA Scientific Advisory Panel (SAP) by providing comprehensive documentation of the algorithms Calendex™ used to estimate non-dietary aggregate and cumulative exposures. Since its development, various scientists have used the software for conducting numerous residential assessments. Since the algorithms must be evaluated in the context of their intended applications, the paper begins with a brief discussion of those applications. The algorithms themselves are presented in subsequent sections. The corresponding computer codes for the computational algorithms are provided in Appendix A. Additionally, this paper also includes a discussion of the data that can be used by Calendex™.

Calendex™ has undergone extensive QA/QC testing in order to permit its use for analyses performed according to Good Laboratory Practice (GLP) regulations. The results of some of those QA/QC tests are summarized for the SAP in this document. The fidelity of the process used to incorporate the data into Calendex™ has been verified through testing that is also described in this report.

Calendex™ is currently licensed to government agencies (US EPA, Health Canada Pesticide Management and Regulatory Authority and the California Department of Pesticide Regulation) and to private clients. Licensees actively participate in improving the capabilities of Calendex™ by providing Novigen examples of analyses and options. The software is routinely tested and frequently upgraded through the addition of more advanced calculation capabilities and new databases, as they become available. Each new version of the software undergoes thorough in-house testing and subsequent "beta" testing by users prior to its for use in analyses conducted in accordance with GLP regulations.

Figure 1 provides a schematic overview of the Calendex™ aggregate and cumulative assessment process. Note that while Novigen's Dietary Exposure and Evaluation Model (DEEM™) program is integrated into Calendex™ to provide dietary analysis capabilities, the DEEM™ dietary analysis

algorithms themselves are not discussed in detail in this documentation as they have been previously reviewed by the SAP (February 2000).

## 1.0 OBJECTIVES OF CALENDEX™

FQPA[1] prompted the initial development of Calendex™ but it has proven useful for a broad range of other exposure assessment scenarios. Calendex™ has been developed to provide a flexible, but powerful, tool to use in estimating consumer and occupational[2] exposure to chemicals. This document focuses on the use of Calendex™ for the estimation of exposure to pesticides – particularly the aggregate and cumulative assessments mandated by FQPA. FQPA specifically requires estimation of aggregate exposure due to residues in the diet and drinking water as well as those encountered due to residential uses of pesticides. Cumulative exposure assessments, also required by FQPA, are estimations of combined exposure chemicals that are determined to cause toxicity by a common mechanism. The Calendex™ software provides a vehicle for managing the various scenarios and data sources in complex analyses of aggregate and cumulative exposure and providing full documentation that is suitable for regulatory situations. Detailed objectives and uses of Calendex™ currently include the following:

- Calendex™ provides estimates of exposure that are statistically representative of the US population as well as a wide range of user-specified subpopulations.

- Calendex™ permits the estimation of exposure to single or multiple compounds for a wide variety of time periods (daily/acute, short-term, intermediate-term, and chronic (up to one year) time periods). Exposure to chemicals can result from residues in food, residues in or around the residence, and/or residues from occupational uses of the chemical. The route of exposure can result from oral, dermal, or inhalation, or a combination of these routes. Oral exposures may occur via residues in the diet or other pathways such as toddler hand-to-mouth activity.

- Calendex™ is designed to allow the user to aggregate exposures as appropriate for the scenarios under consideration. Aggregation may entail one chemical, with only one use or source, but with multiple routes of exposure. For example, a compound might be used exclusively on lawns applied by the homeowner. In this case, the person applying the compound may be exposed by dermal and inhalation routes via applying the compound and using the lawn after the treatment. Aggregation might also imply one chemical, with multiple uses or sources and with multiple exposure routes. For example, if a chemical is used on crops and also as a termiticide, possible routes of exposure are oral (from residues on food), dermal (from contact with treated surfaces in the home), and inhalation (from residues in the air around the home).

[1] The Food Quality Protection Act (FQPA) of 1996 requires sophisticated assessments of aggregate and cumulative exposure to pesticides.

[2] Although occupational assessments are not required under FQPA, it is important to realize that Calendex™ can be used to assess occupational daily exposures. Since the purpose of this document is to discuss assessments required by FQPA, occupational assessments will be not discussed in any detail in this document.

- The Calendex™ model can also be used for cumulative exposure assessments as required under FQPA. Cumulative exposures include situations that encompass exposure to more than one chemical, with multiple uses or sources, and multiple exposure routes. Cumulative assessments are conducted for chemicals that have a similar mode of action toxicologically. Cumulative assessment requires that the relative toxicity of the various chemicals included in the analysis be quantitatively specified. Calendex™ is not designed to determine the appropriate toxicological comparisons to be made between chemicals, but only to conduct the exposure assessment once the chemicals to be included have been identified and the relative potencies of each chemical determined.

- Calendex™ is designed to permit the inclusion of the temporal aspects of exposure in each assessment. Specifically, Calendex™ permits the user to model the changes in exposure due to changes in the chemical concentrations in the environment over time after use of the chemical (e.g., chemical degradation). This capability is particularly important in conducting aggregate and cumulative exposure assessments.

- Calendex™ is designed to permit the inclusion of the spatial aspects of exposure in each assessment. For example, the types of pests encountered in a home in Florida may be very different than those found in a home in northern Maine. These differences are not simply based on types of pests but also on when these pests are of concern. Thus, an exposure model must be able to assess exposures that are specific to both time and location. This type of specificity can be accounted for in Calendex™.

- Calendex™ is designed to permit the user to conduct simple exposure estimates based on point estimates or probabilistic estimates based on distributions and Monte Carlo analysis techniques.

## 2.0 BACKGROUND

### 2.1 Non-dietary Exposure Assessment

The goal of non-dietary exposure assessments is to characterize the exposure of the population of concern (e.g., adults, toddlers, etc.) and to identify the variability associated with that exposure. Typically, the primary objectives are to estimate the level of exposure via ingestion, inhalation, or dermal absorption of the substance and to identify the sources of both variability and uncertainty in the estimate. In addition, the exposure assessment can also be useful in identifying the potential importance of a specific route relative to other pathways of exposure.

The general exposure model is of the form:

*Contact x Residue = Exposure*

To assess the total aggregate or cumulative exposure, three types of data for each product or use are required:

(1) use pattern information of products of interest, frequency of application and amount of product applied;
(2) environmental concentration data on days before, during and after treatment (residue factors); and
(3) exposure factors such as body weight, breathing rate, and activity patterns (contact factors).

The selection of the most appropriate methodology for estimating non-dietary exposure will depend upon:

(1) the intended application or purpose for the exposure assessment;
(2) the biological properties of the substance;
(3) the physical and chemical properties of the substance; and
(4) the route of exposure.

Some of the important considerations for each of the four areas are discussed below:

Intended Application or Purpose for the Exposure Assessment

The purpose of the assessment will play a critical role in determining the most desirable methodology. Different methods will be desirable if the assessment is designed to be conservative (as is often the case for regulatory decision making applications) than when it is designed to be as realistic as possible. Some approaches, such as those that assume the exposure to multiple products containing the same active ingredient will occur simultaneously are designed as "screening" methods. These types of assessments can dramatically overestimate exposure. Although it can be very useful for preliminary assessments, for establishing priorities, or for designing residue studies, is may not be as reliable as an estimate that appropriately incorporates temporal and spatial/regional aspects of the exposure scenarios.

Screening methods, such as EPA's Standard Operating Procedures (SOPs) for Residential Exposure Assessments (US EPA, 1997a, 1999a), sacrifice accuracy of estimate for speed, simplicity, and known over-estimation of exposure in the majority of cases. In the case of the evaluation of toxic effects, exposure estimates following SOP procedures that are less than an acceptable exposure level strongly suggest that real-world exposures will be acceptable. Thus, in these cases, there would be no need to expend resources to collect better data or to apply more sophisticated techniques in search of greater accuracy.

Biological Properties

The duration of dosing that is required to elicit a specified biological effect should define the key exposure assessment parameters. That is, the biological effects that are the result of a single or at most few doses should be compared to an exposure on a single day. Correspondingly, toxic effects that arise as a result of long term exposure should be compared to an average exposure resulting from long-term, repeat exposures.

Other considerations include whether any breakdown products are of toxicological significance and the metabolic pathways in plant and animal systems. Potential biological effects must be carefully considered in planning an exposure assessment. Factors of interest include dose-response relationships, the length of exposure required to produce an adverse effect, potentially sensitive populations, and variability and uncertainty factors.

Physical and Chemical Properties of the Substance

Often when estimating non-dietary exposure of a substance, it is necessary to define or characterize the substance in terms of attributes such as structure, volatility, and solubility. Issues that are related to the substance's properties once they are in the environment include degradation time, dislodgeability, lipophilicity, or volatility.

Route of Exposure

The exposure route or pathway will play a critical role in choosing the most appropriate exposure algorithms used in the assessment. The appropriate algorithms need to reflect the manner in which the chemical is contacted. For example, if exposure to residues from an indoor fogger is evaluated, then the exposure algorithms must account for residues in the air (for the inhalation route) and residues deposited on the carpet (for incidental ingestion via hand to mouth and dermal routes).

## 2.2 Exposure Assessment Models

There are two general exposure assessment methods available in Calendex™: point estimate and probabilistic (Monte Carlo). With appropriate adjustments these models can also be used for estimating cumulative exposures.

### 2.2.1 Point Estimate

A point estimate of exposure to a specific chemical by a particular population is a broad estimate generated using one number to represent the residue (i.e., concentration of the chemical) and one number to represent the contact to the chemical by that population. In estimating exposure using point estimates, the arithmetic mean is most commonly used; however, if the distribution of parameter of interest is known to be skewed, use of the median (or $50^{th}$ percentile) concentration can sometimes be more appropriate (Mosteller and Tukey, 1977). Typically, the most basic models combine data on average contact and average concentration levels of the substance to estimate average exposure.

Calendex™ provides the user with the capability to use point estimates whenever the residue distribution data or contact distribution data are not available.

### 2.2.2 Probabilistic or Monte Carlo Assessment

Probabilistic or Monte Carlo assessments in Calendex™ utilize both residue distributions and the distribution of contact levels. Contact levels vary among individuals. For example the dermal contact level for an adult would be larger than the dermal contact level for a child while a child may have more active contact with the treated surface. Similarly, residue levels present in the residential environment also vary. The variations in the contact and chemical concentrations

produce potential variations in the resulting exposure distributions. Convolution methods can be used to combine the contact and residue distributions.

Calendex™ provides the user with the capability to conduct Monte Carlo analysis whenever the residue distribution data and contact distribution data are available for such analyses. Users can also conduct a combination analysis, using point estimates for some parameters and distributions for those where the data permit.

### 2.3 Considerations for Cumulative Assessments

The method used to estimate non-dietary exposure to multiple chemicals needs to adjust the detected residue levels of each of the chemicals considered, by "relative toxicity factors" that reflect the toxicity levels of these chemicals relative to a "standard" chemical. A total adjusted residue then may be derived for each sample by summing the adjusted residue values corresponding to that sample. An exposure assessment is then conducted using these total adjusted residues. This approach is based on the concepts proposed by the National Academy of Sciences (NAS) for the assessment of joint exposure to organophosphate pesticides, and is similar to that followed by the EPA in the case of dioxin-like compounds. Calendex™ does not specify the procedure for establishing the relative potency, but once the user has determined the relative potency, Calendex™ will adjust the residues accordingly.

## 3.0 OVERVIEW OF CALENDEX™ AND THE CALENDAR MODEL APPROACH

The Calendex™ model estimates human exposure to chemical residues in foods and from non-food (non-dietary) treatments, such as pest control and turf treatments, on acute, short-term, intermediate-term, and chronic bases as appropriate to the toxicity of the compound and the type of exposure. Exposures can be calculated for a large, representative sample of the U.S. population and for a wide range of user-specified subpopulations (e.g., toddlers, the elderly, adolescents, females of childbearing age).

The Calendex™ model, as currently developed, contains demographic and food consumption data for two sample frames that are representative of the entire US population. The U.S. Department of Agriculture created the sample frames as a part of the two most recent national food consumption surveys. Each sample frame contains more than 10,000 individuals that were surveyed in USDA's Continuing Survey of Food Intakes by Individuals (CSFII)[3] (USDA 1992-96) . Each individual provided demographic information as well as detailed food consumption data for two or three days. The USDA developed a "statistical weight" for each individual that can be applied to develop estimates of exposure for the US population. The demographic variables for each individual can be used in part to support the selection of parameters for non-dietary exposure calculations in FQPA aggregate and cumulative exposure assessments as well as to estimate exposure due to residues in the food supply.

[3] Calendex™ can use CSFII surveys. The 1989-91 survey has three days of food consumption data and demographic data for 10,383 participants. The 1994-96 survey has two days of food consumption data and demographic data for 15,303 participants.

Exposure can be computed and aggregated for the following scenarios:

- product-specific across routes (e.g., turf dermal + turf oral)
- route-specific across products (e.g., turf dermal + pet dermal)
- multiple products and multiple routes (e.g., turf dermal + turf oral + pet dermal + pet oral)

In each situation routes can be "linked" if exposures are dependent. Linking does *not* aggregate scenarios together; rather it assumes that the exposures occur simultaneously. For example, the pet oral and pet dermal scenarios should be linked to ensure that these exposures *occur* on the same day.

The post-application exposures associated with chemical residues in food and non-food chemical treatments can be modeled deterministically (i.e., as point estimates) or probabilistically (i.e., derived from mathematical distributions representative of measured data or drawn at random from a file of relevant data points) in the Calendex™ model. In addition, for each non-agricultural treatment type, occupant applicator exposures can be modeled in a Calendex™ analysis using both deterministic and probabilistic techniques. Calendex™ can estimate realistic applicator and post-application exposures by incorporating information about the likelihood that each treatment and contact occur. Probabilistic methods are also used to determine whether a given pesticide is applied in a specific household, the application dates of pesticide treatments in the home, the amount of residue uptake per unit of contact, the level of contact by each individual that results in the uptake of physical chemical residues, and other relevant parameters. Chemical exposure by each individual from the demographic survey data is estimated repeatedly using Monte Carlo analysis that specifies a new set of daily food consumption data, treatment schedules, contact schedules, and residue concentrations with each iteration. These exposure estimates are used to compute means, standard deviations, and probability distributions for the population being modeled.

Calendex™ currently uses the calendar day as the basic unit of time for calculating human exposure to one or more chemicals. All reporting periods longer than a day are built up from sequential daily exposures to an individual, summed, and averaged over the number of days included in the reporting period to provide an average daily exposure for that individual over the time duration specified in the analysis.

### 3.1 The Calendar Model

The Calendar model:

- Uses the probability that individual exposures occurs around specific dates
- Calculates exposure for individual chemical uses and exposure routes
- Combines the exposure-probability distributions for individual uses using Monte Carlo sampling techniques

The calendar model must account for the variation in application; not all products are applied on the same day or used with the same frequency. Information about the frequency of use or application is very important in accounting for this type of information in the model. This

information may be obtained from market use data or product labels that specify frequency of application, or reasonable seasonal assumptions may be made based on professional experience. It is important to recognize that residues from various treatments might overlap. For example, a professional applicator could treat a home for cockroaches on March 1st. June 1st, the homeowner could spray the lawn with the same active ingredient. The family dog could be treated for fleas on August 1st using the same active ingredient. The question might then arise, what is the exposure to a child on September 7th? A realistic model will not assume the worst case for each of these scenarios and simply add the residues together. Instead, a good model will account for such overlap based on the probability of occurrence of such overlap and chemical degradation. Figure 2 presents a graphical representation of how a realistic model determines the available residue per unit of contact on September 7th (day 250 of the year) from the three treatments previously described.

Calendex™ estimates the available residue value on the day of exposure by first computing the number of elapsed days between the application day and the day of exposure for each use of each chemical. Calendex™ then adjusts the level of chemical residue by using a degradation function specified in the analysis set up parameters.

Calendex™ calculates exposure by multiplying the resulting residue level (as just described) by the appropriate contact factors specified by the user. Figure 3 presents a graphical representation of Calendex™ estimated exposures to a chemical used in three products at various times over a one-year period. For each day for which exposure is calculated, the model combines exposure (contact) distributions with the probability that an exposure to a given compound could occur as a result of a previous or concurrent application of a product containing that chemical. The model also takes into account the probability that exposures to more than one product may occur on a single day which provides a more realistic exposure assessment than would occur if exposures resulting from single uses are summed. Monte Carlo techniques are used to estimate the distribution of potential exposures, and to combine these distributions with information about product use. These conditional distributions are combined with the usage probabilities associated with each product to generate exposure distributions for specific calendar days specified by the user and are repeated many thousands of times in the analysis.

## 4.0 CALENDEX™ LIBRARIES

Calendex™ utilizes libraries to organize the various types of data used to estimate exposure and risk. The current libraries are within Calendex™ are:

- equation library,
- CSFII library,
- public data library,
- proprietary data library, and
- drinking water library.

Each of these libraries contains several books of data. Figure 4 illustrates the conceptual layout of the libraries. With the exception of the CSFII Library, all of these libraries can be built, edited, and maintained using the Calendex™ Library Manager. All of the data organized with the

Library Manager is completely defined by the user. Each of the Calendex™ libraries is discussed in more detail below.

### 4.1 Equation Library

It is important to keep in mind that Calendex™ is not programmed to utilize a fixed equation to estimate exposure. Recall that Calendex™ uses a general algorithm of contact x residue = exposure. The user must define all of the parameters that constitute the contact and residue functions. Although the user must determine which equations and parameters are the most appropriate to use, the basic equations and parameters are easily accessible and modifiable within the equation library.

The equation library consists of two books. The first book is the EPA's SOP for conducting residential exposure assessments (US EPA 1997a, 1999a). This provides the basis for all of the equations used to assess potential exposure to pesticides in various scenarios. The SOP equations were previously presented to and reviewed by the SAP (September 1999) and therefore they will not be discussed in great detail.

Eventually more data will become available that will necessitate a modification in the SOP equations. For example, due to the lack of data, the SOP equation for post-application dermal exposure to pet products essentially assumes that 2% of the amount of active ingredient applied is available for exposure (20% applied is dislodgeable and 10% of the dislodgeable is transferred). EPA has been exploring an alternate methodology for assessing dermal exposure by utilizing a "hugging the pet" scenario. Once a final equation for this scenario is approved, the current SOP equation in the library can be easily modified.

The second book in the equation library is comprised of user-defined equations. Not all of the SOP equations are appropriate for some products or use scenarios. Thus, the user must create equations that will appropriately represent these unique scenarios. These equations are designed and stored in the user-defined equation book where they may be based on SOP equations or may be completely original.

### 4.2 CSFII Library

Calendex™ currently uses data from the 1989-91 and 1994-96 USDA Continuing Surveys of Food Intakes by Individuals (CSFII) (USDA, 1992-96). In addition, USDA has conducted the Supplemental Children's Survey to the 1994-96 (CSFII 1998). The CSFII 1998 was conducted in response to the Food Quality Protection Act of 1996, to provide data from a larger sample of children for use by the Environmental Protection Agency in estimating exposure to pesticide residues in the diets of children. The CSFII 1998 was designed to be combined with the CSFII 1994-96; and will be included in Calendex™ upon their release by USDA.

Each of the CSFII surveys uses a stratified area probability sample of individuals residing in the conterminous US. The primary goal of the sample design for the CSFII surveys is to obtain a nationally representative sample of non-institutionalized persons residing in households in the United States for each of 40 analytic domains defined by sex, age, and income level (an "all-

income" group and a "low-income" group). The USDA provided statistical weights that adjusted for the different probabilities of selection and non-response rates and permitted the data from the most recent years of the surveys to be combined. Fourteen demographic characteristics and month of the interview were used to derive the weights for the individuals in the survey so that the distribution of the weighted sample becomes similar to that of the U.S. population with respect to the demographic characteristics. Weights were derived separately for males age 20 years and older, females age 20 years and older and persons less than 20 years of age. Thus, the CSFII provides a sample frame representing the U.S. population.

The data from the CSFII surveys are stored in two books within the CSFII library. The first book consists of the food consumption data that are used in DEEM™ to calculate dietary exposure and are subsequently linked to Calendex™. The dietary intake information collected by the CSFII 1989-91 refers to three consecutive days, and that collected by the 1994-96 refers to two non-consecutive days. USDA derived statistical weights for the all individuals with records on the first day of the survey, and for those individuals with three days of records in the 1989-91 CSFII, and for those individuals with two days of records in the 1994-96 CSFII. DEEM™ uses all individuals in the 1989-91 CSFII with three days of records, and all individuals in the 1994-96 CSFII with two-days of records.

The other book in the CSFII library stores the demographic data obtained from the CSFII surveys. This data includes the respondents' ages, body weights, and heights. In addition, inhalation rates and body surface areas are calculated based on the body weight and height using the equations provided in EPA's Exposure Factors Handbook (US EPA, 1997).

Note that the user cannot modify the CSFII "library." That is, the number of individuals in each survey, the demographic variables, and food consumption records for each individual are essentially locked into supporting data files which cannot be edited without specific programming tools and file specifications which are not provided to users with Calendex™. This ensures that there will always be underlying data consistency with regard to the most basic "drivers" of a Calendex™ analysis, and prevents the user from dropping individuals from an analysis whose intake may exceed what might normally be considered a practical maximum.

### 4.3 Public Data Library

The Public Data Library stores data that are publicly available. These public sources include but are not limited to EPA documents, journal articles, public software outputs, and public databases. The data are categorized within several different books including contact factors, residue factors, chemical/product specific factors, exposure studies, and toxicity data. Since all of these data are completely defined by the user, they are entered, edited, and maintained using the Calendex™ Library Manager.

### 4.3.1 Contact Factor Books

Calendex™ uses a general algorithm of: *contact x residue = exposure*. For example, the general equation for estimating potential exposure for toddlers from incidental ingestion of pesticide residues from pets due to hand-to-mouth behavior is described in equation 1.

Equation 1) $PDR = C \times DR$

where:

| | | |
|---|---|---|
| PDR | = | potential dose rate (mg/day) |
| C | = | contact ($cm^2$/day) |
| DR | = | dislodgeable residue from pet (mg/$cm^2$ pet) |

Typically, the contact function is composed of a variety of parameters and are created by combining related functions, either as fixed (deterministic) values, in the form of distribution functions, or a combination of both. Where a contact distribution is created from other distributions, Monte Carlo sampling is used to choose a value from each distribution independently from one another, and then these values are combined (e.g., multiplied or added together, depending on the nature of the built-up composite function as specified by the user). For example, the contact function, as described in equation 2, is based upon the SOP equation and parameters used to estimate potential exposure for toddlers from incidental ingestion of pesticide residues on pets due to hand-to-mouth behavior.

Equation 2) $C = SA \times FQ \times ET \times SE$

where:

| | | |
|---|---|---|
| C | = | contact ($cm^2$/day) |
| SA | = | surface area of the fingers ($cm^2$/event) |
| FQ | = | frequency of hand-to-mouth activity (events/hr) |
| ET | = | exposure time (hr/day) |
| SE | = | saliva extraction (%) |

The contact factors within the Public Data Library stores similar data (parameters) as described in equation 2. Contact factors are not usually chemical specific, but instead are related to specific types of contact activities, for example, turf contact, pet contact, indoor air breathing, etc. All exposure routes for a given contact type can be included in a single library. Once these libraries are set up they can be used repeatedly for many different analyses. The contact data can come from a variety of public sources including the following, but not limited to:

- EPA's SOPs,
- EPA's Exposure Factors Handbook (US EPA, 1997b),
- National Human Activity Patterns Survey (NHAPS),
- California Activity Surveys,
- Pesticide Handler's Exposure Database (PHED) (Versar, 1995),
- journal articles, or
- outputs from various software systems (i.e., REX, THERdBase, AMEM, MCCEM, SCIES, etc.).

### 4.3.2 Residue Factors Books

Similar to contact functions, the residue function can also be created by combining related functions, either as fixed (deterministic) values, in the form of distribution functions, or both. Where a distribution is created from other distributions, Monte Carlo sampling is used to choose a value from each distribution independently from one another, and then these values are combined (e.g., multiplied or added together, depending on the nature of the built-up composite function as specified by the user). For example, continuing with the pet example from above, the residue function, as described in equation 3, is based upon the SOP equation and parameters used to estimate potential exposure for toddlers from incidental ingestion of pesticide residues on pets due to hand-to-mouth behavior.

$$\text{Equation 3)}\quad DR = (AR \times F) \div SA_{pet}$$

where:

| | | |
|---|---|---|
| DR | = | dislodgeable residue from pet ($mg/cm^2$ pet) |
| AR | = | application rate (mg ai) |
| F | = | fraction of ai available on pet (%) |
| $SA_{pet}$ | = | surface area of pet ($cm^2$) |

The residue factors within the Public Data Library stores similar data (parameters) as described in equation 3. The residue factors are chemical or product specific and need to be modified for each new assessment. These data can come from a variety of public sources including but not limited to the following:

- product labels,
- journal articles (i.e., dislodgeable residue data), or
- pesticide source books and databases (i.e., half lives and degradation data).

### 4.3.3 Exposure Studies Books

In some cases, the exposure to a specific pesticide is already known and therefore the data in the contact factors and residue factors books are not needed. In these cases this type of data is compiled in the exposure studies book. Typically, the data found in this book are from biomonitoring studies published in publicly available journals. These data are not limited to point estimates but can also be empirical or parametric distributions as well.

### 4.3.4 Chemical/Product Specific Factors Books

Calendex™ utilizes a variety of data stored in the chemical/product specific factors books. These data include but are not limited to:

- percent of households treated (e.g., 75% of the households in US use flea and tick products)
- regions of treatment (e.g., treatment in Florida occurs all year round)
- type of applicator (e.g., the product is only sold to homeowners who can treat their own pets)
- dates of application (e.g., the application occurs on the first of the month)

- frequency of application (e.g., the application occurs once a month)

#### 4.3.5 Toxicity Data Books

Exposure estimates derived by Calendex™ can be compared to compound specific toxicity measures to derive risk estimates. The toxicity measure used by Calendex™ depends on the type of assessment being conducted. The toxicity data are stored in two types of books. The first book consists of toxicity values such as dermal, oral, and inhalation No Observed Effect Levels (NOELs) or Reference Doses (RfDs). The other book consists of cumulative adjustment factors used to calculate risk from exposure to several chemicals with the same mechanism of toxicity. The publicly available sources of these data are EPA reviews, EPA's IRIS database, journal articles, or pesticide source books.

Estimates of chronic exposures are usually compared to the chronic RfD or chronic NOEL. Calendex™ allows the user to specify which of these measures to use, and to specify their values. If the RfD is chosen as a measure of toxicity, risk estimates are expressed as a percent of the RfD, while selecting the NOEL will produce Margins of Exposure (MOE).

Estimates of acute exposures are usually compared to the acute NOEL. Acute risk estimates are expressed as MOEs. Estimates of short-term and intermediate-term exposures are usually compared to the short-term and intermediate-term NOELs, respectively. Risk estimates are expressed as MOEs.

### 4.4 Proprietary Data Library

The Proprietary Data Library consists of the same types of books as the Public Data Library except that the sources of the data are not publicly available. The major sources of data stored in this library are registrant- or task force-conducted studies and surveys. Since all of these data are completely defined by the user, they are entered, edited, and maintained using the Calendex™ Library Manager.

### 4.5 Drinking Water Data Library

The Drinking Water Data Library contains the same types of books as the Public and Proprietary Data Libraries. However, it should be noted that the general equation for assessing drinking water exposure is slightly different in that consumption (rather than contact) multiplied by the residue equals exposure (i.e., *consumption x residue = exposure*). The water consumption factor can be derived from the CSFII data or data in EPA's Exposure Factors Handbook. Whereas, the residues may come from USGS's National Water Quality Assessment program (NAWQA) database or registrant conducted studies.

The product specific factors book contains very useful data for estimating drinking water exposure. This data relates to regions of pesticide treatment, dates of treatment, and frequency of treatment. These parameters are extremely important in order to capture the *temporal and spatial* differences in drinking water exposures. Thus, Calendex™ can be used to conduct regional drinking water exposure assessments.

## 5.0 CALENDEX™ CALCULATION METHODOLOGIES

The computational algorithms and codes used by Calendex™ are presented in Appendix A. We describe below a representative set of these methodologies and algorithms.

### 5.1 Calendex Exposure Methodology Sequence

It is important to understand the difference between the terms "treatment" and "application." A "treatment" is the use of a specific chemical to treat a specific problem in the home (e.g., turf treatment). An "application" is the act of applying a specific treatment in the home, which can occur one or more times throughout the year at periodic or non-periodic intervals. Thus an individual can contact a treated area that has accumulated residues from more than one application of a given treatment type.

Figures 5A and 5B present flowcharts of the steps used in Calendex™ to calculate exposure. Note that Figure 5B represents the internal workings of the "compute exposure" box in Figure 5A.

Prior to the analysis:

(1) Define Product and Route Specific Parameters for Each Treatment
Each exposure route (dermal, oral, or inhalation) of concern for each treatment type (e.g., pet treatment, turf treatment, crack and crevice treatment) is set up by the user in a dedicated "aggregate exposure (AGX) file." Each AGX file contains one or more application scenarios (e.g., frequency of application, periods of application, occupant application and/or professional application options) for the relevant treatment along with probability values for each element of each scenario. Each AGX file also contains residue and contact data (probabilistic and/or deterministic) for the relevant treatment-type and contact path (e.g., pet contact, turf contact, indoor air breathing rates, etc.). The contact data are differentiated by age group (infants, children 1-3, 4-6, 6-12, etc.). AGX files that represent different exposure routes for the same treatment-type should have the same set of application scenarios, but will likely have different residue and contact data. Note that while application dates throughout the year are specified probabilistically in each AGX file, the days or weeks for which exposure will be evaluation in each analysis are specified in the computational module of Calendex™ immediately prior to running the analysis.

(2) Compile All Treatments of Interest into One Master File
A master list (AGM file) of all of the AGX files to be included in a single aggregate or cumulative Calendex™ analysis is set up by the user. The use of a master list allows the user to repeat analyses or conduct sensitivity analyses that involve multiple treatments or chemicals without having to specify repeatedly all of the AGX files to be included in each Calendex™ analysis. The AGM file also provides a traceable path for quality assurance purposes. AGX files, which represent different exposure routes for the same treatment, are linked together in the AGM file. This ensures that the exposures from one treatment type occur on the same day.

Running an analysis:

(3) Define Analysis Parameters

The user specifies the following parameters: the type of analysis of interest as discussed below; the name of the DEEM™ dietary residue file (as appropriate); the name of the AGM file; the number of Monte Carlo iterations and random number seed; the appropriate NOEL or RfD values by exposure route; maximum exposure amounts (used to calibrate the distribution bins); and the population demographics of interest (e.g., toddlers 1-3).

The six analysis types available in Calendex™ include the following:

- **Single Day (general)** For each iteration, exposure is calculated for a *randomly* chosen day where all days of the year are given equal probability. The output provides a distribution of daily exposures.

- **Single Day (day specific)** Exposure is calculated for one specific the day of the year that is chosen by the user. The output provides a distribution of the daily exposures for the specified day.

- **Single Day** (**sequential series**) Exposure is calculated for specific sequential days that are chosen by the user. The output provides a distribution of the daily exposures for each of the specified days. For example if the user chose run an analysis for January 1st and January 2nd, Calendex™ would produce one distribution of daily exposures for January 1st and a separate distribution of daily exposures for January 2nd.

- **Multiple Weeks** (**week specific**) Exposure is calculated for a specified week or combined set of weeks (up to 52 combined weeks) that are chosen by the user. The output provides a distribution of the daily exposures averaged over the combined number of days. For example, an analysis that includes weeks 1 through 4 results in one exposure distribution where the exposures are calculated for each day, summed, and divided by 28.

- **Multiple Weeks** (**sequential series**) Exposure is calculated for a series of weeks or a series of a combined set of weeks (up to 13 combined weeks) that are chosen by the user. This allows the user to evaluate up to 13 four-week periods or 4 three-month periods in one run to identify monthly or seasonal trends. The output provides a series of distributions of the daily exposures averaged over the combined number of days. For example, an analysis that includes weeks 1 through 8 with 4 combined weeks results in two exposure distributions. The first distribution results from the exposures for the first 4 weeks, which were calculated for each day, summed, and divided by 28. Similarly, the second distribution results from the exposures for the second 4 weeks, which were calculated for each day, summed, and divided by 28.

- **Multiple Weeks** (**sliding series**) Exposure is calculated for a series of weeks or a series of combined set of weeks (up to 4 combined weeks) that are chosen by the user. The sliding series analysis differs from the sequential series analysis in that the sliding analysis allows the user to evaluate multiple “sliding” week periods (up to 4 weeks). For

example, the user can evaluate multiple "sliding" 3-week periods, starting with week 10 (including weeks 10, 11, and 12), then starting with week 11 (including weeks 11, 12 and 13) etc. The outputs from this analysis are identical to the outputs for the sequential series analysis.

Once all of the parameters have been specified, the analysis is launched.

Calendex™ Analysis

(4) For each exposure iteration (i = 1 to nsims), repeated up to 5000 times for each participant in the CSFII survey (matching the demographic profile specified by the user) Calendex™ does the following:

(5) If dietary exposure is included in this Calendex™ analysis then this step is executed; otherwise, it is skipped. Daily dietary exposure is calculated using the DEEM™ dietary exposure model for each sequential day of interest (dd = 1 to ndays). For each day, a set of daily food records is selected at random from this individual's CSFII records. Daily dietary exposure amounts are then computed using the residue data in the user-specified dietary residue file. These exposure amounts are summed for all days in the analysis.

(6) Calendex™ generates an application scenario for each AGX file included in the analysis. An application scenario identifies the application dates, frequency of application, and whether a professional applicator or homeowner applies the product.

(7) For each AGX file, Calendex™ determines which, if any, of the multiple applications are active during the period of analysis as specified by the user in step 3. In other words, Calendex™ determines if there is available residue for contact during the period of analysis resulting from previous applications. The determination of available residue is based on the application scenario generated in step 6 and the duration of time the residue remains active as specified in the AGX file in step 1.

(8) If there is available residue for contact, Calendex™ calculates or selects a residue value. For each active application of a given treatment type/exposure route, Calendex™ calculates the number of days elapsed between the day of application and the day of exposure. Calendex™ then selects the available residue amount (per unit of contact) on the day of application using a specified residue distribution in the residue library in the corresponding AGX file. Calendex™ then applies a degradation factor to determine the residue amount available after the elapsed days between the day of application and the day of exposure. If contact occurs on the same day as application, the initial residue amount is used instead of a degraded amount. Alternatively (as specified in the AGX file), a residue value for a specific number of elapsed days after application can be drawn directly from a specified residue distribution in the residue library.

(9) On the first day of the specified analysis period, the daily contact amount (see Section 4.3.1) specific to the treatment type and population of interest is generated from the specified contact distribution function located in the corresponding AGX file. This contact is then multiplied by the available residue amount as selected in step 8 to calculate the exposure. If there is another active application of the same treatment, then Calendex™ calculates the

corresponding residue for that application as described in step 8. Calendex™ then calculates exposure using the same contact amount as used for the *first* application and the residue amount calculated for the *second* application. The individual exposures for each application are summed to produce a total daily exposure.

(10) For multiple days or week analyses, steps 8 and 9 are repeated for each subsequent day, assuming the same original, application day residue amount for each application but incorporating further degradation and utilizing a different contact amount on each day. Daily exposure amounts for each exposure route are summed over the number of days in the analysis.

(11) Exposure calculations are repeated for each treatment/exposure route (i.e., for each AGX file included in the analysis) and the total exposure for that iteration is calculated and stored[4] (for later use in estimating a distribution) by exposure route (dermal, inhalation, oral).

(12) If the application day, as generated in step 6, falls within the exposure duration, as specified in step 3, and a self-application scenario was selected in step 6, Calendex™ computes the applicator exposure[5]. For the current exposure route, Calendex™ draws an available residue amount from the applicator residue distribution function and draws a contact amount from the applicator contact distribution function (both functions are assigned in the corresponding AGX file). Calendex™ then multiplies the residue amount by the contact amount to determine the exposure estimate for this exposure route. These exposure estimates are then stored for later use for estimating the distribution of applicator exposures. This process is repeated for a randomly selected adult in that household and for each exposure route of interest.

For all analyses:

(13) When multiple days are evaluated, the daily exposure amounts have already been summed for each day (d = 1 to n) as described in step 10. The average daily exposure (by route) is calculated by dividing the sums of the multiple-day exposures by the number of day's (n) specified in step 3.

(14) If the user has directed the analysis to be reported in terms of exposure per kilogram of body weight, the exposure amounts are all divided by the individual's reported body weight (from the CSFII survey) as specified in step 3.

(15) If the NOELs are the same and if the user specifies that oral and dermal exposures are to be combined, then Calendex™ aggregates the individual's exposure amounts from the two routes. The MOE is calculated as discussed in section 5.5.

[4] The individual exposures are stored in bins that are defined using the same methodology as used in DEEM™

[5] Each adult in the household has an equal chance to be the applicator. Thus if there are two adults in the household, the adult in this analysis has a 50% chance of being the applicator. The user defines the minimum age of an adult in the household that can be an applicator

(16) If the NOEL amounts are different and the user specifies that the oral and dermal exposure routes are to be combined, then the Total MOE as discussed in section 5.5 is computed for each individual and stored for later use in determining the distribution of the Total MOE.

(17) After all iterations have been completed for all participants in the CSFII, the mean exposure amount and the percentiles of the distribution of exposure amounts for each exposure route are computed and reported for the population of interest, along with the corresponding MOE or percent of RfD (as specified by the user).

(18) A "plot file," which contains all of the data in the distribution bins from which the distributions were calculated, is generated and saved. The data in the plot file can be used for post-processing and graphical analysis. The computational method for generating a distribution from a bin array is identical to that used in the DEEM™ program, which has already been reviewed by the SAP.

### 5.2 Monte Carlo Simulation Methodology

Monte Carlo analysis methods are used to bring together the wide range of probability distributions needed to calculate each individual's exposure. Specifically, for each treatment type included in the analysis Monte Carlo is used to determine (1) whether it is applied professionally or by someone in the home, (2) whether that treatment type is made at the individual's residence, (3) how many time a year it is made, (4) the dates that each treatment are made during the year, (5) what residue amount results from each treatment on the day(s) of treatment, and (6) how much contact with potentially residue-bearing surfaces (or other residue transfer mediums) is made by the individual on the days of interest. Calendex™ allows each one of these decision variables to be based on a deterministic value or on a distribution from which a value is drawn using a new random number with each draw.

Note that the food consumption amounts used in the dietary analysis (based on the DEEM™ analysis module) are treated as deterministic values, while the residues assigned to those food consumption amounts can be either deterministic or drawn from a distribution. In addition, all demographic parameters associated with each participant in the CSFII are considered to be deterministic. That is, the person's reported weight and height are used in the analysis, not simulated using a probabilistic distribution.

The Monte Carlo process can be repeated up to 5000 times for each individual in the each CSFII surveys, so that the total number of exposure computations for an analysis of the entire U.S. population using the 1994-96 survey is 76.5 million (15,303 participants times 5000 iterations for each participant).

### 5.3 Interval (bin) Limits of the Exposure Frequency Distribution Methodology

Calendex™ utilizes a binning procedure similar to the one used in DEEM™ which was presented and reviewed by the SAP in February of 2000 and therefore is not repeated in this document.

### 5.4 Degradation Calculation Methodology

Calendex™ is able to incorporate residue degradation by using either actual residue values on specific days after treatment or using degradation equations for half-lives or a straight line to zero over a specified number of days. The degradation equations are presented in equations 4 and 5.

Equation 4) Half-life method: $R_X = R_0 \times 0.5^{X/hl}$, where hl = half life in days

Equation 5) Straight-line method: $R_X = R_0 \times (1 - X/z)$, where z = days to zero residue level

$R_X$ is determined directly from a residue distribution function other than $R_0$: Given that $ld_i$ is the last day that residue function i is valid, find $R_i$ such that $ld(i-1) < X <= ld(i)$. Then $R_X = R_i$ (selected from probability distribution)

where,

X = the integer number of days elapsed between application and contact
$R_0$ = residue concentration factor on day of application (mg/unit of contact)
$R_X$ = residue concentration factor on day X (mg/unit of contact)

Note: When X = 0, $R_X = R_0$ with no adjustment. That is, on the day of application the treatment was assumed to be applied before contact and the residue is not degraded.

### 5.5 MOE Calculation Methodology

When a single exposure route is evaluated for a chemical or multiple routes are evaluated in which the NOEL for each route is the same, the MOE can be calculated for any exposure value in the resulting distribution. For example, if the 90th percentile exposure amount is $Ex_{90}$, then the MOE is simply NOEL/ $Ex_{90}$.

However, when multiple exposure routes are evaluated, each having a different NOEL, then the total MOE cannot be calculated directly for any given exposure in the exposure distribution. Instead, the MOE must be calculated for each individual from the individual components of his or her total exposure: i.e., $MOE_1 = Exp_1/NOEL_1$, $MOE_2 = Exp_2/NOEL_2$, $MOE_3 = Exp_3/NOEL_3$, where subscript 1 refers to the inhalation exposure route, 2 to the dermal exposure route, 3 to the oral exposure route (which includes both dietary and incidental ingestion). Then the Total MOE ($MOE_T$) is calculated based on the equation in OPP's Draft Guidance for Performing Aggregate Exposure and Risk Assessments (US EPA, 1999b), which is presented in equation 6. This Total MOE concept was presented to, and endorsed by, FIFRA's SAP in 1997 (US EPA, 1999b).

Equation 6) $$MOE_T = \frac{1}{\frac{1}{MOE_1} + \frac{1}{MOE_2} + \frac{1}{MOE_n}}.$$

where, for example,

$MOE_1$ = Margin of Exposure (e.g., adult, inhalation route)
$MOE_2$ = Margin of Exposure (e.g., adult, dermal route)

The resulting $MOE_T$ for each individual is then binned so that a distribution of the $MOE_T$'s for the entire subpopulation can be generated, analogous to the method used to generate the exposure distribution itself.

### 5.6 Random Number Generator

The current version of Calendex™ uses the Microsoft Visual Basic system random number generator function RND() to generate pseudorandom U (0,1) values. At a previous SAP meeting, members of the SAP had expressed concern that "the algorithm used by Microsoft is not publicly documented" and that "this random number generator is possibly related to the one used by Microsoft Excel which is also not publicly documented, but has been deemed inadequate." In addition, Novigen has used the commercially available forecasting and risk analysis software Crystal Ball to conduct some of the validation checks of the Monte Carlo algorithms used in DEEM™ and Calendex™. At a previous SAP meeting, members of the SAP had expressed the view that they "did not consider Decisioneering Crystal Ball to be sufficiently independent from Microsoft Visual Basic."

Novigen has obtained additional information regarding Microsoft Visual Basic, Microsoft EXCEL and Crystal Ball random number generators. A summary of that information is provided below.

The documentation regarding Microsoft Visual Basic random number generator that was reviewed by Novigen, indicates the program uses the linear-congruential method for pseudo-random number generation in the RND function. The following pseudo code documents the algorithm used:

**ALGORITHM USED BY MICROSOFT VISUAL BASIC**
**RANDOM NUMBER GENERATOR**

X1 = (X0 * a + c) MOD (2^24)
U1 = Xi/2^24
where:
X1 = new value
X0 = previous value
a = 1,140,671,485
c = 12,820,163
U1 = random number returned by the function

The generator has period length $2^{24} - 1$ (= 16,777,215)

DEEM™ and Calendex™ initialize the random number seed by using the system timer, unless a user specifies a random seed. RND() returns a new sequence for each component in which it is used, these sequences are independent of one another.

The random number generator RAND() used by EXCEL is of the form:

**ALGORITHM USED BY MICROSOFT EXCEL**
**RANDOM NUMBER GENERATOR**

X1 = Fractional part of (X0 * a + c)

Where:
- X1 = new value
- X0 = previous value
- a = 9,821
- c = 0.211327

Crystal Ball uses the following Multiplicative Congruential Generator:

**ALGORITHM USED BY CRYSTAL BALL**
**RANDOM NUMBER GENERATOR**

X1 = (X0 * a) MOD (2^31 –1)
U1 = Xi/2^31
where:
- X1 = new value
- X0 = previous value
- a = 630,360,016
- U1 = random number returned by the function

The generator has period length $2^{31} - 2$ (= 2,147,483,646)

The following is extracted from information provided by Crystal Ball's manufacturer:

"Crystal Ball does not depend on Excel for any of its statistical calculations. In addition, the random number generator used in Crystal Ball is based on a method that has been extensively tested and described in the textbook "Simulation Modeling & Analysis," 2nd Ed. By Averill Law and David Kelton."

Based on that information, Novigen believes that the three random numbers are different. Furthermore, based on the SAP recommendations, Novigen is currently conducting additional tests on the random number generator used by its software. Novigen is also reviewing other

random number generator algorithms, and evaluating the feasibility of using them in its software, should the random number generator used by Microsoft Visual Basic be considered inadequate.

## 6.0 UNCERTAINTY

EPA (1992) has classified uncertainty in exposure assessments in three categories, scenario uncertainty, parameter uncertainty and model uncertainty. We give below examples of how these uncertainties may arise in an aggregate exposure assessment and how Calendex™ may be used to analyze these uncertainties.

### 6.1 Scenario Uncertainty

Scenario uncertainties include descriptive errors, aggregation errors and incomplete analysis. For instance, for a lawn product, scenario uncertainty may result from incorrect information regarding the regions in which the product is used. For example, the assessor may know that the compound is used in the South, but does not have data regarding its use in the other regions. In this case, two runs may be used in Calendex™, one which assumes that lawns in the entire US may be treated with the compound of interest, the other which restricts usage to the South region. A comparison of the results of the two analyses allows the user to evaluate the impact of the scenario uncertainty. Another example of scenario uncertainty refers to assigning the same concentration value to the entire in-doors inhalation exposure, when concentrations may vary across various rooms in the home. For instance, if an individual spends 40% of their "indoors" time in a one room, and 60% in another room, then aggregating the time spent indoors in a total daily value and assigning that total daily time the same concentration value may result in a biased estimate. Calendex™ allows the user to run two assessments, one that aggregates the daily times, and one that keeps them separate. The user can assess the impact of this type of scenario uncertainty by comparing the results of the two analyses. Other sources of scenario uncertainty may result from ignoring an important pathway, e.g., the hand-to-mouth exposures for young children.

### 6.2 Parameter Uncertainty

Parameter uncertainty includes measurement errors, sampling errors, variability and use of surrogate data.

Two examples of measurement uncertainty in the data used by Calendex™ may be the presumed tendency of some survey respondents to underestimate their body weights or to under-report food consumption. In the first example, parameter uncertainty may result in potential overestimation of the exposures, while in the second example, it may result in potential underestimation of exposures.

Alternatively, an assessor may know that the distribution of air concentrations is likely to follow a lognormal distribution, but he or she may not be able to estimate the average of this distribution with enough precision. The assessor can thus use Calendex™ to conduct two assessments, one that uses the most likely estimate of the mean and another that uses an upper bound on that

estimate. The assessor can then compare the results of both analyses for an evaluation of the impact uncertainty in the parameter estimate.

Sampling errors may result from sampling too few observations or non-representative sampling. Generally, studies of residential exposures often include very few measurements, typically conducted for a limited number of scenarios.

### 6.3 Model Uncertainty

Model uncertainty arises because models are simplified representations of actual processes. For instance, Calendex™ uses user-defined models (or equations) to estimate non-dietary exposure. The SOP equations provide models for estimating exposure from various types of treatments. If the assessor is not certain of which model (SOP equation) better represents the actual conditions, he/she can run several analyses with Calendex™ using the various equations he/she thinks apply. A comparison of the results of the various analyses provides the assessor with a measure of the impact of the uncertainty in the exposure model used.

Another example of model uncertainty may result from using the wrong model to represent the degradation, over time, in air (or soil) concentrations. Calendex™ gives the assessor the option of using one of two built-in degradation functions (one that assumes a first order decay and the other that assumes linear degradation), or to use actual measurements for the various days. The impact of the uncertainty in the degradation model used can be assessed by running analyses using the two models, or the observed measured data, and comparing the results of these analyses.

Calendex™ does not include a built-in uncertainty analysis tool. Following the SAP's recommendations regarding DEEM™, Novigen recommends conducting multiple sets of exposure analyses to capture the impact of the critical factors that are identified in the steps leading up to the analysis (e.g., the choice of residue data, whether to combine data from regions, or seasons, etc.).

## 7.0 EXAMPLE OF AGGREGATE EXPOSURE FROM USE OF A GRANULAR TURF PRODUCT

### 7.1 Description of Example

The example used to illustrate Calendex™ estimated aggregate exposures for adults (18+ years old) and toddlers (1 to 3 years old) exposed to residues of Chemical X from a hypothetical turf product. The product is a granular formulation used to control weeds and is applied using a push type spreader. We assumed that the homeowner makes five applications of this product every four weeks with the first application occurring the first week of May. It was also assumed that the homeowner would have a 50% probability of applying the product on a Saturday and a 50% probability of applying the product on a Sunday.

The potential exposures resulting from the use of this product include the following: dermal and inhalation adult applicator exposures, dermal post-application exposure for adults and toddlers, and toddler incidental ingestion via hand-to-mouth behavior. For simplicity sake we did not include the other oral exposures as specified in EPA's residential SOPs for the toddlers. Chemical X was assumed to be completely degraded after 35 days (e.g., degradation follows a straight line to residues of zero).

We also assumed that the toxic effects from the dermal, oral, and inhalation routes are the same therefore it was appropriate for the exposures resulting from these routes to be aggregated together. The dermal NOEL was assumed to be 85 mg/kg BW/day, while the inhalation and oral NOELs were 20 mg/kg BW/day. For simplicity sake we assumed that the short-term and intermediate-term NOELs are the same. Using Calendex™, the exposures were estimated using the following analysis types (see section 5.1): single day (randomly chosen), five four-week periods (weeks 18–21; weeks 22-25; weeks 26-29; weeks 30-33; and weeks 34-37), and one-year time period.

The SOP equations and parameters, which are presented below, were used as the basis for the exposure algorithms. The distribution types and sources of data are listed below each parameter.

**Adult Applicator Dermal and Inhalation Exposures**:

$$\text{Equation 7) PDR} = \frac{UE_{(\text{dermal or inhalation})} \times AR \times A}{BW}$$

where,

PDR = Potential dose rate (mg/kg/day)

UE = Unit Exposure (dermal or inhalation) (mg/lb ai)
- Point estimate: PHED data
- $UE_{dermal}$ = 3 mg/lb ai; $UE_{inhalation}$ = 6.3 mg/lb ai

AR = Application rate (lbs ai/acre)
- Hypothetical uniform distribution: 0.5 – 1.5lbs ai/acre

A = Area treated (acre/day)
- Hypothetical uniform distribution: 0.25 –1.0 acre/day

BW = Body weight (kg)
- Empirical distribution: CSFII data

**Adult and Toddler Post-Application Dermal Exposures**:

$$\text{Equation 8a) } PDR = \frac{DFR \times TC \times ET \times CF1}{BW}$$

where,

PDR = Potential dose rate (mg/kg/day)
DFR = Dislodgeable foliar residue (μg/cm$^2$)
See equation 8b
TC = Transfer coefficient (cm$^2$/hr)
Point estimates: EPA SOPs
Adult short-term =14,500 cm$^2$/hr
Adult intermediate-term = 7,300 cm$^2$/hr
Toddler short-term =5,200 cm$^2$/hr
Toddler intermediate-term = 2,600 cm$^2$/hr
ET = Exposure time (hr/day)
Cumulative distribution of amount of time spent playing on grass:
EPA's Exposure Factors Handbook

| Adults | |
|---|---|
| Percentile | ET |
| 0 | 0 |
| 25 | 0.5 |
| 50 | 2.0 |
| 100 | 2.0 |

| Toddlers | |
|---|---|
| Percentile | ET |
| 0 | 0 |
| 25 | 0.25 |
| 50 | 1.0 |
| 75 | 2.0 |
| 100 | 2.0 |

CF1 = Conversion factor (0.001 mg/μg)
BW = Body weight (kg)
Empirical distribution: CSFII data

$$\text{Equation 8b) } DFR = AR \times F \times CF2 \times CF3$$

where,

DFR = Dislodgeable foliar residue (μg/cm$^2$)
AR = Application rate (lbs ai/acre)
Hypothetical uniform distribution: 0.5 – 1.5 lbs ai/acre
F = Fraction of ai retained on foliage (%)
Point estimate: EPA SOPs: 5%
CF2 = Conversion factor (4.54E8 μg/lb)
CF3 = Conversion factor (24.7E-9 acre/cm$^2$)

**Toddler Post-Application Incidental Ingestion Exposures**:

$$\text{Equation 9) PDR} = \frac{\text{DFR x SA x FQ x ET x SE x CF1}}{\text{BW}}$$

where,

PDR = Potential dose rate (mg/kg/day)
DFR = Dislodgeable foliar residue (μg/cm$^2$)
See equation 8b
SA = Surface area of two fingers (cm$^2$/event)
Point estimate: EPA SOPs: 20 cm$^2$
FQ = Frequency of hand-to-mouth activity (events/hr)
Point estimate: EPA SOPs: 20 events/hr
ET = Exposure time (hr/day)
Cumulative distribution of amount of time spent playing on grass:
Exposure Factors Handbook

| Toddlers | |
|---|---|
| Percentile | ET |
| 0 | 0 |
| 25 | 0.25 |
| 50 | 1.0 |
| 75 | 2.0 |
| 100 | 2.0 |

SE = Saliva extraction (%)
Point estimate: EPA SOPs: 50%
CF1 = Conversion factor (0.001 mg/μg)
BW = Body weight (kg)
Empirical distribution: CSFII data

## 7.2 Results of the Turf Example

**Single Day (randomly selected) Exposures (mg/kg BW/day)**
(per capita)

| Adults Dermal (applicator + post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9$^{th}$ | 0.438402 | 194 |
| 99$^{th}$ | 0.310617 | 274 |
| 95$^{th}$ | 0.199653 | 426 |
| 90$^{th}$ | 0.141706 | 600 |

See page 33 in Appendix B

| Toddlers Dermal (post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9$^{th}$ | 0.779506 | 109 |
| 99$^{th}$ | 0.525480 | 162 |
| 95$^{th}$ | 0.308003 | 276 |
| 90$^{th}$ | 0.202658 | 419 |

See page 36 in Appendix B

**Single Day (randomly selected) Exposures (mg/kg BW/day)**
(per capita)

| Adults Inhalation (applicator) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.088794 | 225 |
| 99th | 0.000000 | NA |
| 95th | 0.000000 | NA |
| 90th | 0.000000 | NA |

See page 30 in Appendix B

| Toddlers Oral (post-application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.030052 | 666 |
| 99th | 0.020093 | 995 |
| 95th | 0.011837 | 1690 |
| 90th | 0.007832 | 2554 |

See page 37 in Appendix B

| Adults Aggregate (dermal + inhalation) | |
|---|---|
| Percentile | MOE |
| 99.9th | 120 |
| 99th | 240 |
| 95th | 410 |
| 90th | 580 |

See page 32 in Appendix B

| Toddlers Aggregate (dermal + oral) | |
|---|---|
| Percentile | MOE |
| 99.9th | 100 |
| 99th | 140 |
| 95th | 250 |
| 90th | 370 |

See page 35 in Appendix B

**Four-Week Exposures (Week 22 –25) (mg/kg BW/day)**
(per capita)

Note: the results from the four-week time period with the highest exposure values are presented here; the results from the other set of four-week time periods are presented in Appendix B.

| Adults Dermal (applicator + post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.123928 | 686 |
| 99th | 0.103439 | 822 |
| 95th | 0.085530 | 994 |

See page 40 in Appendix B

| Toddlers Dermal (post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.193359 | 440 |
| 99th | 0.156434 | 543 |
| 95th | 0.126976 | 669 |

See page 45 in Appendix B

| Adults Inhalation (applicator) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.005957 | 3358 |
| 99th | 0.004691 | 4264 |
| 95th | 0.003521 | 5681 |

See page 40 in Appendix B

| Toddlers Oral (post-application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.014641 | 1366 |
| 99th | 0.011908 | 1680 |
| 95th | 0.009826 | 2035 |

See page 45 in Appendix B

**Four-Week Exposures (Week 22 –25) (mg/kg BW/day)**
(per capita)

| Adults Aggregate | |
|---|---|
| Percentile | MOE |
| 99.9th | 620 |
| 99th | 750 |
| 95th | 910 |

See page 40 in Appendix B

| Toddlers Aggregate | |
|---|---|
| Percentile | MOE |
| 99.9th | 370 |
| 99th | 440 |
| 95th | 530 |

See page 45 in Appendix B

**One-Year Exposures (mg/kg BW/day)**
(per capita)

| Adults Dermal (applicator + post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.039593 | 2147 |
| 99th | 0.033866 | 2510 |
| 95th | 0.029019 | 2929 |
| 90th | 0.026516 | 3206 |

See page 55 in Appendix B

| Toddlers Dermal (post application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.059427 | 1430 |
| 99th | 0.049774 | 1708 |
| 95th | 0.042874 | 1983 |
| 90th | 0.039195 | 2169 |

See page 58 in Appendix B

| Adults Inhalation (applicator) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.001634 | 12,239 |
| 99th | 0.001336 | 14,974 |
| 95th | 0.001092 | 18,321 |
| 90th | 0.000967 | 20,680 |

See page 52 in Appendix B

| Toddlers Oral (post-application) | | |
|---|---|---|
| Percentile | Exposure | MOE |
| 99.9th | 0.004571 | 4376 |
| 99th | 0.003813 | 5246 |
| 95th | 0.003275 | 6106 |
| 90th | 0.003010 | 6643 |

See page 59 in Appendix B

| Adults Aggregate | |
|---|---|
| Percentile | MOE |
| 99.9th | 1900 |
| 99th | 2200 |
| 95th | 2600 |
| 90th | 2900 |

See page 54 in Appendix B

| Toddlers Aggregate | |
|---|---|
| Percentile | MOE |
| 99.9th | 1100 |
| 99th | 1300 |
| 95th | 1500 |
| 90th | 1600 |

See page 57 in Appendix B

## 7.3 Outputs

### 7.3.1 Default Output

Calendex™ generates a comprehensive report of the aggregate and cumulative exposure analyses. The report includes estimates of exposure and risk (presented as either an MOE or %RfD) for each subpopulation identified by the analyst. The exposure and risk estimates are presented for the $10^{th}$ through the $99.9^{th}$ percentiles. For an individual treatment (e.g., only lawn treatment or only pet treatment), exposure and risk estimates are presented for each individual route (e.g., dermal, inhalation, incidental ingestion) as well as any aggregated routes (e.g., inhalation and incidental ingestion combined). For an aggregate assessment (e.g., lawn treatment + pet treatment + dietary), exposure and risk estimates are presented for the individual routes, but the estimates are aggregated by uses (e.g., the dermal estimate would be an aggregation of the dermal from lawn care plus the dermal from pet treatment). Additionally, if there were similar endpoints toxicologically from both dermal and oral exposure then these estimates could be combined as well. In that case there could be a total aggregation.

Six outputs were generated for this example. Appendix B presents the all of the six outputs, which include estimated single day exposures, exposures averaged over five separate four week periods, and estimated exposures averaged over an one-year period for both the adults and toddlers.

### 7.3.2 Plot File

For individual single-day or multiple-day exposures, Calendex™ produces a distributional ".PLT plot" file consisting of the entire per-user exposure distribution. The plot file also includes information about the actual (unweighted) and weighted number of people-days and user-days in the populations considered. The plot file is comma delimited and can be imported in a spreadsheet program for statistical manipulation or to produce graphs. An example of a distributional "PLT" plot file for the toddler yearly exposures is presented in Appendix B, while an example of this plot file graphed illustrating cumulative exposure is presented in Figure 6.

For sequential multiple-day or week exposures, Calendex™ produces a summary plot file consisting of the per-user exposure distribution per averaged time period. For example, if an analysis was conducted for two four-week periods, then two summary plot files would be produced (i.e., one for each four-week time period). The plot file is comma delimited and can be imported in a spreadsheet program for statistical manipulation or to produce graphs. This type of plot file can be used to graphically to show the dates in which the exposures are at a peak level. Examples of a summary plot file for the adult and toddler four-week period exposures are presented in Appendix B.

## 7.4 Sensitivity Analyses

The user is able to assess the relative contribution of a specific exposure route or product (i.e., pet, carpet, or turf products) included in a particular assessment to the total exposure or risk. This also allows the user to determine which products or routes of exposure contribute most to

the total exposure of each of the subpopulations considered. This sensitivity analysis is conducted by running Calendex™ separately for each of the individual products and routes of exposure. The sensitivity analyses will be automated in the future so that only one analysis is needed to determine which product contributes the most to the total exposure.

# 8.0 QUALITY AUDIT AND VALIDATION

## 8.1 Quality Audit of the Computational Algorithms

Audits of the computational algorithms used in Calendex™ were conducted by comparing Calendex™ estimates with estimates derived using spreadsheet calculations or other software (e.g., SPSS®). These include the algorithms for deriving the interval limits, the allocation of the observations to the intervals, the calculation of the various statistics, including the means, standard deviations, and percentile estimates.

### 8.1.1 Quality Audits of Calendex™ Summary Statistics

Two subpopulations were used to test the summary statistic algorithms. We show below representative examples of these tests. Specifically, we compare the estimates of the weighted person-days, mean, and standard deviation, derived using Calendex™ and those derived using spreadsheet functions.

- **Data used:**

  Demographic information for toddlers ages 1 to 3 years and adults ages 18+ years from CSFII, 1994-96. Number of toddlers and adults in the CSFII: 1834 and 9596, respectively.
  Exposure considered: dermal exposure resulting from pet treatment
  SOP equation used:

$$\text{Equation 10) Exposure (mg/kg/day)} = \frac{AR \times F \times T}{BW}$$

where,

| | | |
|---|---|---|
| AR | = | Amount of active ingredient applied (30 mg/day) |
| T | = | Fraction of residue transferred to skin (10%) |
| F | = | Fraction of active ingredient available on pet (20%) |
| BW | = | Body Weight (as reported by survey, transformed into kg, and rounded to the nearest integer) |

- **Results:**

| Parameter | Calendex™ | Spreadsheet Calculation |
|---|---|---|
| **Toddlers** | | |
| **Weighted number of person days (thousands)** | 12270 | 12270 |
| **Mean (mg/kg/day)** | 0.045111 | 0.045046 |
| **Standard deviation (mg/kg/day)** | 0.009825 | 0.009818 |
| **Adults** | | |
| **Weighted number of person days (thousands)** | 190901 | 190901 |
| **Mean (mg/kg/day)** | 0.008367 | 0.008371 |
| **Standard deviation (mg/kg/day)** | 0.001857 | 0.001858 |

The small differences between the estimates is due to the fact that rounded estimates of body weights were used in the spreadsheet calculations while no rounding is used in Calendex™.

### 8.1.2 Assessing the Impact of the Binning Procedure on Interval Estimates

As discussed in section 5.3, the "binning" procedure used by Calendex™ is similar to that used by DEEM™. Percentile estimates derived using the Calendex™ "binned" distributions were compared to percentile estimates derived using the "unbinned" data and SPSS® "WEIGHT" and "PERCENTILE" functions.

We show below results of a representative test.

- **Data used:**

The adults data described above were used to test the impact of the binning algorithms on the weighted percentile estimates.

- **Results:**

| Percentile | Estimates (mg/kg/day) | |
|---|---|---|
| | Calendex™ | No binning SPSS® |
| **10** | 0.006119 | 0.006122 |
| **20** | 0.006785 | 0.006742 |
| **30** | 0.007303 | 0.007317 |
| **40** | 0.007748 | 0.007792 |
| **50** | 0.008159 | 0.008219 |
| **60** | 0.008828 | 0.008824 |
| **70** | 0.009220 | 0.009231 |
| **80** | 0.009939 | 0.010000 |
| **90** | 0.010916 | 0.010909 |
| **95** | 0.011697 | 0.011765 |
| **97.5** | 0.012236 | 0.012245 |
| **99** | 0.013309 | 0.013333 |
| **99.5** | 0.013587 | 0.013636 |
| **99.75** | 0.014077 | 0.013954 |
| **99.9** | 0.014619 | 0.014634 |

The percentile estimates are virtually identical, with some minor differences due, in part, to the fact that the body weight values used in the SPSS® calculations were rounded to the nearest integer.

### 8.1.3 Validation of the Monte Carlo Technique Used in Calendex™

Exposure distributions derived from a series of Calendex™ Monte Carlo assessments were compared to distributions derived using commercial Monte Carlo software (Crystal Ball®). Exposures were calculated for 14 different scenarios on the day of application and over a six-day period following the day of application for both adults and toddlers (1 to 3 years of age). The Calendex™ analyses were conducted for 100 iterations, while the Crystal Ball® analyses were conducted for 5000 iterations. The data and results for a representative set of these scenarios are presented below. See Appendix C for the complete set of data and results.

- **Data used:**

  Demographic information for toddlers ages 1 to 3 years and adults ages 18+ years.
  Number of toddlers and adults in the population: 1834 and 9596, respectively.
  Exposures considered: dermal and oral (incidental ingestion via hand to mouth activity) exposures resulting from pet treatment
  SOP equation used: equations 10 and 11

$$\text{Equation 10) Exposure (mg/kg/day)} = \frac{AR \times F \times T}{BW}$$

where,

AR = Amount of active ingredient applied
T = Fraction of residue transferred to skin
F = Fraction of active ingredient available on pet
BW = Body Weight

$$\text{Equation 11) PDR} = \frac{((AR \times F) \div SA_{pet}) \times SA \times FQ \times ET \times SE}{BW}$$

where,

PDR = Potential dose rate (mg/kg/day)
AR = Amount of active ingredient applied (mg/day)
F = Fraction of active ingredient available on pet (%)
$SA_{pet}$ = Surface area of pet ($cm^2$)
SA = Surface area of two fingers ($cm^2$)
FQ = Frequency of hand-to-mouth activity (events/hr)
ET = Exposure time (hr/day)
SE = Saliva extraction (%)
BW = Body weight (kg)

## Parameters Used in the Exposure Equations

| | | Scenario | | |
|---|---|---|---|---|
| | | A | B | C |
| **Dermal (Adults and Toddlers)** | | | | |
| Application Rate (mg/day)[1] | AR | 30 | 30 | Uniform 15 -120 |
| Fraction of ai available on pet (%) | F | 20 | 20 | 20 |
| Fraction of residue transferred to skin (%) | T | 10 | 10 | 10 |
| Body weight (kg) | BW | -- | CSFII | CSFII |
| **Incidental Ingestion (Toddlers only)** | | | | |
| Application Rate (mg/day)[1] | AR | 30 | 30 | Uniform 15 -120 |
| Fraction of ai available on pet (%) | F | 20 | 20 | 20 |
| Surface area on pet ($cm^2$) | SApet | 6000 | 6000 | 6000 |
| Surface area of fingers ($cm^2$/event) | SA | 20 | 20 | 20 |
| Frequency of hand-to-mouth activity (event/hr) | FQ | 20 | 20 | 20 |
| Exposure time (hr/day) | ET | 2 | 2 | 2 |
| Saliva extraction (%) | SE | 50 | 50 | 50 |
| Body weight (kg) | BW | -- | CSFII | CSFII |

1 For the 7 day exposure period, the residue (application rate) was assumed to dissipate 10% each day

- **Results:**

**Day 0**
**Scenario A**
**Distributions: none**

| Adults | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex™ |
| 0.6 | 0.6 |

| Toddlers | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.6 | 0.6 |

| Toddlers | |
|---|---|
| Oral Exposure (mg/day) | |
| Excel | Calendex |
| 0.4 | 0.4 |

**Day 0**
**Scenario B**
**Distributions: BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.014634 | 0.014622 |
| 99 | 0.013333 | 0.013308 |
| 95 | 0.011765 | 0.011698 |
| 90 | 0.010909 | 0.010916 |
| 50 | 0.008108 | 0.008159 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.075000 | 0.085592 |
| 99 | 0.075000 | 0.075018 |
| 95 | 0.060000 | 0.060069 |
| 90 | 0.060000 | 0.059755 |
| 50 | 0.042857 | 0.042725 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.050000 | 0.056919 |
| 99 | 0.050000 | 0.049888 |
| 95 | 0.040000 | 0.039946 |
| 90 | 0.040000 | 0.039737 |
| 50 | 0.028571 | 0.028696 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 58 | 58 |
| 99 | 67 | 66 |
| 95 | 83 | 83 |
| 90 | 83 | 83 |
| 50 | 117 | 110 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario C**
**Distributions: AR (uniform 15-120), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.051035 | 0.05122 |
| 99 | 0.043655 | 0.043364 |
| 95 | 0.035654 | 0.036011 |
| 90 | 0.031782 | 0.032039 |
| 50 | 0.017931 | 0.017913 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.283563 | 0.283342 |
| 99 | 0.228859 | 0.232118 |
| 95 | 0.194024 | 0.194875 |
| 90 | 0.171057 | 0.171765 |
| 50 | 0.095456 | 0.096905 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.189042 | 0.187551 |
| 99 | 0.152573 | 0.154423 |
| 95 | 0.129349 | 0.130037 |
| 90 | 0.114038 | 0.114533 |
| 50 | 0.063637 | 0.064697 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 18 | 19 |
| 99 | 22 | 23 |
| 95 | 26 | 28 |
| 90 | 29 | 31 |
| 50 | 52 | 51 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario A**
**Distributions: none**

| Adults | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.447174 | 0.447143 |

| Toddlers | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.447174 | 0.447143 |

| Toddlers | |
|---|---|
| Oral Exposure (mg/day) | |
| Excel | Calendex |
| 0.298116 | 0.298095 |

**Week 1**
**Scenario B**
**Distributions: BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.010907 | 0.010955 |
| 99 | 0.009937 | 0.009874 |
| 95 | 0.008768 | 0.008765 |
| 90 | 0.008130 | 0.008098 |
| 50 | 0.006043 | 0.006114 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.055897 | 0.063507 |
| 99 | 0.055897 | 0.05565 |
| 95 | 0.044717 | 0.045012 |
| 90 | 0.044717 | 0.044777 |
| 50 | 0.031941 | 0.032017 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.037265 | 0.042655 |
| 99 | 0.037265 | 0.037008 |
| 95 | 0.029812 | 0.029933 |
| 90 | 0.029812 | 0.029777 |
| 50 | 0.021294 | 0.021291 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 78 | 78 |
| 99 | 89 | 89 |
| 95 | 112 | 110 |
| 90 | 112 | 110 |
| 50 | 157 | 150 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario C**
**Distributions: AR (uniform 15-120), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.029214 | 0.029515 |
| 99 | 0.025062 | 0.025062 |
| 95 | 0.021302 | 0.021277 |
| 90 | 0.019416 | 0.01938 |
| 50 | 0.013625 | 0.013575 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.163679 | 0.162282 |
| 99 | 0.133835 | 0.134247 |
| 95 | 0.113693 | 0.114389 |
| 90 | 0.104418 | 0.104424 |
| 50 | 0.072629 | 0.072896 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.109119 | 0.108159 |
| 99 | 0.089223 | 0.089411 |
| 95 | 0.075795 | 0.076216 |
| 90 | 0.069612 | 0.069572 |
| 50 | 0.048419 | 0.048648 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 30 | 32 |
| 99 | 37 | 39 |
| 95 | 44 | 45 |
| 90 | 48 | 49 |
| 50 | 69 | 68 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

### 8.2 Quality Audit of the Calendar Model

The calendar model used in Calendex™ was applied to chlorpyrifos and the resulting estimated exposures outputs were compared to results of biomonitoring studies measuring the primary metabolite of chlorpyrifos, 2,3,5 trichloropyridinol in the US population (Shurdut, 1998). Data from urine samples collected from approximately 1000 adults from a broad heterogeneous segment of the US were used (Hill, 1995). Estimates of absorbed chlorpyrifos doses were calculated based on the measured TCP levels. The derivation of the absorbed doses adjusted for creatinine excretion rates, the difference in the molecular weights of the two compounds, and using the chlorpyrifos pharmacokinetic model. The derived absorbed doses corresponding to the 99$^{th}$ and 100$^{th}$ percentiles of the distribution of measured TCP levels were 0.52 and 1.1 ug/kg BW/day respectively.

The estimates of the 99.5$^{th}$ percentile of the exposure distribution derived through the calendar model were 0.46 ug/kg and 1.2 ug/kg for adults and children, respectively (Shurdut, 1998). These estimates are essentially equivalent to the exposure estimates determined from actual biological monitoring measurements.

## 9.0 DEFINITIONS

Application:

An "application" is the act of applying a specific treatment in the home. For example, a turf product may be applied four times throughout the year. An application refers to each time it is applied.

Applicator:

An applicator refers to the person actually applying the product. Applicators may be professional or homeowners. The professional applicators' exposures are currently not aggregated with the homeowner or occupant exposures.

Aggregate Exposure (AGX) Files:

These files are created by the user prior to the Calendex analysis. One AGX file is dedicated to a specific route and treatment type (i.e., pet dermal.AGX or turf oral.AGX). AGX files contain treatment information, contact distributions, and residue distributions. See number 1 under section 5.1 for a more detailed discussion.

Aggregate Master (AGM) files:

These files are created by the user prior to the Calendex analysis. AGM files list all of the AGX file to be included in one aggregate analysis. See number 2 under section 5.1 for more detailed discussion.

Contact:

Contact refers to the manner in which someone "touches" the residue. Contact is treatment and route specific. For example, contact to residues on turf is very different

than contact to residues in the air. Typically, contact is comprised of multiple factors (contact factors) and is age specific. See Section 4.3.1 for a more detailed discussion.

Exposure:

Exposure refers to the amount of residue per unit of contact that is taken up by a specific person (e.g., exposure = residue x contact).

Occupant:

Occupant refers to any person living in the home.

Treatment:

A treatment refers to the use of a specific chemical to treat a specific problem in the home (e.g., turf treatment or pet treatment). Multiple treatments containing the same active ingredient may occur within one home.

Residue:

Residue refers to the amount of chemical a person comes in contact. The level is dependent upon the number of elapsed days from when application and the contact occurred. See Section 4.3.2 for a more detailed discussion.

## 10.0 REFERENCES


Hill, R.H., Head, S.L., Baker, S., Gregg, M., Shealy, D.B., Bailey, S.L., Williams, C.C., Sampson, E.J., and Needham, L.L. (1995). Pesticide residues in urine of adults living in the United States: Reference range concentrations. *Environ. Res.* 71, 99-108.

Mosteller, F. and J.W. Tukey (1977). *Data Analysis and Regression.* Reading, MA: Addison-Wesley Publishing. Co.

Shurdut, B. A., Barraj, L., and Francis, M. (1998). Aggregate exposures under the Food Quality Protection Act: an approach using chlorpyrifos. *Regulatory Toxicology and Pharmacology*. 28 (2): 165-177.

United States Department of Agriculture (USDA) (1992). Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals 1989-90. Human Nutrition Information Service. Dataset.

United States Department of Agriculture (USDA) (1993). Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals 1990-91. Human Nutrition Information Service. Dataset.

United States Department of Agriculture (USDA) (1994). Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals 1991-92. Human Nutrition Information Service. Dataset.

United States Department of Agriculture (USDA) (1995). Food Survey Research Group, Agricultural Research Service (ARS). Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals 1993-94. Dataset.

United States Department of Agriculture (USDA) (1996). Food Survey Research Group, Agricultural Research Service (ARS). Nationwide Food Consumption Survey: Continuing Survey of Food Intakes by Individuals 1994-95. Dataset.

United States Environmental Protection Agency (US EPA) (1997a). "Standard Operating Procedures (SOPs) for Residential Exposure Assessments (Draft version dated December 18, 1997)". Residential Exposure Assessment Work Group. Office of Pesticide Programs. Health Effects Division. December 18.

United States Environmental Protection Agency (US EPA) (1997b). EPA Exposure Factors Handbook Volume I-III. Office of Research and Development

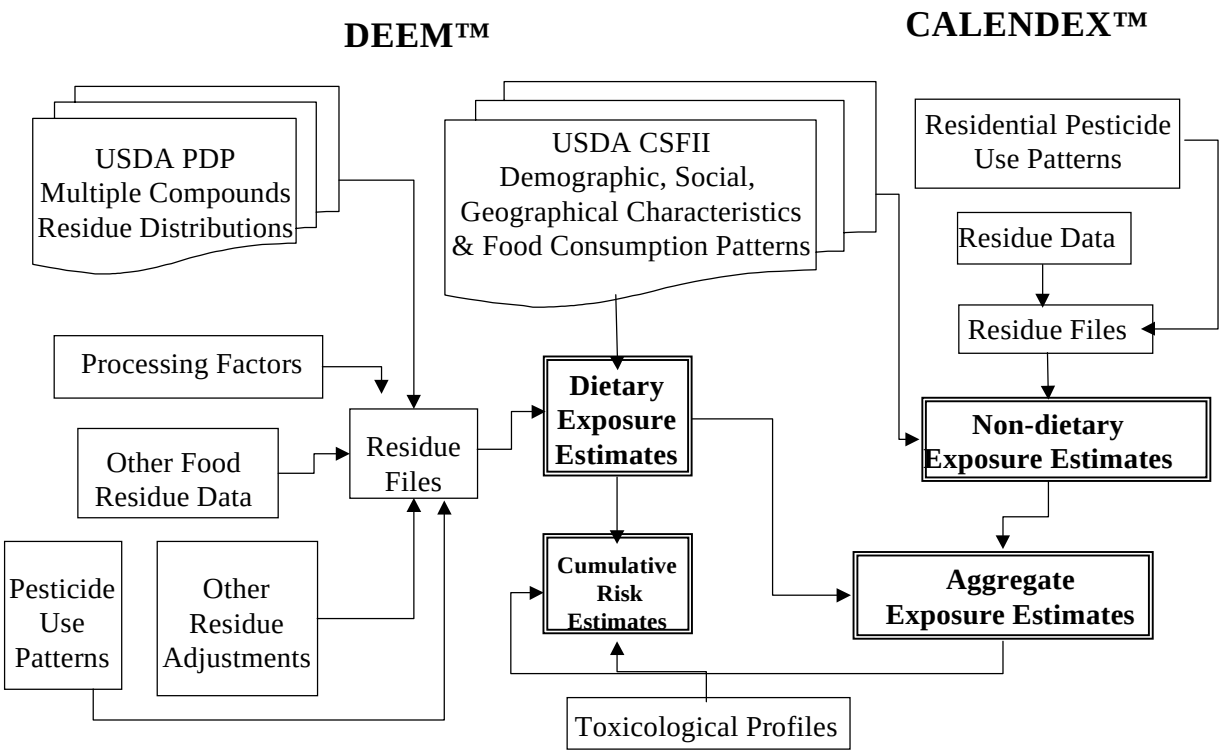
United States Environmental Protection Agency (US EPA) (1999a). "Standard Operating Procedures (SOPs) for Residential Exposure Assessments – Proposed Changes Presented to Science Advisory Panel (SAP). Office of Pesticide Programs. Health Effects Division. September 21.

United States Environmental Protection Agency (US EPA) (1999b). Guidance for Performing Aggregate Exposure and Risk Assessment. Office of Pesticide Programs. October 29.

Versar, Inc. (1995). PHED: The Pesticide Handlers Exposure Database. Reference Manual, Version 1.1. Prepared for The PHED Task Force representing Health Canada, USEPA, and American Crop Protection Association. February.

**Figure 1**

**Components of an Aggregate and Cumulative Risk Assessment**



## Figure 2

## Available Residue for one Application Scenario of Three Treatment Types With Chemical X in one Year

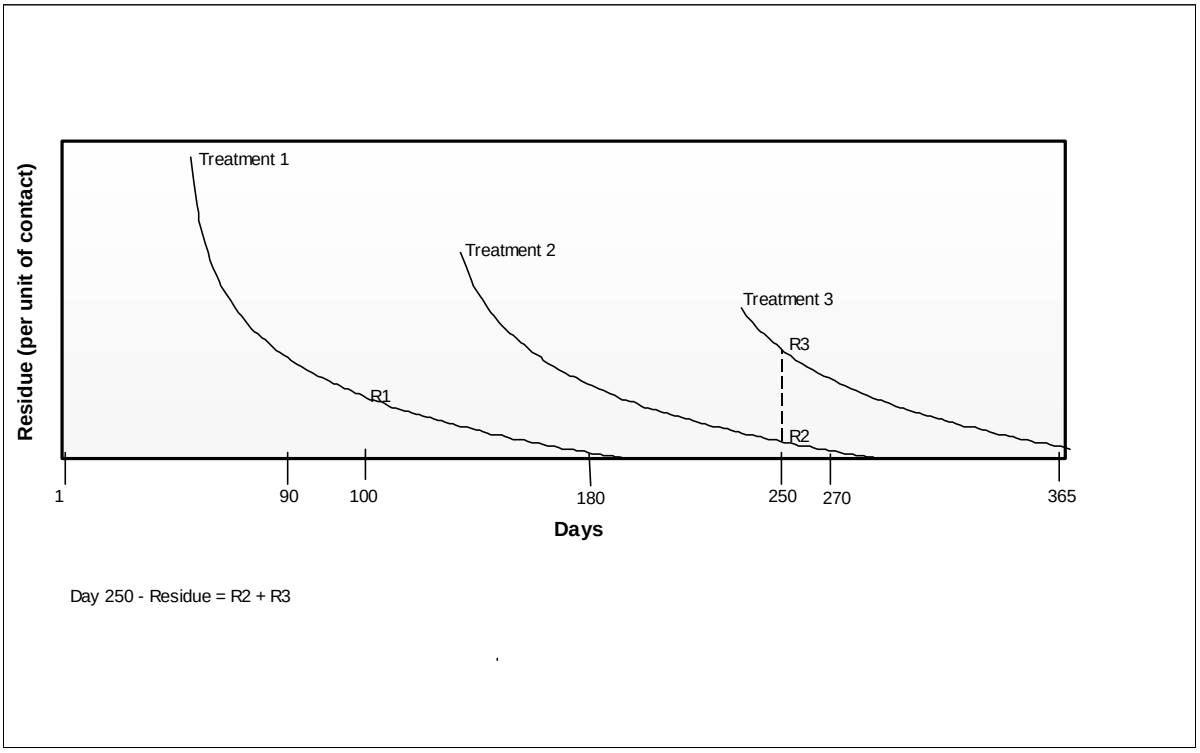
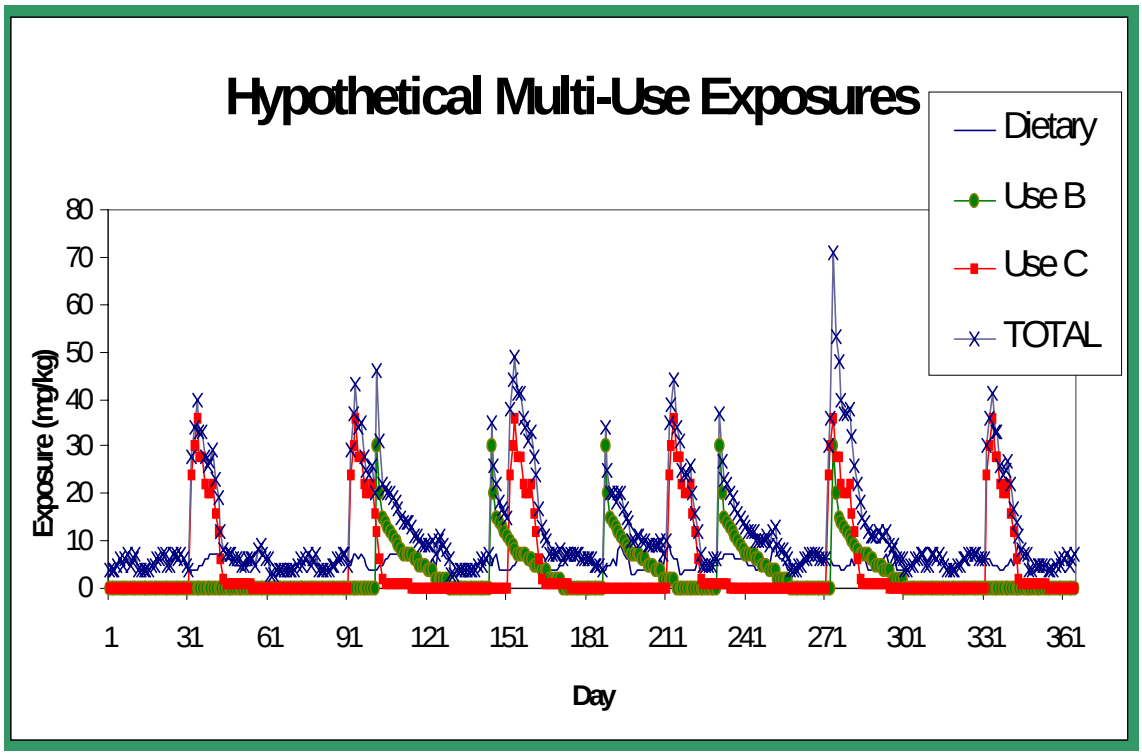


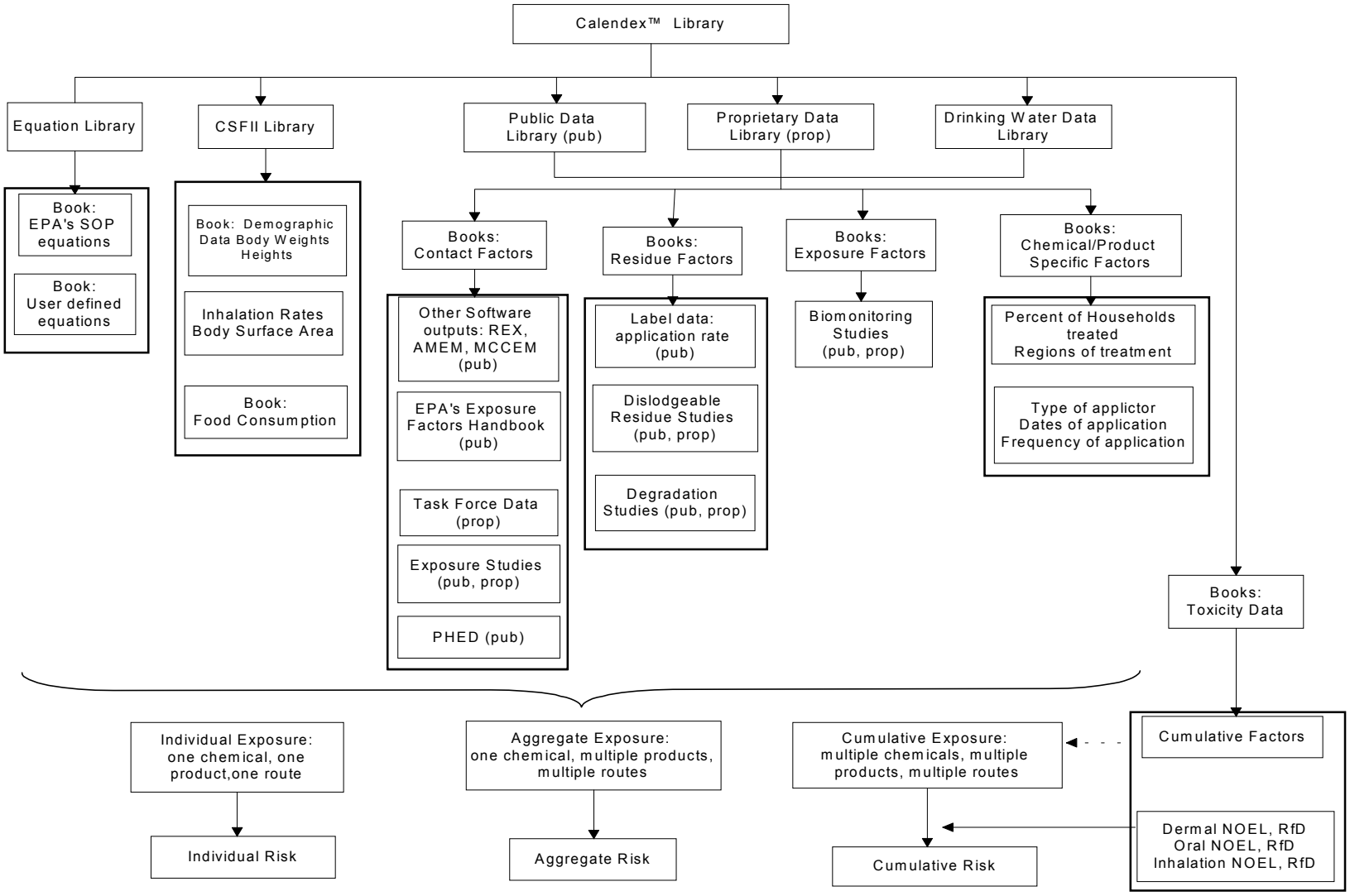
**Figure 3**

**Hypothetical Multi-Use Exposures**



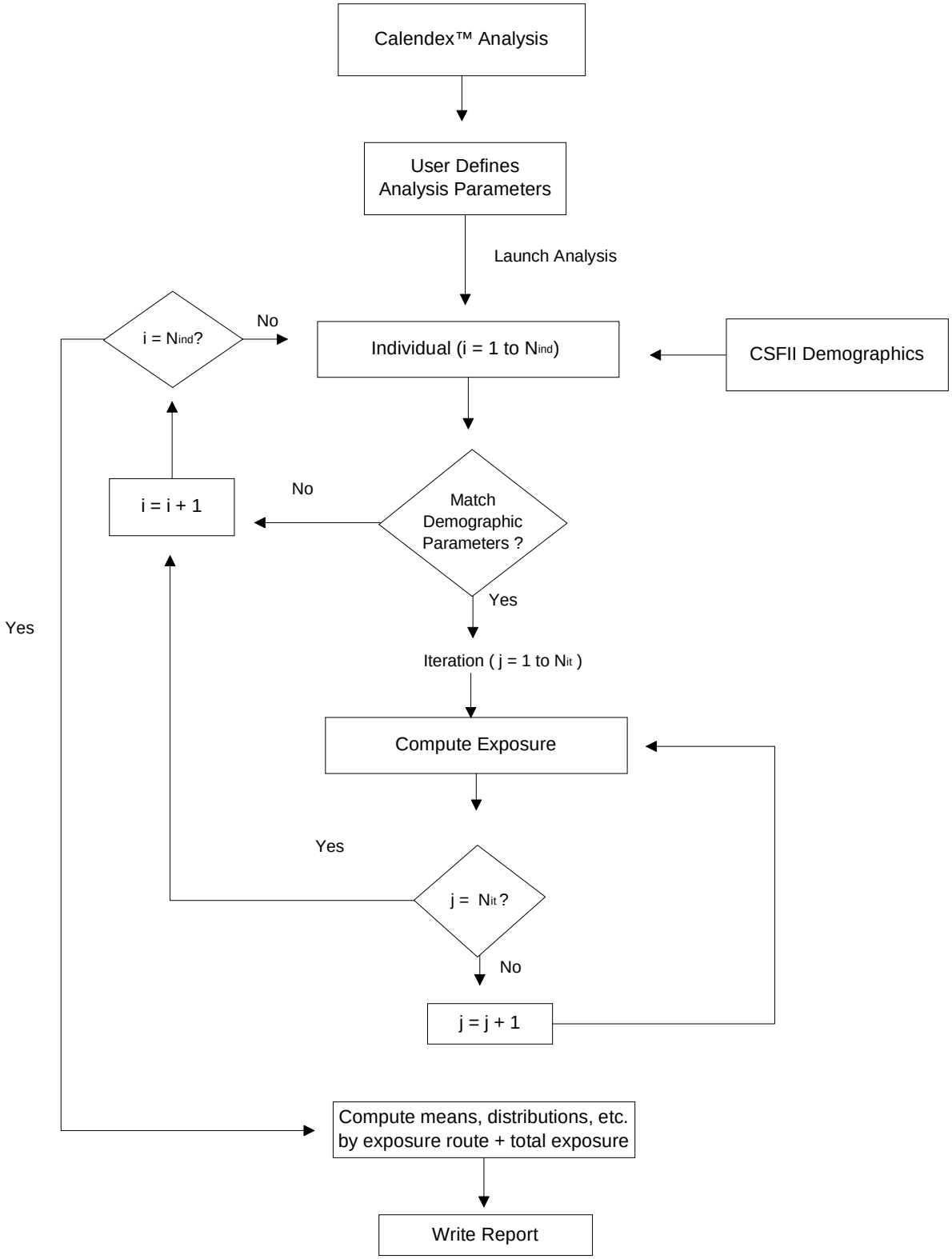
# Figure 4

## Components of Calendex™ Libraries



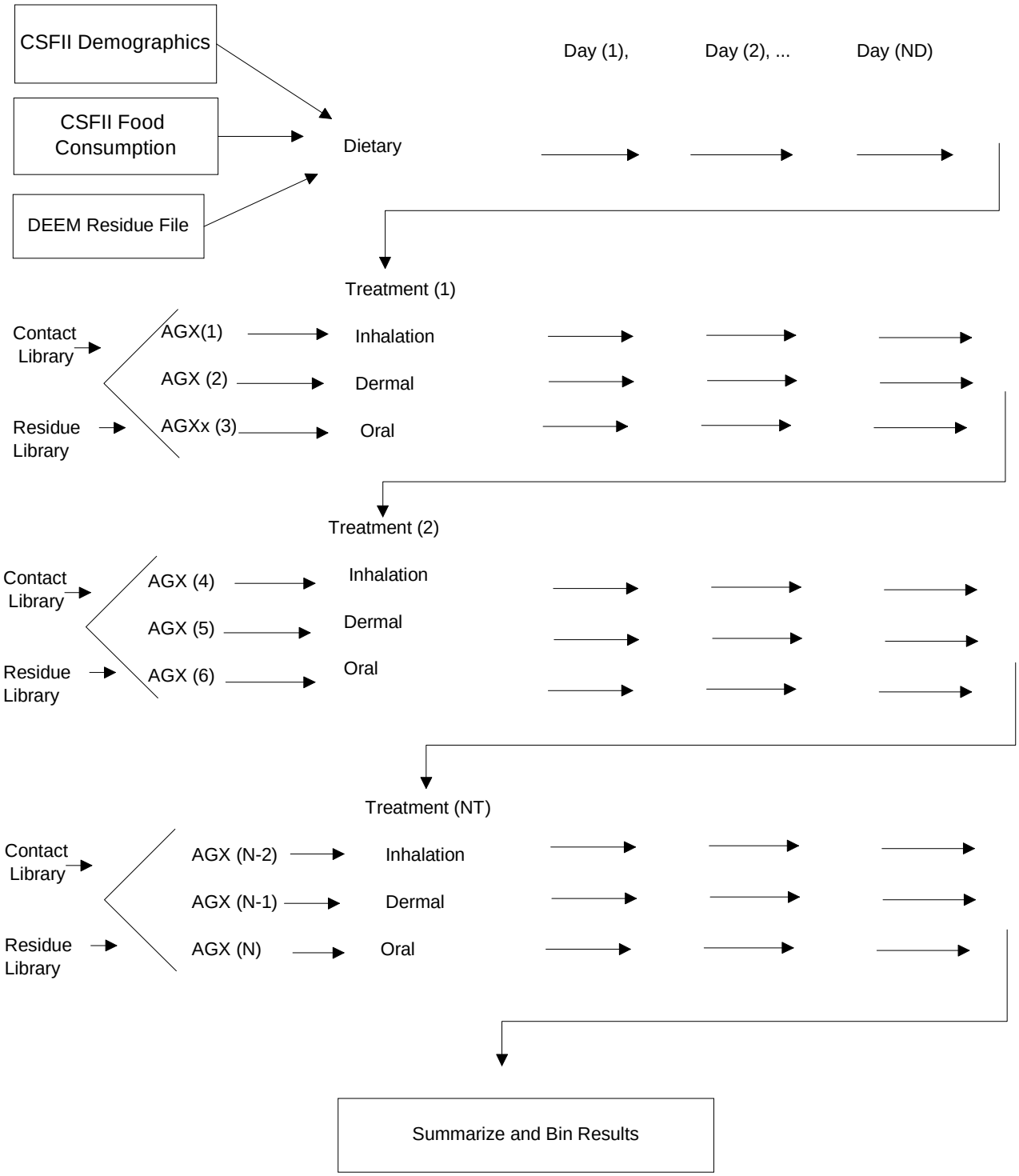
## Figure 5A

## Calendex™ Analysis



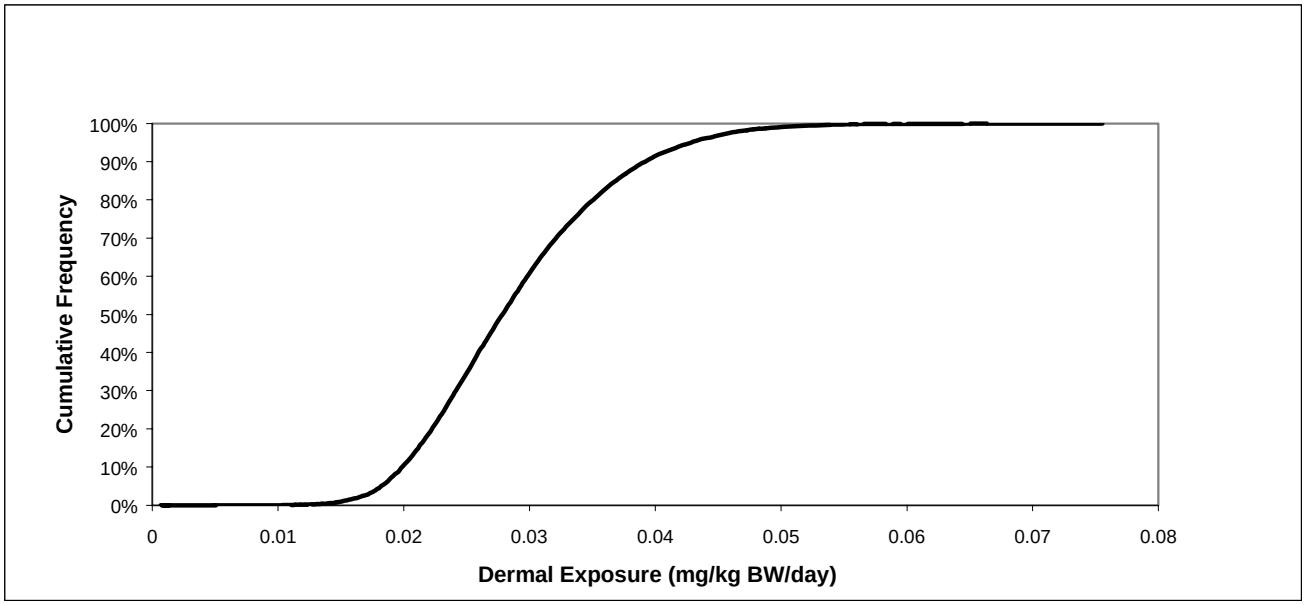
## Figure 5B

## Compute Exposure



## Figure 6

## Summary of Toddler Dermal Exposure to Chemical X Residues



# Appendix A

## Computer Codes For the Computational Algorithms in Calendex™

*General Caveat:*

*The computational algorithms and related computer code provided in this section are copyrighted by Durango Software LCC and intended for use only by the EPA Scientific Advisory Panel in reviewing the Calendex model. These algorithms and computer code are **not** intended for use or reference by other entities developing similar or competing programs which perform exposure calculations related to human contact with chemicals. Any use of these algorithms, code, or code derived from this code, for the purpose of developing alternative exposure analysis programs will be considered to be copyright infringement.*

The following code segments take from the Calendex program correspond to the computation steps outlined above:

Note: This program is written in Visual Basic. All variables are declared ("option explicit") in the program itself. The default data type is integer (DefInt A-Z). Variables are not case specific. Variable type identifiers are used as follows: $= string; & = long integer; ! = real number (7 significant digits); # = long real (14 significant digits). A leading apostrophe is used to set off remarks and other non-executable statements. An "_" at the end of a line of code means that this line of code continues on the next line.

**Subroutine Expos**

Variable definitions:

Mc = iteration index

Nsims = number of iterations to be performed for each participant in the CSFII

Ndays = the number of sequential days included in this analysis. (If weeks are specified, weeks are converted to days internally.)

Csum!(k,j) is an array of exposure values (aggregated over ndays) by type and exposure route, computed at each iteration for each individual, using the k, j indices as follows:
Index k = 0 for occupant exposure; k = 1 for applicator exposure; k = 2 for sum of occupant and applicator exposure
Index j = 0 for exposure over all included exposure routes; j = 1 for inhalation; j = 2 for dermal; j = 3 for inhalation; j = 4 for dietary

C!(j) = array of occupant exposure values returned from the analysis of a single treatment/exposure route: j = 1 for inhalation; j = 2 for dermal; j = 3 for inhalation

Capp!(j) = array of applicant exposure values returned from the analysis of a single treatment/exposure route: j = 1 for inhalation; j = 2 for dermal; j = 3 for inhalation

FoodsYN$ = "Y" when dietary analysis is included in this run; FoodsYN$ = "N" when not.

TreatYN$ = "Y" when non-dietary analysis is included in this run; TreatYN$ = "N" when not.

DietaryExpos! = the total dietary exposure for this individual over ndays.

Px! = random number (0 to .9999999) drawn from the random number generator

Nsd = number of days of participant food records in the CSFII (3 for 1989-92, 2 for 1994-96)

Adult (boolean) = 1 when this participant is an adult (minimum age defined by the user at run time); 0 if not

Nahh = the number of adults in the household (based on CSFII survey and minimum age)

TotAdult& = total number of adults for which the analysis is computed

Wght& = participant's statistical weight from CSFII

Applicator (boolean) = 1 if this individual is the applicator of the treatment in the household; 0 if not

ActiveContact (boolean) = 1 if the user contacted a treated area during the analysis period for a single treatment/exposure route

Ncontact (boolean) = 1 if at least one treated area was contacted during the analysis period (for any treatment/exposure route); 0 otherwise

Pt = person type (actually age group: 1 = infant, 2 = child 1-3, 3= child 4-6; 4 = child 7-12, 5= teenager, 6 = adult). (Contact factors are organized and assigned in the AGX files to these age groups.)

d365e = first day of evaluation period (1-365) as assigned by the user (or selected at random)

idem(j) = array of demographic variables for the current individual; the following are used: idem(1) = season (spring = 1, summer = 2, fall = 3, winter = 4), idem(2) = region (1 = NE, 2 = NC, 3 = S, 4 = W), idem(3) = age in months (infants), idem(4) = age in years, idem(5) = sex, idem(6) = infant nursing code, idem(7) = race code, idem(8) = combined demographic code, idem(13) = body weight in kg, idem(14) = ht in cm,

CombinePathways = number of exposure routes for which exposure will be combined (as set by user at runtime)

Bw (boolean) = 1 if divide results by body weight; 0 if not

userdaysw# = number of user days in analysis, as weighted using statistical weights from CSFII
userdaysu# = number of user days in analysis, not weighted

NOELDermal! = user assigned dermal NOEL
NOELInhal! = user assigned inhalation NOEL
NOELOral! = user assigned oral NOEL

Moex! = weighted MOE for each individual when CombinePathways > 1

IncludeOral (boolean) = 1 when oral exposure is included in total exposure calculation (user determined)

IncludeInhal (boolean) = 1 when inhalation exposure is included in total exposure calculation (user determined)

IncludeDermal (boolean) = 1 when dermal exposure is included in total exposure calculation (user determined)

Persdaysw# = person days evaluated in this analysis, weighted with CSFII statistical weight

Persdaysu# = person days evaluated in this analysis, unweighted

At outset, set variables bottom() and top() used in context-explicit exposure summation algorithms, depending on whether dietary and non-dietary analyses are included and the specification of the CombinePathways variable.

Code:

```
  ReDim top(2)
  top(0) = 4 'occupant exposure vector includes dietary
  top(1) = 3 'applicator exposure vector
  top(2) = 3 'sum of occupant and applicator exposure by pathway (with dietary added into oral)

  ReDim bottom(2)
  If FoodsYN$ = "Y" And TreatYN$ = "N" Then
    bottom(0) = 4
    bottom(1) = 4
    bottom(2) = 4
  Else
    If CombinePathways <= 1 Then  'don't report any total exposure analyses
      bottom(0) = 1
      bottom(1) = 1
      bottom(2) = 1
    'else    'not needed since these values result from dimensioning bottom but to make it
explicit here
    '  bottom(0) = 0
    '  bottom(1) = 0
    '  bottom(2) = 0
    End If
  End If
```

Launch the Calendex analysis by getting demographic and food records for the first individual in the CSFII fitting the demographic profile sequentially, then conducting an independent exposure analysis for each iteration specified by the user. This computational procedure is repeated for each iteration for each qualifying individual in the CSFII. For each individual passing the demographic criteria for the current analysis, compute:

Code:

total1# = wght&  'note that this 3-part construction is needed to maintain accuracy at high iteration levels
total1# = total1# * nsims
persdaysw# = persdaysw# + total1#
persdaysu# = persdaysu# + nsims

```
For mc = 1 To nsims   ‘for each iteration

  ReDim csum!(2, 4) 'initialize treatment exposure for this iteration

  If FoodsYN$ = "Y" Then 'choose day 1 to 3 at random
   'DietaryExpos! used to accumulate exposure for all days 1 to ndays

    DietaryExpos! = 0  'food exposure for this iteration
    For dd = 1 To ndays
      px! = Rnd(1)
      d = Int(nsd * px!) + 1  ‘choose a day of food consumption records for this individual at
random
        'Use DEEM algorithms to compute dietary exposure from this individual’s food consumption
records
        'for day d
      DietaryExpos! = DietaryExpos! + dietary exposure for this day (as computed with DEEM
algorithms
    Next dd

  End If

  If TreatYN$ = "Y" Then

    'first determine if this person is the adult applicator in the household:
```

```
    applicator = 0
    If adult Then
      px! = Rnd(1)
      If nahh Then
        If px! <= 1 / nahh Then applicator = 1
      End If
      totadult& = totadult& + wght&
    End If

    ncontact = 0
    For t = 1 To ntreat

      For dd = 1 To ndays
        ReDim c!(3), capp!(3)
        Call appexpos(t, pt, applicator, ndays, dd, d365e, c!(), capp!(), activecontact, idem(),
lastuse,_
 bu)  'this subroutine is shown below
        If bu = 1 Then Exit Sub 'error encountered, can't continue analysis

        If activecontact Then ncontact = 1

        csum!(0, 1) = csum!(0, 1) + c!(1)
        csum!(0, 2) = csum!(0, 2) + c!(2)
        csum!(0, 3) = csum!(0, 3) + c!(3)

        csum!(1, 1) = csum!(1, 1) + capp!(1)
        csum!(1, 2) = csum!(1, 2) + capp!(2)
        csum!(1, 3) = csum!(1, 3) + capp!(3)
      Next dd  'day
    Next t 'treatment
  End If

  If totamount!(d) > 0 Or ncontact > 0 Then
    'count this person as eater of the target foods, even if residue is 0
    'or count this person as making contact with active residue from any residential treatment
    userdaysw# = userdaysw# + wght&
    userdaysu# = userdaysu# + 1

    If FoodsYN$ = "Y" Then
      k = 0: j = 4
      csum!(k, j) = DietaryExpos!
      If ndays > 1 Then csum!(k, j) = csum!(k, j) / ndays
      If bw Then csum!(k, j) = csum!(k, j) / idem(13) 'adjust for bodyweight in kilograms
      GoSub putinbins 'put into bins for later use in determining the distribution of exposures
for this
                      exposure route for this population
    End If

    If TreatYN$ = "Y" Then

        If CombinePathways > 1 Then
          csum!(0, 0) = 0
          csum!(1, 0) = 0
          If IncludeInhal Then
            csum!(0, 0) = csum!(0, 1)
            csum!(1, 0) = csum!(1, 1)
          End If
          If IncludeDermal Then
            csum!(0, 0) = csum!(0, 0) + csum!(0, 2)
            csum!(1, 0) = csum!(1, 0) + csum!(1, 2)
          End If
          If IncludeOral Then
            csum!(0, 0) = csum!(0, 0) + csum!(0, 3)
            If FoodsYN$ = "Y" Then csum!(0, 0) = csum!(0, 0) + DietaryExpos!
              'note that DietaryExpos! has not yet been adjusted for bw or ndays
            csum!(1, 0) = csum!(1, 0) + csum!(1, 3)
          End If
        End If

        For k = 0 To 1
          For j = bottom(k) To 3
```

```
            'don't do sums if combinepaths <=1; don't do dietary, csum!(0,4), this has already
been done
            If ndays > 1 Then csum!(k, j) = csum!(k, j) / ndays
            If bw Then csum!(k, j) = csum!(k, j) / idem(13)
            GoSub putinbins 'put into bins for later use in determining the distribution of
exposures for
                              this exposure route for this population
          Next
        Next

      'now all exposures for this individual are computed
      'so combine exposures by pathway into sum of occ and app:

        'total inhal,
        k = 2: j = 1
        csum!(k, j) = csum!(0, j) + csum!(1, j)
        GoSub putinbins 'put into bins for later use in determining the distribution of exposures
for this
                        exposure route for this population

        'total dermal
        k = 2: j = 2
        csum!(k, j) = csum!(0, j) + csum!(1, j)
        GoSub putinbins 'put into bins for later use in determining the distribution of exposures
for this
                        exposure route for this population

        'total oral (except dietary)
        k = 2: j = 3
        csum!(k, j) = csum!(0, j) + csum!(1, j)
        GoSub putinbins 'put into bins for later use in determining the distribution of exposures
for this
                        exposure route for this population


        'total oral (including dietary)
        k = 2: j = 4
        csum!(k, j) = csum!(2, 3) + csum!(0, 4)
        GoSub putinbins 'put into bins for later use in determining the distribution of exposures
for this
                        exposure route for this population


        If CombinePathways > 1 Then 'this can only happen if treatyn$ = "Y"

          k = 2: j = 0
          csum!(k, j) = csum!(0, 0) + csum!(1, 0)  'compute total occ + app, but only for those
routes
               specified by user. If oral is specified, then it includes dietary
          GoSub putinbins 'put into bins for later use in determining the distribution of
exposures for
                this exposure route for this population

          If compare$ = "N" Then 'compute moe for each individual and then bin
            ReDim MoeSum!(2)
            If IncludeInhal = 1 Then
              If csum!(0, 1) Then MoeSum!(0) = MoeSum!(0) + csum!(0, 1) / NOELInhal!
              If csum!(1, 1) Then MoeSum!(1) = MoeSum!(1) + csum!(1, 1) / NOELInhal!
              If csum!(2, 1) Then MoeSum!(2) = MoeSum!(2) + csum!(2, 1) / NOELInhal!
            End If
            If IncludeDermal = 1 Then
              If csum!(0, 2) Then MoeSum!(0) = MoeSum!(0) + csum!(0, 2) / NOELDerm!
              If csum!(1, 2) Then MoeSum!(1) = MoeSum!(1) + csum!(1, 2) / NOELDerm!
              If csum!(2, 2) Then MoeSum!(2) = MoeSum!(2) + csum!(2, 2) / NOELDerm!
            End If
            If IncludeOral = 1 Then
              If FoodsYN$ = "Y" Then
                'If (csum!(0, 3) + csum!(0, 4)) Then MoeSum!(0) = MoeSum!(0) + (csum!(0, 3) +
csum!(0, 4))_
                        /  NOELOral!
```

```
                If csum!(2, 4) Then MoeSum!(0) = MoeSum!(0) + csum!(2, 4) + csum!(0, 4) /
NOELOral!
                If (csum!(2, 3) + csum!(0, 4)) Then MoeSum!(2) = MoeSum!(2) + (csum!(2, 3) +
csum!(0, 4))_
                      / NOELOral!
              Else
                If csum!(0, 3) Then MoeSum!(0) = MoeSum!(0) + csum!(0, 3) / NOELOral!
                If csum!(2, 3) Then MoeSum!(2) = MoeSum!(2) + csum!(2, 3) / NOELOral!
              End If
              If csum!(1, 3) Then MoeSum!(1) = MoeSum!(1) + csum!(1, 3) / NOELOral!
            End If

            For i = 0 To 2
              If MoeSum!(i) Then
                moex! = 1 / MoeSum!(i)
                GoSub moebins  'put into bins for later use in determining the distribution of
these values
                               'for the population of interest
              End If
            Next
          End If

        End If

    End If

  End If

Next 'mc
```

**Subroutine putinbins**

This subroutine puts the computed exposure amount for this individual/iteration into the appropriate bin for the corresponding exposure route and recipient. It also adds the exposure amount to the sum of total exposure amounts and the sum of the square of the exposure amounts for later use in computing the mean and standard deviation for each exposure route and recipient.

Variable definitions:

exposw#(k, j) = sum of all weighted exposures for k,j indices defined above for csum!(k,j), weighted with CSFII statistical weight for this individual

expos2w#(k, j) = sum of squares of all weighted exposures for k,j indices defined above for csum!(k,j), weighted with CSFII statistical weight for this individual

wght& = CSFII statistical weight for this individual

bin#(k,j i) = bin array for the k,j indices, i = bin number (0 to nbins)

max!(k,j) = the highest exposure value for the k, j indices in the current analysis

Code:

```
exposw#(k, j) = exposw#(k, j) + csum!(k, j) * wght&
expos2w#(k, j) = expos2w#(k, j) + (csum!(k, j) ^ 2) * wght&
If csum!(k, j) > max!(k, j) Then max!(k, j) = csum!(k, j)

If csum!(k, j) = 0 Then
    bin#(k, j, 0) = bin#(k, j, 0) + wght&
Else
  X = Int(Log(csum!(k, j) / scalar!(k, j)) / Log(1.01)) + 1
  If X < 1 Then
    X = 1
  ElseIf X > nbins Then
    X = nbins + 1
  End If
  bin#(k, j, X) = bin#(k, j, X) + wght&
End If
```

# Subroutine Appexpos

This subroutine is called from the main computational subroutine to calculate the exposure amounts derived from AGX file t (t = 1 to ntreat) for the current individual/iteration over the days of interest (as specified by the user). These exposure amounts are exposure route specific and are based on the application scenario selected for this iteration, the amount of residue available per unit of contact on each application day, the amounts still available on the day of contact (possibly from more than one application of this treatment), and the amount of physical contact for this individual on this day that results in residue uptake. It also computes the applicator exposure on the day of application for each application for self-application scenarios.

Variable definitions:

Px! = a random number (the next random number in the sequence generated by the random number generator

Prt!(t, idem(2)) = the probability of treatment t in region idem(2), where idem(2) is a demographic variable indicating the region (1-4) in which the CSFII participant lives

X = the number of days between treatment and contact. If x = -1, there is no contact with a treated area

PrSA!(t) = the probability that treatment t is self-applied (as opposed to professionally applied). Note that the probability of professional application = 1-PrSA!(t)

SA (boolean) = 1 when self-application is determined, 0 when professional application is determined

PA (boolean) = 1 when professional application is determined, 0 when self-application is determined

NFrSA(t) = number of self-application scenarios for treatment t under consideration, each with its own probability of occurrence.

CumPrFrSA!(t,f) = cumulative probability of the self-application scenarios being considered, where CumPrFrSA!(t, NFrSA(t)) = 1.00

W52a = the week of the year in which the first application is made for this treatment

D7a = the day of the week in which the first application is made for this treatment

CumProbW!(t,w,1) = the cumulative probability that the first application is made in week w for treatment t

CumPrSAW!(t, d) = the cumulative probability that the first application made on day d for the current treatment

d365a(1) = day of year of the current treatment, first application

contact = the day of year that exposure from contacting a treated area is being calculated

RandomWeek(t, 1) (boolean), value = 1 indicates that the day of week of application is recalculated with each application; value = 0 indicates that the day of the week of re-application through the year is same as initial application (self-application scenario)

IntervalSA(t, s, k) = the interval in days between treatment k and application k –1 for treatment t, scenario s, where k = 1 is the initial application this year.

ActiveExp(t, 1) = the maximum period for which exposure is possible after the last application for treatment t, self-application scenario

Ndays = the number of days in a row for which exposure is calculated

Code:

```
px! = Rnd(1)
If px! > PrT!(t, idem(2)) Then  'no treatment
  X = -1
  Exit Sub

Else

  px! = Rnd(1)
  If px! < PrSA!(t) Then   'Self application household
    sa = 1   'px! < PrSA!(t) because when px! = 0, SA is selected even though it if might have a
zero prob
    pa = 0

    'Application scenario selection
    px! = Rnd(1)
    For f = 1 To NFrSA(t)
      If px! < CumPrFrSA!(t, f) Then s = f: Exit For
    Next
    If s = 0 Then s = NFrSA(t)


    'get week of year for first application
    px! = Rnd(1)
    w52a = 0
    If ModelSA(t) = 1 Then  ‘regular frequency throughout year

      If FrSA(t, s) = 1 Then 'FrSA(t,s) = number of applications per year
        freq = 1
      Else
        freq = intervalSA(t, s, 2) / 7
      End If
      For w = 1 To freq
        If px! <= w / freq Then w52a = w: Exit For
      Next
      If w52a = 0 Then w52a = freq

    ElseIf ModelSA(t) = 2 Then
      For w = 1 To 52
        If px! < cumprobw!(t, w, 1) Then w52a = w: Exit For '2.03
      Next

    End If

    'get day of week for application
    px! = Rnd(1)
    d7a = 0
    For d = 1 To 7
      If px! < CumPrSAW!(t, d) Then
         d7a = d
         Exit For
      End If
    Next
    If d7a = 0 Then d7a = 7

    ReDim d365a(FrSA(t, s))
    d365a(1) = (w52a - 1) * 7 + d7a 'get day of year for application 1
    contact = d365c

    If contact >= d365a(1) + intervalSA(t, s, FrSA(t, s)) + ActiveExp(t, 1) Then
     'no exposure possible on this day or any later day in this year, no need to check
      X = -1
      GoTo EndModelSA
    End If

    flag365 = 0
    If FrSA(t, s) > 1 Then  'number of applications in year
       'compute day of application, D365a(), for each follow-on application in year
       'this is only invoked on the first of ndays
       For a = 2 To FrSA(t, s)
```

```
          If RandomWeek(t, 1) = 0 Then
            'don't select a day of week at random for follow on application
            d365a(a) = d365a(1) + intervalSA(t, s, a)
          Else
            flag = 0
            If a = 2 Then
              If intervalSA(t, s, a) >= RandomWeek(t, 1) * 2 * 7 Then flag = 1
                  '* 2 means that there must be at least a full week between treatments
            Else
              If intervalSA(t, s, a) - intervalSA(t, s, a - 1) >= RandomWeek(t, 1) * 2 * 7 Then
flag = 1

            End If

            If flag Then
              px! = Rnd(1)
              d7x = 0
              For d = 1 To 7  'get day of week for reapplication
                If px! < CumPrSAW!(t, d) Then d7x = d: Exit For
              Next d
              If d7x = 0 Then d7x = 7

            Else
              d7x = d7a  'reapplication day of week same as first application

            End If

            d365a(a) = d365a(1) - d7a + d7x + intervalSA(t, s, a)

          End If

        Next a

      End If

      If FrSA(t, s) > 1 Then  'number of applications in year
         'compute day of application, D365a(), for each follow-on application in year
         'this is only invoked on the first of ndays
         For a = 2 To FrSA(t, s)
           If RandomWeek(t, 1) = 0 Then
             d365a(a) = d365a(1) + intervalSA(t, s, a)
           Else
             flag = 0
             If a = 2 Then
               If intervalSA(t, s, a) >= RandomWeek(t, 1) * 2 * 7 Then flag = 1
                 '*2 means that there must be at least a full week between treatments
             Else
               If intervalSA(t, s, a) - intervalSA(t, s, a - 1) >= RandomWeek(t, 1) * 2 * 7 Then
flag = 1

             End If

             If flag Then
               px! = Rnd(1)
               d7x = 0
               For d = 1 To 7  'get day of week for reapplication
                 If px! < CumPrSAW!(t, d) Then d7x = d: Exit For '2.03
               Next d
               If d7x = 0 Then d7x = 7

             Else
               d7x = d7a

             End If

             d365a(a) = d365a(1) - d7a + d7x + intervalSA(t, s, a)
           End If

           If d365a(a) > 365 And ModelSA(t) = 2 Then
             d365a(a) = d365a(a) - 365
             flag365 = 1 'used later to force model-2 for-next loops to fully execute
```

```
        End If
        lasta(a) = d365a(a) 'save for future iterations (by link or chronic)
        If ModelSA(t) = 1 And contact + ndays - 1 < d365a(a) Then Exit For
        'no further contact possible
      Next a
    End If


     X = -1
     If (flaglink = 1 Or dd > 1) And lasta(0) = 1 Then GoTo EndModelSA 'contact day is after end
of last active exposure period
     flagcontact = 0 'when this is 1, same contact amount (cx!) is used since this is the same
day and same person

     For a = 1 To FrSA(t, s) 'check each application during current year
       If flaglink = 1 Or dd > 1 Then d365a(a) = lasta(a)
       If flag365 = 0 And contact < d365a(a) Then Exit For 'no further contact possible this year

       If contact >= d365a(a) And contact < d365a(a) + ActiveExp(t, 1) Then
         X = contact - d365a(a)
         activecontact = 1
         Assigntype = AssigntypeSA(t, ss)
         bodyfactorx = bodyfactor(t)
         apyear = 1
         GoSub ComputeC
         flagcontact = 1
         If cc! Then GoSub GETC1C2C3
         If contact = d365a(a) And applicator = 1 Then GoSub ASSIGNAP 'get self-application
exposure
       End If
     Next a

EndModelSA:
  Else  'professional application scenario determination

    The same algorithms are used to calculate the professional application scenario as are coded
above
    to calculate the occupant applicator.

  End If
```

Subroutine ComputeC

This subroutine computes the daily contact amount for the current individual to be used in the current exposure computation, unless a contact amount from a previous pass is to be used again. It then computes the available residue amount and multiplies this by the contact amount to compute

Variable definitions:

Flagcontact (boolean) = 1 if the contact amount has already been selected for this use; 0 if not

NcontacWK(t,ss) = the assigned contact period (1-5) from this AGX file (t) and exposure schedule (ss)

Cwn = contact week number (1-5)

D365c = the day of the year for which contact is being determined

Cc! = contact amount

Bodyfactorx (boolean) = 1 if body adjustment factor is to be used in the contact equation (specified in AGX file before specifying the contact parameters)

AssignType = 3 if available residue amount for this day is to be taken from a residue distribution;
= 4 if available residue amount is computed for application day, then degraded using sub DEGRADATION (as specified in AGX file)

ContactSA(t, ss, pt, cwn) = The contact index for AGX file t, schedule ss, age group pt, contact week period cwn

cday0!(a) = the residue amount generated for application a on the day of application (to be used again with degradation algorithm)

icday0(a) (boolean) = the residue amount for application day a has already been generated

Code:

```
If flagcontact = 0 Then 'contact has not yet been chosen for this person on this day
  'select appropriate contact week number (cwn)

  If NContactWK(t, ss) = 1 Then
    cwn = 1
  Else
    If d365c > 357 Then  '357 = last day of 51st week, thus d365c is in last week
      cwn = NContactWK(t, ss)
    Else
      cwn = 1
      While d365c > ContactWK(t, ss, cwn) * 7
        cwn = cwn + 1
      Wend
    End If
  End If

  cc! = 0
  If ContactSA(t, ss, pt, cwn) Then
    GoSub contactcalcs
    If cc! = 0 Then Return
    If bodyfactorx Then
      Call BodyAdj(bodyfactorx, baf!, idem())
      cc! = cc! * baf!
    End If
    cx! = cc! 'hold this number temporarily
  Else
    cx! = 1 'set up for multiplication
```

```
          End If
        Else
          'use cx! (contact amount) from last pass
        End If

        cc! = 0

        If Assigntype = 3 Then  'contact with exposure on day x
          GoSub ExposCalcs 'get exposure amount on day x, cc!
          'note that exposure amount is newly selected each day after application, even for
chronic
              analysis
          If cc! = 0 Then Return
          cc! = cc! * cx! 'multiply by contact amount

        ElseIf Assigntype = 4 Then   'contact with exposure on day 0 with degr., cc!
          If icday0(a, apyear) = 0 Then  'application day residue amount has not yet been
determined
            xx = X 'temporary save of x
            X = 0
            GoSub ExposCalcs 'get exposure on application day, cc!
            X = xx 'restore x
            cday0!(a) = cc!  'save the application day residue amount for application a
            icday0(a) = 1    'the application day residue amount has been saved for application
a
          Else
            cc! = cday0!(a)  'use application day residue amount already determined
          End If

          If cc! = 0 Then Return
          cc! = cc! * cx!
          GoSub DEGRADATION  'get cc! * df!(x)
        End If
```

## Subroutine ContactCalcs

This subroutine calculates a contact amount based on the distribution function assigned.

Variable definitions:

ContactSA(t,ss,pt,cwn) = The contact function index assigned in AGX file t, exposure schedule ss, age group pt, contact week number cwn)

ConDisType(t,g) = Contact distribution type from AGX file t, contact function g (see list of distribution types elsewhere in this document)

Px! = random number (0-.9999999)

Cc! = contact amount

Sub GETFROMCDF is a subroutine which will retrieve a contact value from a contact distribution file (CDF) having n contact values, each having the probability 1/n of being selected when drawn with a random number px!

Sub CONASSIGN2 is a subroutine similar to subroutine ContactCalcs which allows contact values to be drawn from other (specifically identified) contact functions in the same AGX file and then be combined as indicated (i.e., multiplied, added, or divided).

```
contactcalcs:
  cc! = 0
  g = ContactSA(t, ss, pt, cwn) 'index for contact functions

  If ConDisType(t, g) > 0 Then px! = Rnd(1)
  If ConDisType(t, g) = -1 Then
    cc! = ConParam!(t, g, 1)

  ElseIf ConDisType(t, g) = 1 Then
    Call uniform(px!, ConParam!(t, g, 1), ConParam!(t, g, 2), cc!)

  ElseIf ConDisType(t, g) = 2 Then
    Call pareto(px!, ConParam!(t, g, 1), ConParam!(t, g, 2), ConParam!(t, g, 3), cc!)

  ElseIf ConDisType(t, g) = 3 Then
    Call triangular(px!, ConParam!(t, g, 1), ConParam!(t, g, 2), ConParam!(t, g, 3), cc!)

  ElseIf ConDisType(t, g) = 4 Then
    Call normal(px!, ConParam!(t, g, 1), ConParam!(t, g, 2), ConParam!(t, g, 3), cc!)
    If cc! < 0 Then cc! = 0

  ElseIf ConDisType(t, g) = 5 Then
    Call lognormal(px!, ConParam!(t, g, 1), ConParam!(t, g, 2), ConParam!(t, g, 3), cc!)

  ElseIf ConDisType(t, g) = 6 Then
    'get exposure from assigned array read in before analysis
    ii = ConParam!(t, g, 1)
    GoSub GETFROMCDF
    cc! = ccdf!

  ElseIf ConDisType(t, g) = 7 Then
    ii = ConParam!(t, g, 1)
    px! = Rnd(1)
    Call CumDist(px!, t, ii, npairs(), CumProb!(), CumExp!(), cc!)

  ElseIf ConDisType(t, g) = 8 Or ConDisType(t, g) = 9 Or ConDisType(t, g) = 10 Then
    If ConDisType(t, g) = 8 Then cc! = 1 Else cc! = 0
    For j1 = 1 To 3
      ConDisType2 = ConDisType(t, ConParam!(t, g, j1))
      If ConDisType2 Then  'j1 = 3 may be null for 8 & 9, always null for 10
        g2 = ConParam!(t, g, j1)
```

```
      GoSub CONASSIGN2 'get c2!
      If ConDisType(t, g) = 8 Then 'multiplicative
        cc! = cc! * c2!
      ElseIf ConDisType(t, g) = 9 Then 'additive
        cc! = cc! + c2!
      ElseIf ConDisType(t, g) = 10 Then 'division
        If j1 = 1 Then
          cc! = c2!
        Else
          If c2! Then
            cc! = cc! / c2!
          Else
            cc! = 0 'returns 0 if division by 0
          End If
        End If
      End If
    End If
  Next
End If
```

## Subroutine ExposCalcs

This subroutine calculates a residue amount based on the distribution function assigned.

Variable definitions:

X = number of elapsed days between application and contact

ActiveExp(t, j) = maximum number of days for which the residue from an application in AGX file t can be active, where j = 1 for self-application (i.e., occupant application) and j = 2 for professional application (which might be a more concentrated application with longer life)

DaysMapSA(t,ss, x) = the map used to determine which residue function to use, based on the AGX file, exposure schedule, and number of elapsed days

AssignmentSA(t,ss,pt,d) = The residue function index assigned in AGX file t, exposure schedule ss, age group pt, index based on elapsed days, d

ExpDisType(t,g) = Residue distribution type from AGX file t, residue function g (see list of distribution types elsewhere in this document)

Px! = random number (0-.9999999)

Cc! = residue amount

Sub GETFROMEDF is a subroutine which will retrieve a residue value from a residue distribution file (RDF) having n residue values, each having the probability 1/n of being selected when drawn with a random number px!

Sub EXPASSIGN2 is a subroutine similar to subroutine ExposCalcs which allows residue values to be drawn from other (specifically identified) residue functions in the same AGX file and then be combined as indicated (i.e., multiplied, added, or divided).

Code:

```
  cc! = 0
  If sa Then  'remember that activeexp days start at day 0
    If X >= ActiveExp(t, 1) Then Return
  ElseIf pa Then
    If X >= ActiveExp(t, 2) Then Return
  End If

  d = 0
  d = daysmapSA(t, ss, X)
  If d = 0 Then Return

  g = AssignmentSA(t, ss, pt, d) ‘index for residue functions

  If ExpDisType(t, g) > 0 Then px! = Rnd(1)

  If ExpDisType(t, g) = -1 Then
    cc! = ExpParam!(t, g, 1)

  ElseIf ExpDisType(t, g) = 1 Then
    Call uniform(px!, ExpParam!(t, g, 1), ExpParam!(t, g, 2), cc!)

  ElseIf ExpDisType(t, g) = 2 Then
    Call pareto(px!, ExpParam!(t, g, 1), ExpParam!(t, g, 2), ExpParam!(t, g, 3), cc!)

  ElseIf ExpDisType(t, g) = 3 Then
    Call triangular(px!, ExpParam!(t, g, 1), ExpParam!(t, g, 2), ExpParam!(t, g, 3), cc!)
```

```
ElseIf ExpDisType(t, g) = 4 Then
  Call normal(px!, ExpParam!(t, g, 1), ExpParam!(t, g, 2), ExpParam!(t, g, 3), cc!)
  If cc! < 0 Then cc! = 0

ElseIf ExpDisType(t, g) = 5 Then
  Call lognormal(px!, ExpParam!(t, g, 1), ExpParam!(t, g, 2), ExpParam!(t, g, 3), cc!)

ElseIf ExpDisType(t, g) = 6 Then
  'get exposure from assigned array read in before analysis
  ii = ExpParam!(t, g, 1)
  GoSub GETFROMEDF
  cc! = cedf!

ElseIf ExpDisType(t, g) = 7 Then
  ii = ExpParam!(t, g, 1)
  Call CumDist(px!, t, ii, npairs(), CumProb!(), CumExp!(), cc!)

ElseIf ExpDisType(t, g) = 8 Or ExpDisType(t, g) = 9 Or ExpDisType(t, g) = 10 Then
  If ExpDisType(t, g) = 8 Then cc! = 1 Else cc! = 0
  For j1 = 1 To 3
    ExpDisType2 = ExpDisType(t, ExpParam!(t, g, j1))
    If ExpDisType2 Then  'j1 = 3 may be null for 8 & 9, always null for 10
      g2 = ExpParam!(t, g, j1)

      GoSub EXPASSIGN2 'get c2!
      If ExpDisType(t, g) = 8 Then 'multiplicative
        cc! = cc! * c2!
      ElseIf ExpDisType(t, g) = 9 Then 'additive
        cc! = cc! + c2!
      ElseIf ExpDisType(t, g) = 10 Then 'division
        If j1 = 1 Then
          cc! = c2!
        Else
          If c2! Then
            cc! = cc! / c2!
          Else
            cc! = 0 'returns 0 if division by 0
          End If
        End If
      End If
    End If
  Next

End If
Return
```

# Subroutine BodyAdj

This subroutine calculates the body adjustment factor used to be used with the contact amount when the contact amount is normalized, as defined by the user in the AGX file. Body adjustment factors can be used with dermal and inhalation contact amounts but not with oral contact amounts.

Variable definitions

idem(14) = ht in cm

idem(13) = wt in kg

idem(5) = sex

idem(4) = age

bfx = 1 for body surface area calculation (dermal); = 2 for breathing rate calculation (inhalation)

baf! = calculated body adjustment factor

Code:

```
  If bfx = 1 Then  'body surface area in m2
    baf! = 0.0235 * idem(14) ^ 0.42246 * idem(13) ^ 0.51456 '
    baf! = baf! * 10000 'change to cm2
    baf! = baf! / 100 'to correct for using percent (rather than ratio) in contact parameter
  ElseIf bfx = 2 Then 'resting breathing rate in m3/hr
    If idem(5) = 1 Then 'males
      If idem(4) < 3 Then
        bmr! = 0.249 * idem(13) - 0.127
      ElseIf idem(4) < 10 Then
        bmr! = 0.095 * idem(13) + 2.11
      ElseIf idem(4) < 18 Then
        bmr! = 0.074 * idem(13) + 2.754
      ElseIf idem(4) < 30 Then
        bmr! = 0.063 * idem(13) + 2.896
      ElseIf idem(4) < 60 Then
        bmr! = 0.048 * idem(13) + 3.653
      Else
        bmr! = 0.049 * idem(13) + 2.459
      End If
    Else
      If idem(4) < 3 Then
        bmr! = 0.244 * idem(13) - 0.13
      ElseIf idem(4) < 10 Then
        bmr! = 0.085 * idem(13) + 2.033
      ElseIf idem(4) < 18 Then
        bmr! = 0.056 * idem(13) + 2.898
      ElseIf idem(4) < 30 Then
        bmr! = 0.062 * idem(13) + 2.036
      ElseIf idem(4) < 60 Then
        bmr! = 0.034 * idem(13) + 3.538
      Else
        bmr! = 0.038 * idem(13) + 2.755
      End If
    End If
    baf! = bmr! * 1.35 '(H = .05, VQ = 27)  'daily breathing rate in m3
    baf! = baf! / 24 'hourly rate in m3
  End If

End Sub
```

**Subroutine GETC1C2C3:**

This subroutine assigns the current exposure value (cc!) to the appropriate exposure route array C!(). In the case where dermal must be broken into dermal and oral amounts, i.e., where dermal includes hand-to-mouth residue transfer, the exposure value is separated into two amounts before assigning these amounts to array C!().

Variable definitions:

ExpTypex(t) is the exposure route type assigned in AGX file t (1 = inhalation, 2 = dermal, 3 = oral)

Percoral! = the decimal value of the percent of dermal pick-up transferred to the mouth

Sub CALC_HTM_RATIO is a subroutine similar to ContactCalcs which derives a percentage HTM value from the assigned contact function.

Code:

```
c!(0) = c!(0) + cc!
If ExpTypex(t) < 4 Then  'individual exposure paths
  c!(exptypex(t)) = cc!

Else 'combined dermal and oral need to be broken apart
  percoral! = 0
  If g_AGXType(t) < 4 Then
    'old agx file type; all distribution data were saved in decimal form except cum dist
    If HTMDistType(t, pt) Then GoSub CALC_HTM_RATIO

  Else 'new agx file type, all data were saved as percent and must be converted to decimal

    If HTMDistType(t, pt) Then
      GoSub CALC_HTM_RATIO
      percoral! = percoral! / 100
    End If
  End If

  c!(2) = cc! * (1 - percoral!)
  c!(3) = cc! * percoral!
End If
```

**Subroutine ASSIGNAP**:

This subroutine is used to generate applicator exposure on the day of application (same distribution used for all applicators)
Note: in older AGX files, all three exposure routes for applicators could be handled in a single AGX file. In newer AGX files, only one exposure route can be handled, the same exposure route declared for occupant exposure. In order to maintain backwards compatibility, this subroutine will work with both AGX file types. Note that if the contact amount is not specified, the residue amount is assumed to be the exposure amount, i.e., it is not multiplied by the 0 contact value.

Variable definitions:

Cappx! = the applicator exposure amount

Capp!(i) = the exposure-route specific array of applicator exposure amounts for this pass

AppDistType(t, i, j) = The applicator distribution type for AGX file t, exposure route i (1 to 3), j = 1 for contact distribution type, j = 2 for residue distribution type, j = 3 for residue distribution type when representing exposure amount.

Subroutine COMPAPP is a subroutine similar to subroutine ContactCalcx and ExposCalcs which returns a contact value or a residue value from the designated distribution function.

Code:

```
For i = 1 To maxapp
  'note: maxapp refers to highest applicator exposure type (1-3), not the max number of
application types
  'thus maxapp =3 when oral/gi is used, even if it is the only one used

  cappx! = 0
  If (AppDistType(t, i, 1) <> 0 And AppDistType(t, i, 2) <> 0) Or AppDistType(t, i, 3) <> 0 Then
  'with new agx format appdisttype(t,i,3) is not used; force the next test
    If AppDistType(t, i, 1) Or g_AGXType(t) >= 4 Then
      k = 1 'contact rate
      GoSub COMPAPP
      capp1! = cappx!  'temporary save of cappx!
      If cappx! > 0 Then
        k = 2 'residue amount
        GoSub COMPAPP
        cappx! = capp1! * cappx!
      End If

    ElseIf AppDistType(t, i, 3) Then
      k = 3 'exposure amount
      GoSub COMPAPP
    End If
    If cappx! Then capp!(i) = cappx!
  End If
Next
```

**Subroutine Degradation**

This subroutine calculates the amount of available residue x days after the day of application, based either on a straight-line degradation model or a half-life model.

Variable definitions:

X = elapsed days from application

Df!() is an array of computed degradation factors

AssignmentSA(t, ss, pt, j) = the degradation type used in AGX file t, exposure schedule ss, age group pt, j = 1 for half life, j = 2 for straight line

hl! = half life in days (as assigned in AGX file)

zpoint! = zero point in straight-line calculation

cc! is the residue amount on the day of application

Code:

```
          If X Then 'only do DEGRADATION if contact date is after day of application
          ReDim df!(X To X)

          If AssignmentSA(t, ss, pt, 2) = 1 Then 'this is degr. type
            hl! = DegParam!(t, ss, pt)
            Call halflife(X, X, hl!, df!())

          Else
            zpoint! = DegParam!(t, ss, pt)
            Call straightline(X, X, zpoint!, df!())

          End If

          cc! = cc! * df!(X)

        End If
```

**Subroutine straightline(d1, d2, zpoint!, df!())**

Generates a vector of degradation scalars based on the straight-line degradation of the chemical residue to zero

```
For i = d1 To d2  'returns day d1 to d2
  If zpoint! Then
    sumd! = i / zpoint!
    If sumd! > 1 Then sumd! = 1
    df!(i) = 1 - sumd!
  Else
    df!(i) = 0
  End If
Next
```

## Subroutine halflife(d1, d2, hl!, df!())

Generates a vector of degradation scalars based on the half-life of the chemical residue

```
For i = d1 To d2  'returns day d1 to d2
  df!(i) = 0.5 ^ ((i) / hl!)
Next
```

## Calculation of mean and standard deviation of exposure amounts by exposure route and recipient

```
Means:

  If FoodsYN$ = "Y" Then
    cmeans!(0, 4) = exposw#(0, 4) / userdaysw#  'this is the user mean
  End If

  If TreatYN$ = "Y" Then
    For k = 0 To 2
      For j = bottom(k) To 3
        cmeans!(k, j) = exposw#(k, j) / userdaysw#  'this is the user mean
      Next
    Next
  End If

  If FoodsYN$ = "Y" And TreatYN$ = "Y" Then
    cmeans!(2, 4) = cmeans!(2, 3) + cmeans!(0, 4)
  End If

  If persdaysw# Then
    userpcratio! = userdaysw# / persdaysw# * 100  'percent of person-days that are users
  Else
    userpcratio! = 0
  End If

  Note: per capita mean = cmeans!(k, j) * userpcratio! / 100


Standard deviation:

Varu# = variance

Exposw#(x,y) = sum of all exposures (weighted using CSFII statistical weights) for the exposure
routes and
                recipient types (see csum!( ) for corresponding index definitions)

Expos2w#(x,y) =  sum of squares related to exposw#()

Sdu# = standard deviation for users

Sdpc# = standard deviation per capita


      If userdaysw# > 1 Then
        varu# = (expos2w#(X, y) - (exposw#(X, y) ^ 2) / userdaysw#) / (userdaysw# - 1)
        If varu# < 0 Then varu# = 0
        sdu# = varu# ^ 0.5
        varpc# = (expos2w#(X, y) - (exposw#(X, y) ^ 2) / persdaysw#) / (persdaysw# - 1)
        If varpc# < 0 Then varpc# = 0
        sdpc# = varpc# ^ 0.5

      Else
        sdu# = -1
        sdpc# = -1
      End If
```

# The remaining subroutines in this section are used to compute an amount, c!, given a distribution type and appropriate parameters, as passed from the calling code above.

**Subroutine lognormal(p!, m!, sd!, max!, c!)**

Draws a real number from a log-normal distribution

Variable definitions:

p! = random number

m! = mean

sd! = standard deviation

max! = maximum value

Code:

```
If m! > 0 Then
  mx! = Log((m! ^ 2) / ((m! ^ 2 + sd! ^ 2) ^ 0.5))
  sdx! = (Log(1 + (sd! / m!) ^ 2)) ^ 0.5
  Call normal(p!, mx!, sdx!, 0, c!)
  c! = Exp(c!)
  If max! Then
    If c! > max! Then c! = max!
  End If
Else
  c! = 0
End If
```

**Subroutine normal(p!, m!, sd!, max!, c!)**

Draws a real number from a normal distribution

Variable definitions:

p! = random number

m! = mean

sd! = standard deviation

max! = maximum value

Code:

```
  If p! = 0 Then p! = 0.0000001
  If p! = 1 Then p! = 0.9999999
  If p! <= 0.5 Then
    y! = -Log(2 * p!)
  Else
    y! = -Log(2 * (1 - p!))
  End If
  If y! <> 0 Then
   top! = 4 * y! ^ 4 + 100 * y! ^ 3 + 205 * y! ^ 2
```

```
 bottom! = 2 * y! ^ 3 + 56 * y! ^ 2 + 192 * y! + 131
 If bottom! Then
   quot! = top! / bottom!
 Else
   quot! = 0
 End If
 c! = (quot! ^ 0.5)
 If p! <= 0.5 Then c! = -c!
Else
  c! = 0
End If
c! = c! * sd! + m!
If max! Then
  If c! > max! Then c! = max!
End If
```

**Subroutine pareto(p!, a!, k!, max!, c!)**

Draws a real number from a pareto distribution

Variable definitions:

p! = random number

k! = location parameter

a! = shape parameter

max! = maximum value

Code:

```
If p! < 1 Then
  c! = k! / (1 - p!) ^ (1 / a!)
  If max! Then
    If c! > max! Then c! = max!
  End If
Else
  c! = 0
End If
```

**Subroutine triangular(p!, l!, m!, u!, c!)**

Draws a real number from a triangular distribution

Variable definitions:

p! = random number

l! = lower limit

m! = most likely value

u! = upper limit

Code:

```
If u! = l! Then
  c! = u!
```

```
Else
  h! = (m! - l!) / (u! - l!)
  If p! <= h! Then
    c! = l! + (u! - l!) * (p! * h!) ^ 0.5
  Else
    c! = l! + (u! - l!) * (1 - (1 - h! - p! + p! * h!) ^ 0.5)
  End If
End If
```

**Subroutine uniform(p!, l!, u!, c!)**

Draws a real number from a uniform distribution

Variable definitions:

P! = random number

l! = lower limit

u! = upper limit

Code:

```
c! = l! + p! * (u! - l!)
```

# Appendix B

## Results of Granular Turf Product Example

## Adult Single Day (Randomly Selected) Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf short-term.AGM
No dietary analysis
Exposure analysis for non-specific day (contact dates throughout year)
Analysis Date 08-23-2000:09:38:47 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 100 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

==========

==========

Occupant Inhalation Exposure
No exposure

==========

Occupant Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.038388 | 0.096094 |
| Standard Deviation | 0.071242 | 0.084616 |
| Margin of Exposure | 2214 | 885 |

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.008816 | 9642 | 10.00 | 0.215910 | 394 |
| 80.00 | 0.020475 | 4151 | 5.00 | 0.264350 | 322 |
| 70.00 | 0.036305 | 2341 | 2.50 | 0.307724 | 276 |
| 60.00 | 0.054473 | 1560 | 1.00 | 0.359630 | 236 |
| 50.00 | 0.074724 | 1138 | 0.50 | 0.396019 | 215 |
| 40.00 | 0.097636 | 871 | 0.25 | 0.430365 | 198 |
| 30.00 | 0.124936 | 680 | 0.10 | 0.473281 | 180 |
| 20.00 | 0.160577 | 529 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.141290 | 602 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.198828 | 428 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.249067 | 341 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.307648 | 276 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.347459 | 245 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.384682 | 221 |
| 30.00 | 0.027804 | 3057 | 0.10 | 0.430308 | 198 |
| 20.00 | 0.074592 | 1140 | | | |

==========

Occupant Oral/GI Exposure (non-dietary)
No exposure

==========

Dietary Exposure
No exposure

==========

## Adult Single Day (Randomly Selected) Exposures

Total Applicator Inhalation + Dermal Exposure

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | n/a |
| 80.00 | n/a | n/a | 5.00 | n/a | n/a |
| 70.00 | n/a | n/a | 2.50 | n/a | n/a |
| 60.00 | n/a | n/a | 1.00 | n/a | 350 |
| 50.00 | n/a | n/a | 0.50 | n/a | 250 |
| 40.00 | n/a | n/a | 0.25 | n/a | 200 |
| 30.00 | n/a | n/a | 0.10 | n/a | 160 |
| 20.00 | n/a | n/a | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | n/a |
| 80.00 | n/a | n/a | 5.00 | n/a | n/a |
| 70.00 | n/a | n/a | 2.50 | n/a | n/a |
| 60.00 | n/a | n/a | 1.00 | n/a | n/a |
| 50.00 | n/a | n/a | 0.50 | n/a | 420 |
| 40.00 | n/a | n/a | 0.25 | n/a | 270 |
| 30.00 | n/a | n/a | 0.10 | n/a | 200 |
| 20.00 | n/a | n/a | | | |

## Adult Single Day (Randomly Selected) Exposures

Applicator Inhalation Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.000445 | 0.001114 |
| Standard Deviation | 0.005560 | 0.008755 |
| Margin of Exposure | 44949 | 17957 |

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000000 | n/a |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000000 | n/a |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000000 | n/a |
| 60.00 | 0.000000 | n/a | 1.00 | 0.049673 | 403 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.072211 | 277 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.088850 | 225 |
| 30.00 | 0.000000 | n/a | 0.10 | 0.110173 | 182 |
| 20.00 | 0.000000 | n/a | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000000 | n/a |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000000 | n/a |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000000 | n/a |
| 60.00 | 0.000000 | n/a | 1.00 | 0.000000 | n/a |
| 50.00 | 0.000000 | n/a | 0.50 | 0.041622 | 481 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.065506 | 305 |
| 30.00 | 0.000000 | n/a | 0.10 | 0.088794 | 225 |
| 20.00 | 0.000000 | n/a | | | |

## Adult Single Day (Randomly Selected) Exposures

Applicator Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.000212 | 0.000531 |
| Standard Deviation | 0.002647 | 0.004167 |
| Margin of Exposure | 400538 | 160009 |

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000000 | n/a |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000000 | n/a |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000000 | n/a |
| 60.00 | 0.000000 | n/a | 1.00 | 0.023637 | 3596 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.034388 | 2472 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.043001 | 1977 |
| 30.00 | 0.000000 | n/a | 0.10 | 0.052290 | 1626 |
| 20.00 | 0.000000 | n/a | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000000 | n/a |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000000 | n/a |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000000 | n/a |
| 60.00 | 0.000000 | n/a | 1.00 | 0.000000 | n/a |
| 50.00 | 0.000000 | n/a | 0.50 | 0.019666 | 4322 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.031222 | 2722 |
| 30.00 | 0.000000 | n/a | 0.10 | 0.042987 | 1977 |
| 20.00 | 0.000000 | n/a | | | |

Applicator Oral/GI Exposure
No exposure

## Adult Single Day (Randomly Selected) Exposures

Total Inhalation + Dermal Exposure (Occ. + App.)

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 9500 | 10.00 | n/a | 370 |
| 80.00 | n/a | 4000 | 5.00 | n/a | 300 |
| 70.00 | n/a | 2300 | 2.50 | n/a | 240 |
| 60.00 | n/a | 1500 | 1.00 | n/a | 180 |
| 50.00 | n/a | 1100 | 0.50 | n/a | 150 |
| 40.00 | n/a | 850 | 0.25 | n/a | 120 |
| 30.00 | n/a | 660 | 0.10 | n/a | 100 |
| 20.00 | n/a | 510 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | 580 |
| 80.00 | n/a | n/a | 5.00 | n/a | 410 |
| 70.00 | n/a | n/a | 2.50 | n/a | 320 |
| 60.00 | n/a | n/a | 1.00 | n/a | 240 |
| 50.00 | n/a | n/a | 0.50 | n/a | 200 |
| 40.00 | n/a | n/a | 0.25 | n/a | 160 |
| 30.00 | n/a | 3000 | 0.10 | n/a | 120 |
| 20.00 | n/a | 1100 | | | |

## Adult Single Day (Randomly Selected) Exposures

Total Dermal Exposure (Occ.+ App.)

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.038601 | 0.096626 |
| Standard Deviation | 0.071741 | 0.085305 |
| Margin of Exposure | 2202 | 880 |

Percent of Person-Days that are User-Days = 39.95%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.008881 | 9571 | 10.00 | 0.216869 | 392 |
| 80.00 | 0.020701 | 4106 | 5.00 | 0.266173 | 319 |
| 70.00 | 0.036633 | 2320 | 2.50 | 0.310703 | 274 |
| 60.00 | 0.054829 | 1550 | 1.00 | 0.363790 | 234 |
| 50.00 | 0.075004 | 1133 | 0.50 | 0.401165 | 212 |
| 40.00 | 0.097904 | 868 | 0.25 | 0.438468 | 194 |
| 30.00 | 0.125239 | 679 | 0.10 | 0.483003 | 176 |
| 20.00 | 0.161127 | 528 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.141706 | 600 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.199653 | 426 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.250613 | 339 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.310617 | 274 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.351296 | 242 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.389485 | 218 |
| 30.00 | 0.028108 | 3024 | 0.10 | 0.438402 | 194 |
| 20.00 | 0.074868 | 1135 | | | |

## Adult Single Day (Randomly Selected) Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf short-term.AGM
No dietary analysis
Exposure analysis for non-specific day (contact dates throughout year)
Analysis Date 08-23-2000:09:38:47 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 100 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| | Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|---|
| | Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| Occupant Dermal Exposure | 0.038388 | 2214 | 0.198828 | 428 | 0.307648 | 276 | 0.430308 | 198 |
| Total Applicator Inhalation + Dermal Exposure | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 200 |
| Applicator Inhalation Exposure | 0.000445 | 44949 | 0.000000 | n/a | 0.000000 | n/a | 0.088794 | 225 |
| Applicator Dermal Exposure | 0.000212 | 400538 | 0.000000 | n/a | 0.000000 | n/a | 0.042987 | 1977 |
| Total Inhalation + Dermal Exposure (Occ. + App.) | n/a | n/a | n/a | 410 | n/a | 240 | n/a | 120 |
| Total Dermal Exposure (Occ.+ App.) | 0.038601 | 2202 | 0.199653 | 426 | 0.310617 | 274 | 0.438402 | 194 |

==========

## Toddler Single Day (Randomly Selected) Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf short-term.AGM
No dietary analysis
Exposure analysis for non-specific day (contact dates throughout year)
Analysis Date 08-23-2000:09:34:27 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 100 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

==========

Total Occupant Dermal + Oral Exposure

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 39.19%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 4100 | 10.00 | n/a | 220 |
| 80.00 | n/a | 2200 | 5.00 | n/a | 170 |
| 70.00 | n/a | 1400 | 2.50 | n/a | 140 |
| 60.00 | n/a | 1000 | 1.00 | n/a | 120 |
| 50.00 | n/a | 730 | 0.50 | n/a | 110 |
| 40.00 | n/a | 550 | 0.25 | n/a | 100 |
| 30.00 | n/a | 420 | 0.10 | n/a | 91 |
| 20.00 | n/a | 310 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | 370 |
| 80.00 | n/a | n/a | 5.00 | n/a | 250 |
| 70.00 | n/a | n/a | 2.50 | n/a | 190 |
| 60.00 | n/a | n/a | 1.00 | n/a | 140 |
| 50.00 | n/a | n/a | 0.50 | n/a | 130 |
| 40.00 | n/a | n/a | 0.25 | n/a | 110 |
| 30.00 | n/a | 1800 | 0.10 | n/a | 100 |
| 20.00 | n/a | 760 | | | |

==========

Occupant Inhalation Exposure
No exposure

==========

## Toddler Single Day (Randomly Selected) Exposures

Occupant Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.054849 | 0.139966 |
| Standard Deviation | 0.113843 | 0.145462 |
| Margin of Exposure | 1550 | 607 |

Percent of Person-Days that are User-Days = 39.19%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.008460 | 10047 | 10.00 | 0.342038 | 249 |
| 80.00 | 0.019787 | 4296 | 5.00 | 0.435991 | 195 |
| 70.00 | 0.036913 | 2303 | 2.50 | 0.528687 | 161 |
| 60.00 | 0.061443 | 1383 | 1.00 | 0.632438 | 134 |
| 50.00 | 0.092486 | 919 | 0.50 | 0.705074 | 121 |
| 40.00 | 0.130457 | 652 | 0.25 | 0.781200 | 109 |
| 30.00 | 0.176830 | 481 | 0.10 | 0.862279 | 99 |
| 20.00 | 0.241245 | 352 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.202658 | 419 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.308003 | 276 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.403931 | 210 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.525480 | 162 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.604631 | 141 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.681088 | 125 |
| 30.00 | 0.025090 | 3388 | 0.10 | 0.779506 | 109 |
| 20.00 | 0.088873 | 956 | | | |

## Toddler Single Day (Randomly Selected) Exposures

Occupant Oral/GI Exposure (non-dietary)

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.002119 | 0.005406 |
| Standard Deviation | 0.004385 | 0.005594 |
| Margin of Exposure | 9440 | 3699 |

Percent of Person-Days that are User-Days = 39.19%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000336 | 59549 | 10.00 | 0.013239 | 1511 |
| 80.00 | 0.000783 | 25537 | 5.00 | 0.016896 | 1184 |
| 70.00 | 0.001446 | 13833 | 2.50 | 0.020183 | 991 |
| 60.00 | 0.002431 | 8226 | 1.00 | 0.024364 | 821 |
| 50.00 | 0.003611 | 5539 | 0.50 | 0.027206 | 735 |
| 40.00 | 0.005036 | 3972 | 0.25 | 0.030101 | 664 |
| 30.00 | 0.006822 | 2932 | 0.10 | 0.033410 | 599 |
| 20.00 | 0.009269 | 2158 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.007832 | 2554 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.011837 | 1690 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.015676 | 1276 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.020093 | 995 |
| 50.00 | 0.000000 | n/a | 0.50 | 0.023253 | 860 |
| 40.00 | 0.000000 | n/a | 0.25 | 0.026206 | 763 |
| 30.00 | 0.000973 | 20559 | 0.10 | 0.030052 | 666 |
| 20.00 | 0.003482 | 5743 | | | |

Dietary Exposure
No exposure

## Toddler Single Day (Randomly Selected) Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf short-term.AGM
No dietary analysis
Exposure analysis for non-specific day (contact dates throughout year)
Analysis Date 08-23-2000:09:34:28 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 100 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Total Occupant Dermal + Oral Exposure** | | | | | | | |
| n/a | n/a | n/a | 250 | n/a | 140 | n/a | 100 |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.054849 | 1550 | 0.308003 | 276 | 0.525480 | 162 | 0.779506 | 109 |
| **Occupant Oral/GI Exposure (non-dietary)** | | | | | | | |
| 0.002119 | 9440 | 0.011837 | 1690 | 0.020093 | 995 | 0.030052 | 666 |

==========
==========

## Adult Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 18 (of 52)
Analysis Date 08-23-2000:09:50:45 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| Occupant Dermal Exposure | | | | | | | |
| 0.045746 | 1858 | 0.079183 | 1073 | 0.095803 | 887 | 0.116874 | 727 |
| Total Applicator Inhalation + Dermal Exposure | | | | | | | |
| n/a | n/a | n/a | 5200 | n/a | 4000 | n/a | 3100 |
| Applicator Inhalation Exposure | | | | | | | |
| 0.001163 | 17192 | 0.003519 | 5684 | 0.004648 | 4303 | 0.005945 | 3364 |
| Applicator Dermal Exposure | | | | | | | |
| 0.000554 | 153395 | 0.001676 | 50705 | 0.002218 | 38320 | 0.002806 | 30287 |
| Total Inhalation + Dermal Exposure (Occ. + App.) | | | | | | | |
| n/a | n/a | n/a | 970 | n/a | 800 | n/a | 660 |
| Total Dermal Exposure (Occ.+ App.) | | | | | | | |
| 0.046300 | 1836 | 0.079868 | 1064 | 0.096575 | 880 | 0.117878 | 721 |

==========
==========

## Adult Four-Week Period Exposures

Population parameters: Adults (18+)  All Seasons
All Regions  Sex: M F-all
All Races

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 22 (of 52)
Analysis Date 08-23-2000:10:08:32 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+)  All Seasons
All Regions  Sex: M F-all
All Races

Summary calculations (per capita):

| Mean Exposure | MOE | 95th Percentile Exposure | MOE | 99th Percentile Exposure | MOE | 99.9th Percentile Exposure | MOE |
|---|---|---|---|---|---|---|---|
| **Occupant Dermal Exposure** | | | | | | | |
| 0.050411 | 1686 | 0.084865 | 1002 | 0.102609 | 828 | 0.123417 | 689 |
| **Total Applicator Inhalation + Dermal Exposure** | | | | | | | |
| n/a | n/a | n/a | 5200 | n/a | 4000 | n/a | 3100 |
| **Applicator Inhalation Exposure** | | | | | | | |
| 0.001157 | 17280 | 0.003521 | 5681 | 0.004691 | 4264 | 0.005957 | 3358 |
| **Applicator Dermal Exposure** | | | | | | | |
| 0.000552 | 153851 | 0.001681 | 50551 | 0.002220 | 38291 | 0.002818 | 30168 |
| **Total Inhalation + Dermal Exposure (Occ. + App.)** | | | | | | | |
| n/a | n/a | n/a | 910 | n/a | 750 | n/a | 620 |
| **Total Dermal Exposure (Occ.+ App.)** | | | | | | | |
| 0.050964 | 1668 | 0.085530 | 994 | 0.103439 | 822 | 0.123928 | 686 |

==========
==========

## Adult Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 26 (of 52)
Analysis Date 08-23-2000:10:26:36 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.050411 | 1686 | 0.084865 | 1002 | 0.102609 | 828 | 0.123417 | 689 |
| **Total Applicator Inhalation + Dermal Exposure** | | | | | | | |
| n/a | n/a | n/a | 5200 | n/a | 4000 | n/a | 3100 |
| **Applicator Inhalation Exposure** | | | | | | | |
| 0.001157 | 17280 | 0.003521 | 5681 | 0.004691 | 4264 | 0.005957 | 3358 |
| **Applicator Dermal Exposure** | | | | | | | |
| 0.000552 | 153851 | 0.001681 | 50551 | 0.002220 | 38291 | 0.002818 | 30168 |
| **Total Inhalation + Dermal Exposure (Occ. + App.)** | | | | | | | |
| n/a | n/a | n/a | 910 | n/a | 750 | n/a | 620 |
| **Total Dermal Exposure (Occ.+ App.)** | | | | | | | |
| 0.050964 | 1668 | 0.085530 | 994 | 0.103439 | 822 | 0.123928 | 686 |

==========
==========

## Adult Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 30 (of 52)
Analysis Date 08-23-2000:10:44:40 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.050411 | 1686 | 0.084865 | 1002 | 0.102609 | 828 | 0.123417 | 689 |
| **Total Applicator Inhalation + Dermal Exposure** | | | | | | | |
| n/a | n/a | n/a | 5200 | n/a | 4000 | n/a | 3100 |
| **Applicator Inhalation Exposure** | | | | | | | |
| 0.001157 | 17280 | 0.003521 | 5681 | 0.004691 | 4264 | 0.005957 | 3358 |
| **Applicator Dermal Exposure** | | | | | | | |
| 0.000552 | 153851 | 0.001681 | 50551 | 0.002220 | 38291 | 0.002818 | 30168 |
| **Total Inhalation + Dermal Exposure (Occ. + App.)** | | | | | | | |
| n/a | n/a | n/a | 910 | n/a | 750 | n/a | 620 |
| **Total Dermal Exposure (Occ.+ App.)** | | | | | | | |
| 0.050964 | 1668 | 0.085530 | 994 | 0.103439 | 822 | 0.123928 | 686 |

==========
==========

## Adult Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 34 (of 52)
Analysis Date 08-23-2000:10:57:51 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.050411 | 1686 | 0.084865 | 1002 | 0.102609 | 828 | 0.123417 | 689 |
| **Total Applicator Inhalation + Dermal Exposure** | | | | | | | |
| n/a | n/a | n/a | 5200 | n/a | 4000 | n/a | 3100 |
| **Applicator Inhalation Exposure** | | | | | | | |
| 0.001157 | 17280 | 0.003521 | 5681 | 0.004691 | 4264 | 0.005957 | 3358 |
| **Applicator Dermal Exposure** | | | | | | | |
| 0.000552 | 153851 | 0.001681 | 50551 | 0.002220 | 38291 | 0.002818 | 30168 |
| **Total Inhalation + Dermal Exposure (Occ. + App.)** | | | | | | | |
| n/a | n/a | n/a | 910 | n/a | 750 | n/a | 620 |
| **Total Dermal Exposure (Occ.+ App.)** | | | | | | | |
| 0.050964 | 1668 | 0.085530 | 994 | 0.103439 | 822 | 0.123928 | 686 |

# Adult Four-Week Period Exposures
# (Summary Plot File)

Novigen Sciences ver. 4.04
CALENDEX Summary for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 consecutive contact weeks; sequential series: weeks 18 to 37 (of 52)
Analysis Date 08-23-2000:09:50:45 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10

---

Week Total Occupant Inhalation + Dermal Exposure

| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 0.024571 | 0.03417 | 0.043318 | 0.053532 | 0.070516 | 0.079183 | 0.086783 | 0.095803 | 0.102954 | 0.116874 |
| 22 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 26 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 30 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 34 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |

Week Occupant Inhalation Exposure

| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Week Occupant Dermal Exposure

| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 0.024571 | 0.03417 | 0.043318 | 0.053532 | 0.070516 | 0.079183 | 0.086783 | 0.095803 | 0.102954 | 0.116874 |
| 22 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 26 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 30 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |
| 34 | 0.028421 | 0.03864 | 0.047893 | 0.05853 | 0.076074 | 0.084865 | 0.092732 | 0.102609 | 0.109089 | 0.123417 |

Week Occupant Oral/GI Exposure (non-dietary)

| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Toddler Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 18 (of 52)
Analysis Date 08-23-2000:11:02:19 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean Exposure | Mean MOE | 95th Percentile Exposure | 95th Percentile MOE | 99th Percentile Exposure | 99th Percentile MOE | 99.9th Percentile Exposure | 99.9th Percentile MOE |
|---|---|---|---|---|---|---|---|
| Total Occupant Dermal + Oral Exposure | | | | | | | |
| n/a | n/a | n/a | 570 | n/a | 470 | n/a | 380 |
| Occupant Dermal Exposure | | | | | | | |
| 0.067636 | 1257 | 0.119546 | 711 | 0.146145 | 582 | 0.180217 | 472 |
| Occupant Oral/GI Exposure (non-dietary) | | | | | | | |
| 0.005213 | 3836 | 0.009154 | 2185 | 0.011152 | 1793 | 0.013980 | 1431 |

==========
==========

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 22 (of 52)
Analysis Date 08-23-2000:11:04:13 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean Exposure | Mean MOE | 95th Percentile Exposure | 95th Percentile MOE | 99th Percentile Exposure | 99th Percentile MOE | 99.9th Percentile Exposure | 99.9th Percentile MOE |
|---|---|---|---|---|---|---|---|
| Total Occupant Dermal + Oral Exposure | | | | | | | |
| n/a | n/a | n/a | 530 | n/a | 440 | n/a | 370 |
| Occupant Dermal Exposure | | | | | | | |
| 0.074694 | 1138 | 0.126976 | 669 | 0.156434 | 543 | 0.193359 | 440 |
| Occupant Oral/GI Exposure (non-dietary) | | | | | | | |
| 0.005764 | 3470 | 0.009826 | 2035 | 0.011908 | 1680 | 0.014641 | 1366 |

==========

## Toddler Four-Week Period Exposures

```
Novigen Sciences                                                    ver. 4.04
CALENDEX Analysis for CHEMICAL X                                 CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 26 (of 52)
Analysis Date 08-23-2000:11:06:06     Exposure amounts adjusted for body weight
NOEL Oral = 20   Inhalation = 20   Dermal = 85  mg/kg bw/day
Est'd max exposure: Oral = 100   Inhalation = 100   Dermal = 100  mg/kg bw/day
MC iterations = 10   MC seed=  10
Analyst Comments:

--------------------------------------------------------------------------------
Population parameters: Children 1-3  All Seasons
All Regions  Sex: M F-all
All Races

Summary calculations (per capita):

       Mean            95th Percentile      99th Percentile     99.9th Percentile
  Exposure    MOE      Exposure     MOE     Exposure     MOE     Exposure     MOE
 ---------- --------- ---------- --------- ---------- --------- ---------- ---------
Total Occupant Dermal + Oral Exposure
    n/a         n/a      n/a           530    n/a           440    n/a           370

Occupant Dermal Exposure
   0.074694      1138   0.126976       669   0.156434       543   0.193359       440

Occupant Oral/GI Exposure (non-dietary)
   0.005764      3470   0.009826      2035   0.011908      1680   0.014641      1366


================================================================================
================================================================================

Novigen Sciences                                                    ver. 4.04
CALENDEX Analysis for CHEMICAL X                                 CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 30 (of 52)
Analysis Date 08-23-2000:11:08:01     Exposure amounts adjusted for body weight
NOEL Oral = 20   Inhalation = 20   Dermal = 85  mg/kg bw/day
Est'd max exposure: Oral = 100   Inhalation = 100   Dermal = 100  mg/kg bw/day
MC iterations = 10   MC seed=  10
Analyst Comments:

--------------------------------------------------------------------------------
Population parameters: Children 1-3  All Seasons
All Regions  Sex: M F-all
All Races

Summary calculations (per capita):

       Mean            95th Percentile      99th Percentile     99.9th Percentile
  Exposure    MOE      Exposure     MOE     Exposure     MOE     Exposure     MOE
 ---------- --------- ---------- --------- ---------- --------- ---------- ---------
Total Occupant Dermal + Oral Exposure
    n/a         n/a      n/a           530    n/a           440    n/a           370

Occupant Dermal Exposure
   0.074694      1138   0.126976       669   0.156434       543   0.193359       440

Occupant Oral/GI Exposure (non-dietary)
   0.005764      3470   0.009826      2035   0.011908      1680   0.014641      1366


================================================================================
================================================================================
```

## Toddler Four-Week Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 combined contact weeks: starting week 34 (of 52)
Analysis Date 08-23-2000:11:09:56 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Total Occupant Dermal + Oral Exposure** | | | | | | | |
| n/a | n/a | n/a | 530 | n/a | 440 | n/a | 370 |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.074694 | 1138 | 0.126976 | 669 | 0.156434 | 543 | 0.193359 | 440 |
| **Occupant Oral/GI Exposure (non-dietary)** | | | | | | | |
| 0.005764 | 3470 | 0.009826 | 2035 | 0.011908 | 1680 | 0.014641 | 1366 |

==========

# Toddler Four-Week Period Exposures
# (Summary Plot File)

Novigen Sciences ver. 4.04
CALENDEX Summary for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 4 consecutive contact weeks; sequential series: weeks 18 to 37 (of 52)
Analysis Date 08-23-2000:11:02:19 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10

---

| Week | Total Occupant Dermal + Oral Exposure | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
| 18 | 0.040086 | 0.054966 | 0.06839 | 0.084704 | 0.111798 | 0.126109 | 0.138081 | 0.153722 | 0.163904 | 0.190861 |
| 22 | 0.04663 | 0.062453 | 0.076416 | 0.092499 | 0.120056 | 0.134145 | 0.147621 | 0.16443 | 0.174978 | 0.202259 |
| 26 | 0.04663 | 0.062453 | 0.076416 | 0.092499 | 0.120056 | 0.134145 | 0.147621 | 0.16443 | 0.174978 | 0.202259 |
| 30 | 0.04663 | 0.062453 | 0.076416 | 0.092499 | 0.120056 | 0.134145 | 0.147621 | 0.16443 | 0.174978 | 0.202259 |
| 34 | 0.04663 | 0.062453 | 0.076416 | 0.092499 | 0.120056 | 0.134145 | 0.147621 | 0.16443 | 0.174978 | 0.202259 |

| Week | Occupant Inhalation Exposure | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Week | Occupant Dermal Exposure | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
| 18 | 0.035719 | 0.049966 | 0.063278 | 0.079152 | 0.105596 | 0.119546 | 0.131053 | 0.146145 | 0.156494 | 0.180217 |
| 22 | 0.041915 | 0.056806 | 0.070695 | 0.0865 | 0.113426 | 0.126976 | 0.13978 | 0.156434 | 0.166567 | 0.193359 |
| 26 | 0.041915 | 0.056806 | 0.070695 | 0.0865 | 0.113426 | 0.126976 | 0.13978 | 0.156434 | 0.166567 | 0.193359 |
| 30 | 0.041915 | 0.056806 | 0.070695 | 0.0865 | 0.113426 | 0.126976 | 0.13978 | 0.156434 | 0.166567 | 0.193359 |
| 34 | 0.041915 | 0.056806 | 0.070695 | 0.0865 | 0.113426 | 0.126976 | 0.13978 | 0.156434 | 0.166567 | 0.193359 |

**Toddler Four-Week Period Exposures**
**(Summary Plot File)**

| Week | Occupant Oral/GI Exposure (non-dietary) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | 10 | 30 | 50 | 70 | 90 | 95 | 97.5 | 99 | 99.5 | 99.9 |
| 18 | 0.002763 | 0.003854 | 0.004917 | 0.006091 | 0.008099 | 0.009154 | 0.010066 | 0.011152 | 0.011961 | 0.01398 |
| 22 | 0.003237 | 0.004387 | 0.00544 | 0.006659 | 0.00877 | 0.009826 | 0.010753 | 0.011908 | 0.012691 | 0.014641 |
| 26 | 0.003237 | 0.004387 | 0.00544 | 0.006659 | 0.00877 | 0.009826 | 0.010753 | 0.011908 | 0.012691 | 0.014641 |
| 30 | 0.003237 | 0.004387 | 0.00544 | 0.006659 | 0.00877 | 0.009826 | 0.010753 | 0.011908 | 0.012691 | 0.014641 |
| 34 | 0.003237 | 0.004387 | 0.00544 | 0.006659 | 0.00877 | 0.009826 | 0.010753 | 0.011908 | 0.012691 | 0.014641 |

## Adult One-Year Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 52 combined weeks: starting week 1 (of 52)
Analysis Date 08-23-2000:14:25:45 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

==========

Occupant Inhalation Exposure
No exposure

==========

Occupant Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.019402 | 0.019402 |
| Standard Deviation | 0.005112 | 0.005112 |
| Margin of Exposure | 4381 | 4381 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.013329 | 6377 | 10.00 | 0.026235 | 3240 |
| 80.00 | 0.015014 | 5662 | 5.00 | 0.028735 | 2958 |
| 70.00 | 0.016356 | 5197 | 2.50 | 0.030911 | 2750 |
| 60.00 | 0.017614 | 4826 | 1.00 | 0.033536 | 2535 |
| 50.00 | 0.018839 | 4512 | 0.50 | 0.035274 | 2410 |
| 40.00 | 0.020142 | 4220 | 0.25 | 0.037161 | 2287 |
| 30.00 | 0.021637 | 3928 | 0.10 | 0.039144 | 2171 |
| 20.00 | 0.023496 | 3618 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.013329 | 6377 | 10.00 | 0.026235 | 3240 |
| 80.00 | 0.015014 | 5662 | 5.00 | 0.028735 | 2958 |
| 70.00 | 0.016356 | 5197 | 2.50 | 0.030911 | 2750 |
| 60.00 | 0.017614 | 4826 | 1.00 | 0.033536 | 2535 |
| 50.00 | 0.018839 | 4512 | 0.50 | 0.035274 | 2410 |
| 40.00 | 0.020142 | 4220 | 0.25 | 0.037161 | 2287 |
| 30.00 | 0.021637 | 3928 | 0.10 | 0.039144 | 2171 |
| 20.00 | 0.023496 | 3618 | | | |

==========

Occupant Oral/GI Exposure (non-dietary)
No exposure

==========

Dietary Exposure
No exposure

==========

## Adult One-Year Period Exposures

Total Applicator Inhalation + Dermal Exposure

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | 18000 |
| 80.00 | n/a | n/a | 5.00 | n/a | 16000 |
| 70.00 | n/a | n/a | 2.50 | n/a | 15000 |
| 60.00 | n/a | n/a | 1.00 | n/a | 13000 |
| 50.00 | n/a | 33000 | 0.50 | n/a | 12000 |
| 40.00 | n/a | 28000 | 0.25 | n/a | 12000 |
| 30.00 | n/a | 24000 | 0.10 | n/a | 11000 |
| 20.00 | n/a | 21000 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | n/a | 10.00 | n/a | 18000 |
| 80.00 | n/a | n/a | 5.00 | n/a | 16000 |
| 70.00 | n/a | n/a | 2.50 | n/a | 15000 |
| 60.00 | n/a | n/a | 1.00 | n/a | 13000 |
| 50.00 | n/a | 33000 | 0.50 | n/a | 12000 |
| 40.00 | n/a | 28000 | 0.25 | n/a | 12000 |
| 30.00 | n/a | 24000 | 0.10 | n/a | 11000 |
| 20.00 | n/a | 21000 | | | |

## Adult One-Year Period Exposures

Applicator Inhalation Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.000446 | 0.000446 |
| Standard Deviation | 0.000410 | 0.000410 |
| Margin of Exposure | 44796 | 44796 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000967 | 20680 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.001092 | 18321 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.001203 | 16632 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.001336 | 14974 |
| 50.00 | 0.000527 | 37936 | 0.50 | 0.001428 | 14003 |
| 40.00 | 0.000628 | 31851 | 0.25 | 0.001517 | 13186 |
| 30.00 | 0.000720 | 27782 | 0.10 | 0.001634 | 12239 |
| 20.00 | 0.000821 | 24349 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000967 | 20680 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.001092 | 18321 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.001203 | 16632 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.001336 | 14974 |
| 50.00 | 0.000527 | 37936 | 0.50 | 0.001428 | 14003 |
| 40.00 | 0.000628 | 31851 | 0.25 | 0.001517 | 13186 |
| 30.00 | 0.000720 | 27782 | 0.10 | 0.001634 | 12239 |
| 20.00 | 0.000821 | 24349 | | | |

## Adult One-Year Period Exposures

Applicator Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.000213 | 0.000213 |
| Standard Deviation | 0.000195 | 0.000195 |
| Margin of Exposure | 399597 | 399597 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000461 | 184566 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000520 | 163577 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000573 | 148426 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.000634 | 133985 |
| 50.00 | 0.000252 | 337334 | 0.50 | 0.000680 | 124924 |
| 40.00 | 0.000299 | 284153 | 0.25 | 0.000724 | 117437 |
| 30.00 | 0.000343 | 247847 | 0.10 | 0.000779 | 109161 |
| 20.00 | 0.000392 | 217052 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.000000 | n/a | 10.00 | 0.000461 | 184566 |
| 80.00 | 0.000000 | n/a | 5.00 | 0.000520 | 163577 |
| 70.00 | 0.000000 | n/a | 2.50 | 0.000573 | 148426 |
| 60.00 | 0.000000 | n/a | 1.00 | 0.000634 | 133985 |
| 50.00 | 0.000252 | 337334 | 0.50 | 0.000680 | 124924 |
| 40.00 | 0.000299 | 284153 | 0.25 | 0.000724 | 117437 |
| 30.00 | 0.000343 | 247847 | 0.10 | 0.000779 | 109161 |
| 20.00 | 0.000392 | 217052 | | | |

Applicator Oral/GI Exposure
No exposure

## Adult One-Year Period Exposures

Total Inhalation + Dermal Exposure (Occ. + App.)

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 5800 | 10.00 | n/a | 2900 |
| 80.00 | n/a | 5100 | 5.00 | n/a | 2600 |
| 70.00 | n/a | 4700 | 2.50 | n/a | 2400 |
| 60.00 | n/a | 4300 | 1.00 | n/a | 2200 |
| 50.00 | n/a | 4000 | 0.50 | n/a | 2100 |
| 40.00 | n/a | 3800 | 0.25 | n/a | 2000 |
| 30.00 | n/a | 3500 | 0.10 | n/a | 1900 |
| 20.00 | n/a | 3200 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 5800 | 10.00 | n/a | 2900 |
| 80.00 | n/a | 5100 | 5.00 | n/a | 2600 |
| 70.00 | n/a | 4700 | 2.50 | n/a | 2400 |
| 60.00 | n/a | 4300 | 1.00 | n/a | 2200 |
| 50.00 | n/a | 4000 | 0.50 | n/a | 2100 |
| 40.00 | n/a | 3800 | 0.25 | n/a | 2000 |
| 30.00 | n/a | 3500 | 0.10 | n/a | 1900 |
| 20.00 | n/a | 3200 | | | |

## Adult One-Year Period Exposures

Total Dermal Exposure (Occ.+ App.)

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.019615 | 0.019615 |
| Standard Deviation | 0.005153 | 0.005153 |
| Margin of Exposure | 4333 | 4333 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.013495 | 6299 | 10.00 | 0.026516 | 3206 |
| 80.00 | 0.015199 | 5592 | 5.00 | 0.029019 | 2929 |
| 70.00 | 0.016550 | 5136 | 2.50 | 0.031226 | 2722 |
| 60.00 | 0.017812 | 4772 | 1.00 | 0.033866 | 2510 |
| 50.00 | 0.019048 | 4462 | 0.50 | 0.035652 | 2384 |
| 40.00 | 0.020360 | 4175 | 0.25 | 0.037429 | 2271 |
| 30.00 | 0.021871 | 3886 | 0.10 | 0.039593 | 2147 |
| 20.00 | 0.023743 | 3580 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.013495 | 6299 | 10.00 | 0.026516 | 3206 |
| 80.00 | 0.015199 | 5592 | 5.00 | 0.029019 | 2929 |
| 70.00 | 0.016550 | 5136 | 2.50 | 0.031226 | 2722 |
| 60.00 | 0.017812 | 4772 | 1.00 | 0.033866 | 2510 |
| 50.00 | 0.019048 | 4462 | 0.50 | 0.035652 | 2384 |
| 40.00 | 0.020360 | 4175 | 0.25 | 0.037429 | 2271 |
| 30.00 | 0.021871 | 3886 | 0.10 | 0.039593 | 2147 |
| 20.00 | 0.023743 | 3580 | | | |

==========

## Adult One-Year Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 52 combined weeks: starting week 1 (of 52)
Analysis Date 08-23-2000:14:25:45 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Adults (18+) All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.019402 | 4381 | 0.028735 | 2958 | 0.033536 | 2535 | 0.039144 | 2171 |
| **Total Applicator Inhalation + Dermal Exposure** | | | | | | | |
| n/a | n/a | n/a | 16000 | n/a | 13000 | n/a | 11000 |
| **Applicator Inhalation Exposure** | | | | | | | |
| 0.000446 | 44796 | 0.001092 | 18321 | 0.001336 | 14974 | 0.001634 | 12239 |
| **Applicator Dermal Exposure** | | | | | | | |
| 0.000213 | 399597 | 0.000520 | 163577 | 0.000634 | 133985 | 0.000779 | 109161 |
| **Total Inhalation + Dermal Exposure (Occ. + App.)** | | | | | | | |
| n/a | n/a | n/a | 2600 | n/a | 2200 | n/a | 1900 |
| **Total Dermal Exposure (Occ.+ App.)** | | | | | | | |
| 0.019615 | 4333 | 0.029019 | 2929 | 0.033866 | 2510 | 0.039593 | 2147 |

==========
==========

## Toddler One-Year Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 52 combined weeks: starting week 1 (of 52)
Analysis Date 08-23-2000:18:29:04 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

==========

Total Occupant Dermal + Oral Exposure

Means for combined pathways are not reported when NOEL's are different.

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 3100 | 10.00 | n/a | 1600 |
| 80.00 | n/a | 2800 | 5.00 | n/a | 1500 |
| 70.00 | n/a | 2600 | 2.50 | n/a | 1400 |
| 60.00 | n/a | 2400 | 1.00 | n/a | 1300 |
| 50.00 | n/a | 2300 | 0.50 | n/a | 1200 |
| 40.00 | n/a | 2100 | 0.25 | n/a | 1100 |
| 30.00 | n/a | 2000 | 0.10 | n/a | 1100 |
| 20.00 | n/a | 1800 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | n/a | 3100 | 10.00 | n/a | 1600 |
| 80.00 | n/a | 2800 | 5.00 | n/a | 1500 |
| 70.00 | n/a | 2600 | 2.50 | n/a | 1400 |
| 60.00 | n/a | 2400 | 1.00 | n/a | 1300 |
| 50.00 | n/a | 2300 | 0.50 | n/a | 1200 |
| 40.00 | n/a | 2100 | 0.25 | n/a | 1100 |
| 30.00 | n/a | 2000 | 0.10 | n/a | 1100 |
| 20.00 | n/a | 1800 | | | |

==========

Occupant Inhalation Exposure
No exposure

==========

## Toddler One-Year Period Exposures

Occupant Dermal Exposure

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.028824 | 0.028824 |
| Standard Deviation | 0.007627 | 0.007627 |
| Margin of Exposure | 2949 | 2949 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.019872 | 4277 | 10.00 | 0.039195 | 2169 |
| 80.00 | 0.022251 | 3820 | 5.00 | 0.042874 | 1983 |
| 70.00 | 0.024133 | 3522 | 2.50 | 0.045857 | 1854 |
| 60.00 | 0.025940 | 3277 | 1.00 | 0.049774 | 1708 |
| 50.00 | 0.027861 | 3051 | 0.50 | 0.052735 | 1612 |
| 40.00 | 0.029838 | 2849 | 0.25 | 0.055384 | 1535 |
| 30.00 | 0.032108 | 2647 | 0.10 | 0.059427 | 1430 |
| 20.00 | 0.035071 | 2424 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.019872 | 4277 | 10.00 | 0.039195 | 2169 |
| 80.00 | 0.022251 | 3820 | 5.00 | 0.042874 | 1983 |
| 70.00 | 0.024133 | 3522 | 2.50 | 0.045857 | 1854 |
| 60.00 | 0.025940 | 3277 | 1.00 | 0.049774 | 1708 |
| 50.00 | 0.027861 | 3051 | 0.50 | 0.052735 | 1612 |
| 40.00 | 0.029838 | 2849 | 0.25 | 0.055384 | 1535 |
| 30.00 | 0.032108 | 2647 | 0.10 | 0.059427 | 1430 |
| 20.00 | 0.035071 | 2424 | | | |

## Toddler One-Year Period Exposures

Occupant Oral/GI Exposure (non-dietary)

| | Daily Exposure Analysis (mg/kg body weight/day) per Capita | per User |
|---|---|---|
| Mean | 0.002215 | 0.002215 |
| Standard Deviation | 0.000585 | 0.000585 |
| Margin of Exposure | 9031 | 9031 |

Percent of Person-Days that are User-Days = 100.00%

Estimated percentile of user-days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.001528 | 13088 | 10.00 | 0.003010 | 6643 |
| 80.00 | 0.001719 | 11635 | 5.00 | 0.003275 | 6106 |
| 70.00 | 0.001865 | 10722 | 2.50 | 0.003534 | 5659 |
| 60.00 | 0.001999 | 10006 | 1.00 | 0.003813 | 5246 |
| 50.00 | 0.002137 | 9357 | 0.50 | 0.004047 | 4942 |
| 40.00 | 0.002286 | 8749 | 0.25 | 0.004293 | 4658 |
| 30.00 | 0.002467 | 8108 | 0.10 | 0.004571 | 4376 |
| 20.00 | 0.002689 | 7438 | | | |

Estimated percentile of per-capita days exceeding calculated exposure in mg/kg body wt/day and corresponding Margin of Exposure (MOE)

| Percentile | Exposure | MOE | Percentile | Exposure | MOE |
|---|---|---|---|---|---|
| 90.00 | 0.001528 | 13088 | 10.00 | 0.003010 | 6643 |
| 80.00 | 0.001719 | 11635 | 5.00 | 0.003275 | 6106 |
| 70.00 | 0.001865 | 10722 | 2.50 | 0.003534 | 5659 |
| 60.00 | 0.001999 | 10006 | 1.00 | 0.003813 | 5246 |
| 50.00 | 0.002137 | 9357 | 0.50 | 0.004047 | 4942 |
| 40.00 | 0.002286 | 8749 | 0.25 | 0.004293 | 4658 |
| 30.00 | 0.002467 | 8108 | 0.10 | 0.004571 | 4376 |
| 20.00 | 0.002689 | 7438 | | | |

Dietary Exposure
No exposure

## Toddler One-Year Period Exposures

Novigen Sciences ver. 4.04
CALENDEX Analysis for CHEMICAL X CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 52 combined weeks: starting week 1 (of 52)
Analysis Date 08-23-2000:18:29:04 Exposure amounts adjusted for body weight
NOEL Oral = 20 Inhalation = 20 Dermal = 85 mg/kg bw/day
Est'd max exposure: Oral = 100 Inhalation = 100 Dermal = 100 mg/kg bw/day
MC iterations = 10 MC seed= 10
Analyst Comments:

---

Population parameters: Children 1-3 All Seasons
All Regions Sex: M F-all
All Races

Summary calculations (per capita):

| Mean | | 95th Percentile | | 99th Percentile | | 99.9th Percentile | |
|---|---|---|---|---|---|---|---|
| Exposure | MOE | Exposure | MOE | Exposure | MOE | Exposure | MOE |
| **Total Occupant Dermal + Oral Exposure** | | | | | | | |
| n/a | n/a | n/a | 1500 | n/a | 1300 | n/a | 1100 |
| **Occupant Dermal Exposure** | | | | | | | |
| 0.028824 | 2949 | 0.042874 | 1983 | 0.049774 | 1708 | 0.059427 | 1430 |
| **Occupant Oral/GI Exposure (non-dietary)** | | | | | | | |
| 0.002215 | 9031 | 0.003275 | 6106 | 0.003813 | 5246 | 0.004571 | 4376 |

==========
==========

## Toddler One-Year Period Exposures
## (PLT Plot File)

```
Novigen Sciences                                                    ver. 4.04
CALENDEX Plot File for CHEMICAL X                                CSFII 1994-96
AGM file: C:\examples\Turf intermediate-term.AGM
No dietary analysis
Exposure analysis for 52 combined weeks: starting week 1 (of 52)
Analysis Date 08-23-2000:18:29:04     Exposure amounts adjusted for body weight
NOEL Oral = 20   Inhalation = 20   Dermal = 85  mg/kg bw/day
Est'd max exposure: Oral = 100   Inhalation = 100   Dermal = 100  mg/kg bw/day
MC iterations = 10   MC seed=  10
-------------------------------------------------------------------------------
Population parameters: Children 1-3  All Seasons
All Regions  Sex: M F-all
All Races

Total person days (weighted / unweighted) = 12270  1834
Total user days (weighted / unweighted)   = 12270  1834

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

Lower Bin Range, Upper Bin Range,       1,              2,              3,
     0.00066893,     0.00067562,           0,              0,              4,
     0.00075377,     0.00076131,           0,              0,              4,
     0.00076131,     0.00076892,           0,              0,              6,
     0.00076892,     0.00077661,           0,              0,             13,
     0.00077661,     0.00078438,           0,              0,              6,
     0.00079222,     0.00080014,           0,              0,             11,
     0.00083263,     0.00084096,           0,              0,              8,
     0.00084096,     0.00084937,           0,              0,              8,
     0.00085786,     0.00086644,           0,              0,             15,
     0.00086644,     0.00087510,           0,              0,              5,
     0.00087510,     0.00088385,           0,              0,             32,
     0.00089269,     0.00090162,           0,              0,              5,
     0.00090162,     0.00091064,           0,              0,             30,
     0.00091064,     0.00091974,           0,              0,              6,
     0.00091974,     0.00092894,           0,              0,             18,
     0.00092894,     0.00093823,           0,              0,             25,
     0.00093823,     0.00094761,           0,              0,             15,
     0.00094761,     0.00095709,           0,              0,             24,
     0.00095709,     0.00096666,           0,              0,             19,
     0.00096666,     0.00097633,           0,              0,             27,
     0.00097633,     0.00098609,           0,              0,             18,
     0.00098609,     0.00099595,           0,              0,             54,
     0.00099595,     0.00100591,           0,              0,             46,
     0.00100591,     0.00101597,           0,              0,             33,
     0.00101597,     0.00102613,           0,              0,             20,
     0.00102613,     0.00103639,           0,              0,             53,
     0.00103639,     0.00104675,           0,              0,             66,
     0.00104675,     0.00105722,           0,              0,             18,
     0.00105722,     0.00106779,           0,              0,             59,
     0.00106779,     0.00107847,           0,              0,             84,
     0.00107847,     0.00108926,           0,              0,             21,
     0.00108926,     0.00110015,           0,              0,             64,
     0.00110015,     0.00111115,           0,              0,             56,
     0.00111115,     0.00112226,           0,              0,             84,
     0.00112226,     0.00113348,           0,              0,             76,
     0.00113348,     0.00114482,           0,              0,            115,
     0.00114482,     0.00115627,           0,              0,            154,
     0.00115627,     0.00116783,           0,              0,            153,
     0.00116783,     0.00117951,           0,              0,             98,
     0.00117951,     0.00119130,           0,              0,            144,
     0.00119130,     0.00120322,           0,              0,            116,
     0.00120322,     0.00121525,           0,              0,            177,
     0.00121525,     0.00122740,           0,              0,            306,
```

## Toddler One-Year Period Exposures
## (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.00122740, | 0.00123967, | 0, | 0, | 209, |
| 0.00123967, | 0.00125207, | 0, | 0, | 190, |
| 0.00125207, | 0.00126459, | 0, | 0, | 289, |
| 0.00126459, | 0.00127724, | 0, | 0, | 281, |
| 0.00127724, | 0.00129001, | 0, | 0, | 205, |
| 0.00129001, | 0.00130291, | 0, | 0, | 275, |
| 0.00130291, | 0.00131594, | 0, | 0, | 271, |
| 0.00131594, | 0.00132910, | 0, | 0, | 368, |
| 0.00132910, | 0.00134239, | 0, | 0, | 301, |
| 0.00134239, | 0.00135581, | 0, | 0, | 379, |
| 0.00135581, | 0.00136937, | 0, | 0, | 293, |
| 0.00136937, | 0.00138307, | 0, | 0, | 525, |
| 0.00138307, | 0.00139690, | 0, | 0, | 496, |
| 0.00139690, | 0.00141086, | 0, | 0, | 540, |
| 0.00141086, | 0.00142497, | 0, | 0, | 585, |
| 0.00142497, | 0.00143922, | 0, | 0, | 515, |
| 0.00143922, | 0.00145362, | 0, | 0, | 643, |
| 0.00145362, | 0.00146815, | 0, | 0, | 564, |
| 0.00146815, | 0.00148283, | 0, | 0, | 704, |
| 0.00148283, | 0.00149766, | 0, | 0, | 869, |
| 0.00149766, | 0.00151264, | 0, | 0, | 763, |
| 0.00151264, | 0.00152776, | 0, | 0, | 687, |
| 0.00152776, | 0.00154304, | 0, | 0, | 878, |
| 0.00154304, | 0.00155847, | 0, | 0, | 850, |
| 0.00155847, | 0.00157406, | 0, | 0, | 985, |
| 0.00157406, | 0.00158980, | 0, | 0, | 1096, |
| 0.00158980, | 0.00160570, | 0, | 0, | 1142, |
| 0.00160570, | 0.00162175, | 0, | 0, | 909, |
| 0.00162175, | 0.00163797, | 0, | 0, | 990, |
| 0.00163797, | 0.00165435, | 0, | 0, | 974, |
| 0.00165435, | 0.00167089, | 0, | 0, | 855, |
| 0.00167089, | 0.00168760, | 0, | 0, | 1332, |
| 0.00168760, | 0.00170448, | 0, | 0, | 1182, |
| 0.00170448, | 0.00172152, | 0, | 0, | 1292, |
| 0.00172152, | 0.00173874, | 0, | 0, | 1255, |
| 0.00173874, | 0.00175613, | 0, | 0, | 1426, |
| 0.00175613, | 0.00177369, | 0, | 0, | 1559, |
| 0.00177369, | 0.00179142, | 0, | 0, | 1630, |
| 0.00179142, | 0.00180934, | 0, | 0, | 1461, |
| 0.00180934, | 0.00182743, | 0, | 0, | 1444, |
| 0.00182743, | 0.00184571, | 0, | 0, | 1523, |
| 0.00184571, | 0.00186416, | 0, | 0, | 1675, |
| 0.00186416, | 0.00188280, | 0, | 0, | 1620, |
| 0.00188280, | 0.00190163, | 0, | 0, | 1687, |
| 0.00190163, | 0.00192065, | 0, | 0, | 1612, |
| 0.00192065, | 0.00193986, | 0, | 0, | 1758, |
| 0.00193986, | 0.00195925, | 0, | 0, | 1925, |
| 0.00195925, | 0.00197885, | 0, | 0, | 1712, |
| 0.00197885, | 0.00199864, | 0, | 0, | 2054, |
| 0.00199864, | 0.00201862, | 0, | 0, | 1735, |
| 0.00201862, | 0.00203881, | 0, | 0, | 1798, |
| 0.00203881, | 0.00205920, | 0, | 0, | 1869, |
| 0.00205920, | 0.00207979, | 0, | 0, | 1693, |
| 0.00207979, | 0.00210059, | 0, | 0, | 1939, |
| 0.00210059, | 0.00212159, | 0, | 0, | 1855, |
| 0.00212159, | 0.00214281, | 0, | 0, | 1864, |
| 0.00214281, | 0.00216424, | 0, | 0, | 1981, |
| 0.00216424, | 0.00218588, | 0, | 0, | 1859, |
| 0.00218588, | 0.00220774, | 0, | 0, | 2033, |
| 0.00220774, | 0.00222981, | 0, | 0, | 1717, |

# Toddler One-Year Period Exposures
# (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.00222981, | 0.00225211, | 0, | 0, | 1572, |
| 0.00225211, | 0.00227463, | 0, | 0, | 1734, |
| 0.00227463, | 0.00229738, | 0, | 0, | 1785, |
| 0.00229738, | 0.00232035, | 0, | 0, | 1500, |
| 0.00232035, | 0.00234356, | 0, | 0, | 1555, |
| 0.00234356, | 0.00236699, | 0, | 0, | 1659, |
| 0.00236699, | 0.00239066, | 0, | 0, | 1589, |
| 0.00239066, | 0.00241457, | 0, | 0, | 1662, |
| 0.00241457, | 0.00243871, | 0, | 0, | 1637, |
| 0.00243871, | 0.00246310, | 0, | 0, | 1578, |
| 0.00246310, | 0.00248773, | 0, | 0, | 1427, |
| 0.00248773, | 0.00251261, | 0, | 0, | 1488, |
| 0.00251261, | 0.00253774, | 0, | 0, | 1458, |
| 0.00253774, | 0.00256311, | 0, | 0, | 1532, |
| 0.00256311, | 0.00258874, | 0, | 0, | 1351, |
| 0.00258874, | 0.00261463, | 0, | 0, | 1356, |
| 0.00261463, | 0.00264078, | 0, | 0, | 1365, |
| 0.00264078, | 0.00266719, | 0, | 0, | 1427, |
| 0.00266719, | 0.00269386, | 0, | 0, | 1315, |
| 0.00269386, | 0.00272080, | 0, | 0, | 1320, |
| 0.00272080, | 0.00274800, | 0, | 0, | 1298, |
| 0.00274800, | 0.00277548, | 0, | 0, | 1143, |
| 0.00277548, | 0.00280324, | 0, | 0, | 1115, |
| 0.00280324, | 0.00283127, | 0, | 0, | 1096, |
| 0.00283127, | 0.00285958, | 0, | 0, | 1000, |
| 0.00285958, | 0.00288818, | 0, | 0, | 1158, |
| 0.00288818, | 0.00291706, | 0, | 0, | 949, |
| 0.00291706, | 0.00294623, | 0, | 0, | 1043, |
| 0.00294623, | 0.00297570, | 0, | 0, | 1023, |
| 0.00297570, | 0.00300545, | 0, | 0, | 727, |
| 0.00300545, | 0.00303551, | 0, | 0, | 905, |
| 0.00303551, | 0.00306586, | 0, | 0, | 942, |
| 0.00306586, | 0.00309652, | 0, | 0, | 675, |
| 0.00309652, | 0.00312749, | 0, | 0, | 719, |
| 0.00312749, | 0.00315876, | 0, | 0, | 722, |
| 0.00315876, | 0.00319035, | 0, | 0, | 706, |
| 0.00319035, | 0.00322225, | 0, | 0, | 626, |
| 0.00322225, | 0.00325447, | 0, | 0, | 617, |
| 0.00325447, | 0.00328702, | 0, | 0, | 587, |
| 0.00328702, | 0.00331989, | 0, | 0, | 609, |
| 0.00331989, | 0.00335309, | 0, | 0, | 474, |
| 0.00335309, | 0.00338662, | 0, | 0, | 331, |
| 0.00338662, | 0.00342048, | 0, | 0, | 338, |
| 0.00342048, | 0.00345469, | 0, | 0, | 347, |
| 0.00345469, | 0.00348924, | 0, | 0, | 281, |
| 0.00348924, | 0.00352413, | 0, | 0, | 405, |
| 0.00352413, | 0.00355937, | 0, | 0, | 251, |
| 0.00355937, | 0.00359496, | 0, | 0, | 296, |
| 0.00359496, | 0.00363091, | 0, | 0, | 228, |
| 0.00363091, | 0.00366722, | 0, | 0, | 271, |
| 0.00366722, | 0.00370390, | 0, | 0, | 232, |
| 0.00370390, | 0.00374093, | 0, | 0, | 161, |
| 0.00374093, | 0.00377834, | 0, | 0, | 318, |
| 0.00377834, | 0.00381613, | 0, | 0, | 168, |
| 0.00381613, | 0.00385429, | 0, | 0, | 62, |
| 0.00385429, | 0.00389283, | 0, | 0, | 114, |
| 0.00389283, | 0.00393176, | 0, | 0, | 98, |
| 0.00393176, | 0.00397108, | 0, | 0, | 184, |
| 0.00397108, | 0.00401079, | 0, | 0, | 97, |
| 0.00401079, | 0.00405090, | 0, | 0, | 48, |

# Toddler One-Year Period Exposures
# (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.00405090, | 0.00409140, | 0, | 0, | 75, |
| 0.00409140, | 0.00413232, | 0, | 0, | 59, |
| 0.00413232, | 0.00417364, | 0, | 0, | 60, |
| 0.00417364, | 0.00421538, | 0, | 0, | 40, |
| 0.00421538, | 0.00425753, | 0, | 0, | 37, |
| 0.00425753, | 0.00430011, | 0, | 0, | 37, |
| 0.00430011, | 0.00434311, | 0, | 0, | 20, |
| 0.00434311, | 0.00438654, | 0, | 0, | 16, |
| 0.00438654, | 0.00443040, | 0, | 0, | 11, |
| 0.00443040, | 0.00447471, | 0, | 0, | 45, |
| 0.00447471, | 0.00451946, | 0, | 0, | 27, |
| 0.00451946, | 0.00456465, | 0, | 0, | 55, |
| 0.00456465, | 0.00461030, | 0, | 0, | 33, |
| 0.00461030, | 0.00465640, | 0, | 0, | 8, |
| 0.00465640, | 0.00470296, | 0, | 0, | 5, |
| 0.00470296, | 0.00474999, | 0, | 0, | 6, |
| 0.00474999, | 0.00479749, | 0, | 0, | 5, |
| 0.00479749, | 0.00484547, | 0, | 0, | 7, |
| 0.00489392, | 0.00494286, | 0, | 0, | 18, |
| 0.00494286, | 0.00499229, | 0, | 0, | 4, |
| 0.00504221, | 0.00509264, | 0, | 0, | 14, |
| 0.00514356, | 0.00519500, | 0, | 0, | 8, |
| 0.00519500, | 0.00524695, | 0, | 0, | 12, |
| 0.00621398, | 0.00627612, | 0, | 0, | 7, |
| 0.00880275, | 0.00889077, | 0, | 8, | 0, |
| 0.00906948, | 0.00916017, | 0, | 4, | 0, |
| 0.00916017, | 0.00925178, | 0, | 4, | 0, |
| 0.00962743, | 0.00972371, | 8, | 0, | 0, |
| 0.00972371, | 0.00982095, | 0, | 15, | 0, |
| 0.00991916, | 0.01001835, | 0, | 4, | 0, |
| 0.01001835, | 0.01011853, | 4, | 8, | 0, |
| 0.01011853, | 0.01021972, | 4, | 0, | 0, |
| 0.01032191, | 0.01042513, | 0, | 8, | 0, |
| 0.01042513, | 0.01052938, | 4, | 21, | 0, |
| 0.01063468, | 0.01074102, | 0, | 8, | 0, |
| 0.01084843, | 0.01095692, | 4, | 11, | 0, |
| 0.01095692, | 0.01106649, | 0, | 21, | 0, |
| 0.01106649, | 0.01117715, | 8, | 12, | 0, |
| 0.01117715, | 0.01128892, | 11, | 9, | 0, |
| 0.01128892, | 0.01140181, | 8, | 6, | 0, |
| 0.01140181, | 0.01151583, | 21, | 17, | 0, |
| 0.01151583, | 0.01163099, | 0, | 10, | 0, |
| 0.01163099, | 0.01174730, | 8, | 0, | 0, |
| 0.01174730, | 0.01186477, | 15, | 0, | 0, |
| 0.01186477, | 0.01198342, | 0, | 4, | 0, |
| 0.01198342, | 0.01210325, | 11, | 5, | 0, |
| 0.01210325, | 0.01222429, | 11, | 29, | 0, |
| 0.01222429, | 0.01234653, | 17, | 10, | 0, |
| 0.01234653, | 0.01246999, | 22, | 11, | 0, |
| 0.01246999, | 0.01259470, | 0, | 31, | 0, |
| 0.01259470, | 0.01272064, | 0, | 22, | 0, |
| 0.01272064, | 0.01284785, | 4, | 23, | 0, |
| 0.01284785, | 0.01297633, | 0, | 5, | 0, |
| 0.01297633, | 0.01310609, | 21, | 26, | 0, |
| 0.01310609, | 0.01323715, | 0, | 18, | 0, |
| 0.01323715, | 0.01336952, | 18, | 26, | 0, |
| 0.01336952, | 0.01350322, | 21, | 74, | 0, |
| 0.01350322, | 0.01363825, | 8, | 27, | 0, |
| 0.01363825, | 0.01377463, | 17, | 16, | 0, |
| 0.01377463, | 0.01391238, | 28, | 36, | 0, |

# Toddler One-Year Period Exposures
# (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.01391238, | 0.01405150, | 25, | 80, | 0, |
| 0.01405150, | 0.01419202, | 38, | 34, | 0, |
| 0.01419202, | 0.01433394, | 4, | 77, | 0, |
| 0.01433394, | 0.01447728, | 5, | 114, | 0, |
| 0.01447728, | 0.01462205, | 39, | 110, | 0, |
| 0.01462205, | 0.01476827, | 4, | 48, | 0, |
| 0.01476827, | 0.01491595, | 40, | 65, | 0, |
| 0.01491595, | 0.01506511, | 39, | 145, | 0, |
| 0.01506511, | 0.01521576, | 48, | 134, | 0, |
| 0.01521576, | 0.01536792, | 29, | 123, | 0, |
| 0.01536792, | 0.01552160, | 70, | 140, | 0, |
| 0.01552160, | 0.01567682, | 113, | 188, | 0, |
| 0.01567682, | 0.01583358, | 46, | 144, | 0, |
| 0.01583358, | 0.01599192, | 117, | 144, | 0, |
| 0.01599192, | 0.01615184, | 77, | 138, | 0, |
| 0.01615184, | 0.01631336, | 109, | 170, | 0, |
| 0.01631336, | 0.01647649, | 161, | 240, | 0, |
| 0.01647649, | 0.01664126, | 139, | 230, | 0, |
| 0.01664126, | 0.01680767, | 80, | 240, | 0, |
| 0.01680767, | 0.01697575, | 130, | 193, | 0, |
| 0.01697575, | 0.01714550, | 180, | 189, | 0, |
| 0.01714550, | 0.01731696, | 178, | 340, | 0, |
| 0.01731696, | 0.01749013, | 140, | 342, | 0, |
| 0.01749013, | 0.01766503, | 130, | 367, | 0, |
| 0.01766503, | 0.01784168, | 280, | 541, | 0, |
| 0.01784168, | 0.01802010, | 199, | 419, | 0, |
| 0.01802010, | 0.01820030, | 211, | 646, | 0, |
| 0.01820030, | 0.01838230, | 217, | 470, | 0, |
| 0.01838230, | 0.01856612, | 223, | 623, | 0, |
| 0.01856612, | 0.01875179, | 209, | 616, | 0, |
| 0.01875179, | 0.01893930, | 261, | 697, | 0, |
| 0.01893930, | 0.01912870, | 334, | 748, | 0, |
| 0.01912870, | 0.01931998, | 479, | 685, | 0, |
| 0.01931998, | 0.01951318, | 497, | 609, | 0, |
| 0.01951318, | 0.01970831, | 560, | 985, | 0, |
| 0.01970831, | 0.01990540, | 554, | 849, | 0, |
| 0.01990540, | 0.02010445, | 564, | 899, | 0, |
| 0.02010445, | 0.02030550, | 714, | 880, | 0, |
| 0.02030550, | 0.02050855, | 628, | 875, | 0, |
| 0.02050855, | 0.02071364, | 586, | 1077, | 0, |
| 0.02071364, | 0.02092077, | 651, | 1055, | 0, |
| 0.02092077, | 0.02112998, | 835, | 1108, | 0, |
| 0.02112998, | 0.02134128, | 789, | 1197, | 0, |
| 0.02134128, | 0.02155469, | 975, | 1070, | 0, |
| 0.02155469, | 0.02177024, | 959, | 1180, | 0, |
| 0.02177024, | 0.02198794, | 832, | 1219, | 0, |
| 0.02198794, | 0.02220782, | 1049, | 1286, | 0, |
| 0.02220782, | 0.02242990, | 1069, | 1443, | 0, |
| 0.02242990, | 0.02265420, | 915, | 1405, | 0, |
| 0.02265420, | 0.02288074, | 1248, | 1463, | 0, |
| 0.02288074, | 0.02310955, | 1137, | 1274, | 0, |
| 0.02310955, | 0.02334064, | 1194, | 1496, | 0, |
| 0.02334064, | 0.02357405, | 1144, | 1659, | 0, |
| 0.02357405, | 0.02380979, | 1290, | 1681, | 0, |
| 0.02380979, | 0.02404789, | 1431, | 1602, | 0, |
| 0.02404789, | 0.02428837, | 1495, | 1496, | 0, |
| 0.02428837, | 0.02453125, | 1384, | 1584, | 0, |
| 0.02453125, | 0.02477656, | 1361, | 1642, | 0, |
| 0.02477656, | 0.02502433, | 1477, | 1578, | 0, |
| 0.02502433, | 0.02527457, | 1571, | 1622, | 0, |

# Toddler One-Year Period Exposures
# (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.02527457, | 0.02552732, | 1774, | 1824, | 0, |
| 0.02552732, | 0.02578259, | 1559, | 1920, | 0, |
| 0.02578259, | 0.02604042, | 1674, | 1858, | 0, |
| 0.02604042, | 0.02630082, | 1637, | 1499, | 0, |
| 0.02630082, | 0.02656383, | 1429, | 1706, | 0, |
| 0.02656383, | 0.02682947, | 1653, | 1705, | 0, |
| 0.02682947, | 0.02709776, | 1868, | 1777, | 0, |
| 0.02709776, | 0.02736874, | 1785, | 1878, | 0, |
| 0.02736874, | 0.02764243, | 1857, | 1730, | 0, |
| 0.02764243, | 0.02791885, | 1842, | 1581, | 0, |
| 0.02791885, | 0.02819804, | 1796, | 1833, | 0, |
| 0.02819804, | 0.02848002, | 1586, | 1801, | 0, |
| 0.02848002, | 0.02876482, | 1730, | 1784, | 0, |
| 0.02876482, | 0.02905247, | 1929, | 1693, | 0, |
| 0.02905247, | 0.02934299, | 1736, | 1774, | 0, |
| 0.02934299, | 0.02963642, | 1778, | 1944, | 0, |
| 0.02963642, | 0.02993279, | 1814, | 1628, | 0, |
| 0.02993279, | 0.03023212, | 1826, | 1775, | 0, |
| 0.03023212, | 0.03053444, | 1890, | 1728, | 0, |
| 0.03053444, | 0.03083978, | 1650, | 1812, | 0, |
| 0.03083978, | 0.03114818, | 1855, | 1580, | 0, |
| 0.03114818, | 0.03145966, | 1824, | 1674, | 0, |
| 0.03145966, | 0.03177426, | 1866, | 1654, | 0, |
| 0.03177426, | 0.03209200, | 1632, | 1448, | 0, |
| 0.03209200, | 0.03241292, | 1674, | 1591, | 0, |
| 0.03241292, | 0.03273705, | 1918, | 1299, | 0, |
| 0.03273705, | 0.03306442, | 1808, | 1500, | 0, |
| 0.03306442, | 0.03339506, | 1675, | 1282, | 0, |
| 0.03339506, | 0.03372901, | 1488, | 1428, | 0, |
| 0.03372901, | 0.03406630, | 1559, | 1503, | 0, |
| 0.03406630, | 0.03440697, | 1702, | 1478, | 0, |
| 0.03440697, | 0.03475104, | 1585, | 1295, | 0, |
| 0.03475104, | 0.03509855, | 1423, | 1058, | 0, |
| 0.03509855, | 0.03544953, | 1427, | 1337, | 0, |
| 0.03544953, | 0.03580403, | 1554, | 1267, | 0, |
| 0.03580403, | 0.03616207, | 1358, | 1310, | 0, |
| 0.03616207, | 0.03652369, | 1440, | 1135, | 0, |
| 0.03652369, | 0.03688893, | 1259, | 1044, | 0, |
| 0.03688893, | 0.03725782, | 1289, | 1146, | 0, |
| 0.03725782, | 0.03763039, | 1297, | 999, | 0, |
| 0.03763039, | 0.03800670, | 1414, | 1035, | 0, |
| 0.03800670, | 0.03838677, | 1287, | 1016, | 0, |
| 0.03838677, | 0.03877063, | 1224, | 966, | 0, |
| 0.03877063, | 0.03915834, | 1175, | 849, | 0, |
| 0.03915834, | 0.03954992, | 1361, | 878, | 0, |
| 0.03954992, | 0.03994542, | 1093, | 917, | 0, |
| 0.03994542, | 0.04034488, | 1083, | 700, | 0, |
| 0.04034488, | 0.04074832, | 946, | 632, | 0, |
| 0.04074832, | 0.04115581, | 1052, | 718, | 0, |
| 0.04115581, | 0.04156737, | 861, | 595, | 0, |
| 0.04156737, | 0.04198304, | 1061, | 696, | 0, |
| 0.04198304, | 0.04240287, | 739, | 515, | 0, |
| 0.04240287, | 0.04282690, | 787, | 495, | 0, |
| 0.04282690, | 0.04325517, | 799, | 658, | 0, |
| 0.04325517, | 0.04368772, | 772, | 518, | 0, |
| 0.04368772, | 0.04412460, | 672, | 359, | 0, |
| 0.04412460, | 0.04456584, | 667, | 302, | 0, |
| 0.04456584, | 0.04501150, | 613, | 528, | 0, |
| 0.04501150, | 0.04546162, | 594, | 391, | 0, |
| 0.04546162, | 0.04591623, | 616, | 441, | 0, |

## Toddler One-Year Period Exposures
## (PLT Plot File)

Bin Totals:
Columns:
 1 = Total Occupant Dermal + Oral Exposure
 2 = Occupant Dermal Exposure
 3 = Occupant Oral/GI Exposure (non-dietary)

| Lower Bin Range, | Upper Bin Range, | 1, | 2, | 3, |
|---|---|---|---|---|
| 0.04591623, | 0.04637539, | 588, | 312, | 0, |
| 0.04637539, | 0.04683915, | 396, | 299, | 0, |
| 0.04683915, | 0.04730754, | 351, | 219, | 0, |
| 0.04730754, | 0.04778061, | 387, | 246, | 0, |
| 0.04778061, | 0.04825842, | 459, | 229, | 0, |
| 0.04825842, | 0.04874101, | 544, | 117, | 0, |
| 0.04874101, | 0.04922841, | 314, | 183, | 0, |
| 0.04922841, | 0.04972070, | 335, | 158, | 0, |
| 0.04972070, | 0.05021791, | 225, | 186, | 0, |
| 0.05021791, | 0.05072008, | 233, | 97, | 0, |
| 0.05072008, | 0.05122729, | 288, | 131, | 0, |
| 0.05122729, | 0.05173956, | 196, | 76, | 0, |
| 0.05173956, | 0.05225695, | 124, | 85, | 0, |
| 0.05225695, | 0.05277953, | 155, | 64, | 0, |
| 0.05277953, | 0.05330732, | 162, | 85, | 0, |
| 0.05330732, | 0.05384039, | 189, | 73, | 0, |
| 0.05384039, | 0.05437880, | 117, | 53, | 0, |
| 0.05437880, | 0.05492258, | 51, | 39, | 0, |
| 0.05492258, | 0.05547181, | 92, | 61, | 0, |
| 0.05547181, | 0.05602653, | 72, | 33, | 0, |
| 0.05602653, | 0.05658679, | 75, | 39, | 0, |
| 0.05658679, | 0.05715266, | 80, | 21, | 0, |
| 0.05715266, | 0.05772419, | 51, | 34, | 0, |
| 0.05772419, | 0.05830143, | 15, | 23, | 0, |
| 0.05830143, | 0.05888445, | 69, | 16, | 0, |
| 0.05888445, | 0.05947329, | 53, | 9, | 0, |
| 0.05947329, | 0.06006802, | 44, | 35, | 0, |
| 0.06006802, | 0.06066870, | 43, | 0, | 0, |
| 0.06066870, | 0.06127539, | 19, | 11, | 0, |
| 0.06127539, | 0.06188814, | 24, | 7, | 0, |
| 0.06188814, | 0.06250703, | 18, | 7, | 0, |
| 0.06250703, | 0.06313209, | 16, | 0, | 0, |
| 0.06313209, | 0.06376342, | 16, | 12, | 0, |
| 0.06376342, | 0.06440105, | 14, | 0, | 0, |
| 0.06440105, | 0.06504506, | 9, | 7, | 0, |
| 0.06504506, | 0.06569551, | 2, | 0, | 0, |
| 0.06569551, | 0.06635246, | 14, | 10, | 0, |
| 0.06635246, | 0.06701599, | 5, | 5, | 0, |
| 0.06768615, | 0.06836301, | 7, | 7, | 0, |
| 0.06904664, | 0.06973711, | 7, | 0, | 0, |
| 0.06973711, | 0.07043448, | 6, | 14, | 0, |
| 0.07043448, | 0.07113882, | 9, | 0, | 0, |
| 0.07256871, | 0.07329440, | 7, | 0, | 0, |
| 0.07402734, | 0.07476762, | 9, | 0, | 0, |
| 0.07476762, | 0.07551529, | 5, | 7, | 0, |
| 0.08096262, | 0.08177225, | 7, | 0, | 0, |
| Exceeds max bin | | 0, | 0, | 0, |

# Appendix C

## Validation of Monte Carlo Technique Used in Calendex™

**Data:**

**Parameters Used in QA Analyses**

| | | Scenario | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G |
| **Dermal (Adults and Toddlers)** | | | | | | | | |
| Application Rate (mg/day)[1] | AR | 30 | 30 | Uniform 15 -120 | 30 | -- | -- | Uniform 15 -120 |
| Fraction of ai available on pet (%) | F | 20 | 20 | 20 | 20 | -- | -- | 20 |
| Fraction of residue transferred to skin (%) | T | 10 | 10 | 10 | Lognormal; mean =0.1 and std = 0.1 | -- | -- | Lognormal; mean =0.1 and std = 0.1 |
| Body weight (kg) | BW | -- | CSFII | CSFII | CSFII | -- | -- | CSFII |
| **Incidental Ingestion (Toddlers only)** | | | | | | | | |
| Application Rate (mg/day)[1] | AR | 30 | 30 | Uniform 15 -120 | 30 | 30 | 30 | Uniform 15 -120 |
| Fraction of ai available on pet (%) | F | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Surface area on pet ($cm^2$) | SApet | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 | 6000 |
| Surface area of fingers ($cm^2$/event) | SA | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Frequency of hand-to-mouth activity (event/hr) | FQ | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Exposure time (hr/day) | ET | 2 | 2 | 2 | 2 | Cumulative Distribution[2] | 2 | Cumulative Distribution |
| Saliva extraction (%) | SE | 50 | 50 | 50 | 50 | 50 | Triangular (25, 50, 75) | Triangular (25, 50, 75) |
| Body weight (kg) | BW | -- | CSFII | CSFII | CSFII | CSFII | CSFII | CSFII |

1 For the 7 day exposure period, the residue (application rate) was assumed to dissipate 10% each day

2 The cumulative distribution is from the Exposure Factors Handbook for the amount of time spent in animal care per day

## Results:

**Day 0**
**Scenario A**
**Distributions: none**

| Adults | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.6 | 0.6 |

| Toddlers | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.6 | 0.6 |

| Toddlers | |
|---|---|
| Oral Exposure (mg/day) | |
| Excel | Calendex |
| 0.4 | 0.4 |

**Day 0**
**Scenario B**
**Distributions: BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.014634 | 0.014622 |
| 99 | 0.013333 | 0.013308 |
| 95 | 0.011765 | 0.011698 |
| 90 | 0.010909 | 0.010916 |
| 50 | 0.008108 | 0.008159 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.075000 | 0.085592 |
| 99 | 0.075000 | 0.075018 |
| 95 | 0.060000 | 0.060069 |
| 90 | 0.060000 | 0.059755 |
| 50 | 0.042857 | 0.042725 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.050000 | 0.056919 |
| 99 | 0.050000 | 0.049888 |
| 95 | 0.040000 | 0.039946 |
| 90 | 0.040000 | 0.039737 |
| 50 | 0.028571 | 0.028696 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 58 | 58 |
| 99 | 67 | 66 |
| 95 | 83 | 83 |
| 90 | 83 | 83 |
| 50 | 117 | 110 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario C**
**Distributions: AR (uniform 15-120), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.051035 | 0.05122 |
| 99 | 0.043655 | 0.043364 |
| 95 | 0.035654 | 0.036011 |
| 90 | 0.031782 | 0.032039 |
| 50 | 0.017931 | 0.017913 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.283563 | 0.283342 |
| 99 | 0.228859 | 0.232118 |
| 95 | 0.194024 | 0.194875 |
| 90 | 0.171057 | 0.171765 |
| 50 | 0.095456 | 0.096905 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.189042 | 0.187551 |
| 99 | 0.152573 | 0.154423 |
| 95 | 0.129349 | 0.130037 |
| 90 | 0.114038 | 0.114533 |
| 50 | 0.063637 | 0.064697 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 18 | 19 |
| 99 | 22 | 23 |
| 95 | 26 | 28 |
| 90 | 29 | 31 |
| 50 | 52 | 51 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario D**
**Distributions: T (lognormal; mean = 0.1 and std =0.1), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.087454 | 0.081913 |
| 99 | 0.041674 | 0.042563 |
| 95 | 0.023333 | 0.02379 |
| 90 | 0.017696 | 0.017442 |
| 50 | 0.005776 | 0.005767 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.420211 | 0.435296 |
| 99 | 0.225475 | 0.229766 |
| 95 | 0.125248 | 0.127558 |
| 90 | 0.093135 | 0.09351 |
| 50 | 0.030836 | 0.031119 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.057143 | 0.056903 |
| 99 | 0.050000 | 0.049885 |
| 95 | 0.040000 | 0.039946 |
| 90 | 0.040000 | 0.039735 |
| 50 | 0.028571 | 0.028696 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 27 | 27 |
| 99 | 46 | 44 |
| 95 | 65 | 65 |
| 90 | 78 | 76 |
| 50 | 122 | 120 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario E**
**Distributions: ET (cumulative time spent in animal care from EFH), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | -- | -- |
| 99 | -- | -- |
| 95 | -- | -- |
| 90 | -- | -- |
| 50 | -- | -- |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.085714 | 0.085445 |
| 99 | 0.075000 | 0.074872 |
| 95 | 0.060000 | 0.059959 |
| 90 | 0.060000 | 0.059645 |
| 50 | 0.042857 | 0.043076 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.050880 | 0.052162 |
| 99 | 0.043021 | 0.04287 |
| 95 | 0.034730 | 0.03485 |
| 90 | 0.029652 | 0.029955 |
| 50 | 0.014264 | 0.014426 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 65 | 64 |
| 99 | 79 | 78 |
| 95 | 94 | 93 |
| 90 | 108 | 100 |
| 50 | 174 | 170 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario F**
**Distributions: SE (triangular 25, 50, 75), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | -- | -- |
| 99 | -- | -- |
| 95 | -- | -- |
| 90 | -- | -- |
| 50 | -- | -- |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.085714 | 0.085568 |
| 99 | 0.075000 | 0.075014 |
| 95 | 0.060000 | 0.060069 |
| 90 | 0.060000 | 0.059752 |
| 50 | 0.042857 | 0.042725 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.068971 | 0.066296 |
| 99 | 0.054537 | 0.055049 |
| 95 | 0.047032 | 0.046775 |
| 90 | 0.042316 | 0.042365 |
| 50 | 0.028963 | 0.028915 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 53 | 54 |
| 99 | 66 | 65 |
| 95 | 75 | 75 |
| 90 | 82 | 81 |
| 50 | 115 | 110 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Day 0**
**Scenario G**
**Distributions: AR, T, ET, SE, BW**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.303676 | 0.22274 |
| 99 | 0.121379 | 0.111391 |
| 95 | 0.063955 | 0.05865 |
| 90 | 0.044615 | 0.04146 |
| 50 | 0.011724 | 0.011694 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 1.464395 | 1.236918 |
| 99 | 0.570984 | 0.596789 |
| 95 | 0.308506 | 0.31566 |
| 90 | 0.223320 | 0.223158 |
| 50 | 0.062396 | 0.062861 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.188295 | 0.194215 |
| 99 | 0.140361 | 0.141773 |
| 95 | 0.097953 | 0.09873 |
| 90 | 0.078548 | 0.078296 |
| 50 | 0.026373 | 0.025925 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 10 | 10 |
| 99 | 18 | 19 |
| 95 | 28 | 30 |
| 90 | 36 | 37 |
| 50 | 94 | 89 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario A**
**Distributions: none**

| Adults | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.447174 | 0.447143 |

| Toddlers | |
|---|---|
| Dermal Exposure (mg/day) | |
| Excel | Calendex |
| 0.447174 | 0.447143 |

| Toddlers | |
|---|---|
| Oral Exposure (mg/day) | |
| Excel | Calendex |
| 0.298116 | 0.298095 |

**Week 1**
**Scenario B**
**Distributions: BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.010907 | 0.010955 |
| 99 | 0.009937 | 0.009874 |
| 95 | 0.008768 | 0.008765 |
| 90 | 0.008130 | 0.008098 |
| 50 | 0.006043 | 0.006114 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.055897 | 0.063507 |
| 99 | 0.055897 | 0.05565 |
| 95 | 0.044717 | 0.045012 |
| 90 | 0.044717 | 0.044777 |
| 50 | 0.031941 | 0.032017 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.037265 | 0.042655 |
| 99 | 0.037265 | 0.037008 |
| 95 | 0.029812 | 0.029933 |
| 90 | 0.029812 | 0.029777 |
| 50 | 0.021294 | 0.021291 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 78 | 78 |
| 99 | 89 | 89 |
| 95 | 112 | 110 |
| 90 | 112 | 110 |
| 50 | 157 | 150 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario C**
**Distributions: AR (uniform 15-120), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.029214 | 0.029515 |
| 99 | 0.025062 | 0.025062 |
| 95 | 0.021302 | 0.021277 |
| 90 | 0.019416 | 0.01938 |
| 50 | 0.013625 | 0.013575 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.163679 | 0.162282 |
| 99 | 0.133835 | 0.134247 |
| 95 | 0.113693 | 0.114389 |
| 90 | 0.104418 | 0.104424 |
| 50 | 0.072629 | 0.072896 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.109119 | 0.108159 |
| 99 | 0.089223 | 0.089411 |
| 95 | 0.075795 | 0.076216 |
| 90 | 0.069612 | 0.069572 |
| 50 | 0.048419 | 0.048648 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 30 | 32 |
| 99 | 37 | 39 |
| 95 | 44 | 45 |
| 90 | 48 | 49 |
| 50 | 69 | 68 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario D**
**Distributions: T (lognormal; mean = 0.1 and std =0.1), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.022521 | 0.022869 |
| 99 | 0.016739 | 0.015698 |
| 95 | 0.011333 | 0.011501 |
| 90 | 0.009749 | 0.009805 |
| 50 | 0.005696 | 0.00567 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.123739 | 0.123375 |
| 99 | 0.085465 | 0.084683 |
| 95 | 0.061467 | 0.061863 |
| 90 | 0.052556 | 0.052678 |
| 50 | 0.030146 | 0.030522 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.042588 | 0.042669 |
| 99 | 0.037265 | 0.037014 |
| 95 | 0.029812 | 0.029933 |
| 90 | 0.029812 | 0.029776 |
| 50 | 0.021294 | 0.021292 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 60 | 67 |
| 99 | 85 | 85 |
| 95 | 103 | 100 |
| 90 | 112 | 110 |
| 50 | 155 | 150 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario E**
**Distributions: ET (cumulative time spent in animal care from EFH), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | -- | -- |
| 99 | -- | -- |
| 95 | -- | -- |
| 90 | -- | -- |
| 50 | -- | -- |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.063882 | 0.064028 |
| 99 | 0.049686 | 0.055549 |
| 95 | 0.044717 | 0.04493 |
| 90 | 0.044717 | 0.044694 |
| 50 | 0.031941 | 0.031959 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.026242 | 0.027337 |
| 99 | 0.021752 | 0.022332 |
| 95 | 0.018595 | 0.018533 |
| 90 | 0.016700 | 0.016695 |
| 50 | 0.011113 | 0.011139 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 107 | 100 |
| 99 | 133 | 120 |
| 95 | 151 | 150 |
| 90 | 163 | 160 |
| 50 | 228 | 220 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario F**
**Distributions: SE (triangular 25, 50, 75), BW (CSFII)**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | -- | -- |
| 99 | -- | -- |
| 95 | -- | -- |
| 90 | -- | -- |
| 50 | -- | -- |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.063882 | 0.063528 |
| 99 | 0.049686 | 0.055659 |
| 95 | 0.044717 | 0.045012 |
| 90 | 0.044717 | 0.044776 |
| 50 | 0.031941 | 0.032017 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.042378 | 0.043636 |
| 99 | 0.035996 | 0.036335 |
| 95 | 0.031714 | 0.0316 |
| 90 | 0.029625 | 0.02953 |
| 50 | 0.021521 | 0.021548 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 79 | 78 |
| 99 | 94 | 92 |
| 95 | 107 | 100 |
| 90 | 114 | 110 |
| 50 | 155 | 150 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day

**Week 1**
**Scenario G**
**Distributions: AR, T, ET, SE, BW**

| Adults | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.072292 | 0.059538 |
| 99 | 0.039707 | 0.038818 |
| 95 | 0.027693 | 0.027531 |
| 90 | 0.023115 | 0.023055 |
| 50 | 0.012414 | 0.012456 |

| Toddlers | | |
|---|---|---|
| Dermal Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.353411 | 0.317005 |
| 99 | 0.193414 | 0.209771 |
| 95 | 0.145204 | 0.147864 |
| 90 | 0.124186 | 0.123837 |
| 50 | 0.066546 | 0.067161 |

| Toddlers | | |
|---|---|---|
| Oral Exposure (mg/kg/day) | | |
| | CB | Calendex |
| 99.9 | 0.071491 | 0.073122 |
| 99 | 0.058152 | 0.057485 |
| 95 | 0.045128 | 0.045721 |
| 90 | 0.039972 | 0.040192 |
| 50 | 0.024034 | 0.02454 |

| Toddlers | | |
|---|---|---|
| Dermal + Oral MOE | | |
| | CB | Calendex |
| 99.9 | 30 | 34 |
| 99 | 44 | 46 |
| 95 | 58 | 58 |
| 90 | 66 | 66 |
| 50 | 104 | 100 |

Oral NOEL = 5 mg/kg/day; Dermal NOEL = 15 mg/kg/day