Agricultural Health Study

Phase III
Data File Users Manual
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Stanley E. Legum, Ph.D., Editor

Michael C. R. Alavanja, Dr. P.H., NCI Project Officer
Jane Hoppin, Sc.D., NIEHS Project Officer

Phase III Data Working Group

Gabriella Andreotti, Ph.D., M.P.H.
Joe Barker
Michael C. R. Alavanja, Dr. P.H.
Pat Clark
Marsha Dunn, M.P.H.
Laura Beane-Freeman, Ph.D.
Linda Gowen
Jane Hoppin, Sc.D.
Stanley E. Legum, Ph.D.
Stuart Long
Himanshi Singh, MBA

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1. INTRODUCTION

The Agricultural Health Study (AHS) is a collaborative effort involving the National Cancer Institute (NCI), the National Institute of Environmental Health Sciences (NIEHS), and the U.S. Environmental Protection Agency (EPA). The goals are to investigate the effects of environmental, occupational, dietary, and genetic factors on the health of the agricultural population. This study is providing information that agricultural workers can use in making decisions about their health and the health of their families.

The AHS has four major components:

1. The main prospective cohort study of cancer and noncancer outcomes that includes:

   - a. Linkage with cancer registries and vital statistics registries;

   - b. Ongoing data collection (i.e., telephone interview, food frequency questionnaire, and cheek cell collection (buccal cells));

2. Cross-sectional studies that collect (a) questionnaire data, (b) functional measures, (c) biomarkers, and (d) geographic information system (GIS) data;

3. Nested case-control studies; and

4. Exposure assessment and validation studies.

The AHS cohort includes 89,656 private pesticide applicators, spouses of private applicators, and commercial pesticide applicators recruited within Iowa and North Carolina (Table 1-1. Composition of Cohort). Data for the main cohort study have been collected in phases at approximately five year intervals. Phase I, initial cohort recruitment, began in December 1993 and concluded in 1997. Phase II follow up began in 1999 and concluded for private applicators and spouses in 2003. Phase II follow up of commercial applicators started in October 2003 and concluded in October 2005. The Phase III follow up began in November 2005 and concluded in February 2010.

Table 1–1.   Composition of Cohort

Type of Respondent	Number Enrolled
Private Applicators	52,394
Spouses	32,346
Commercial Applicators	4,916
Total	89,656

This study explores potential causes of cancer and other diseases among farmers and their families and among commercial pesticide applicators. Current medical research suggests that, while agricultural workers are generally healthier than the general United States population, they may have higher rates of some cancers, including leukemia, myeloma, non-Hodgkin's lymphoma, and cancers of the lip, stomach, skin, brain, and prostate. Other conditions, such as asthma, neurologic diseases, and adverse reproductive outcomes may also be related to agricultural exposures. The Agricultural Health Study is designed to identify occupational, lifestyle, and genetic factors that may affect the rate of diseases in farming populations.

Iowa and North Carolina were selected for this study based on a nationwide competition. Both states have strong agricultural sectors with diverse production methods, commodities, and products. Information we learn from these two states will be helpful to farmers throughout the United States and other countries using modern agricultural technologies.

Phase I data collection involved administration of questionnaires to pesticide applicators and spouses of private pesticide applicators (i.e., spouses of farmers) to obtain information on pesticide use, other agricultural exposures, work practices that modify exposures, and other activities that may affect either exposure or disease risks (e.g., diet, exercise, alcohol consumption, medical conditions, family history of cancer, other occupations, and smoking history).

Phase II data collection involved administration of a computer-assisted telephone interview (CATI) to cohort members approximately 5 years after their initial enrollment. Following completion of the interview, participants were invited to participate in a collection of buccal (cheek) cells and asked to complete a Diet History Questionnaire. Those who agreed to the buccal cell collection were mailed a kit containing mouthwash, a collection cup, an informed consent form, and a preaddressed, postage-paid mailing envelope. Those who agreed to complete the Diet History Questionnaire were sent a questionnaire and a preaddressed, postage-paid mailing envelope.

Phase III data collection involved administration of a computer-assisted telephone interview (CATI) to cohort members approximately 10 years after their initial enrollment. Additionally, individuals with new diagnoses of specific cancers were invited to participate in a collection of buccal (cheek) cells. Those who agreed to the buccal cell collection were mailed a kit containing mouthwash, a collection cup, an informed consent form, and a preaddressed, postage-paid mailing envelope. Details on the buccal

collection and laboratory procedures and the related Buccal Receipt File are described in the. *Agricultural Health Study Demographic, Registry, and Biospecimen Files Users Manual.*

Cohort members were tracked passively through state vital statistics offices and the National Death Index (NDI) to determine vital status and, in the case of deceased persons, cause of death. They were also tracked through the Iowa and North Carolina cancer registries in order to record all malignant cancers in the cohort that were reported to the registries. Addresses for individuals not known to be dead and not contacted in the previous year were requested from the Internal Revenue Service. This was done to verify that they were alive and to determine whether they had moved out of Iowa and North Carolina so that person years of follow up could be determined.

This manual describes the Phase III data files and provides the basic information that an analyst needs to use them. It includes a brief description of the data collection and editing procedures and usage notes to guide the analyst. Detailed codebooks describing each of the variables and the meanings of the recorded responses are available to qualified researchers. The codebooks also contain frequency distributions for each of the variables. Copies of the questionnaires completed by the participants are available on the Internet at http://aghealth.nci.nih.gov/questionnaires.html. Information on how to obtain access to the data is available at http://aghealth.nci.nih.gov/guidelines.html.

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2. DATA COLLECTION PROCEDURES

2.1 Eligibility

Farmers and commercial applicators who had enrolled in Phase I of the AHS by completing the Phase I Enrollment Questionnaire and had either completed another Phase I questionnaire, participated in any other Phase I or Phase II data collection activity, or had a spouse complete the Phase I Spouse Questionnaire were eligible for the Phase III interviews whether or not they still resided on a farm and whether or not they still participated in agricultural activities. All spouses of private applicators who enrolled during Phase I by completing the Spouse Questionnaire were eligible. Participation in each of the data collection activities was voluntary.

A few cohort members were excluded from the Phase III interviewing and other active data collection activities. These included those who died prior to being contacted for an interview, those who felt too ill to participate, those unable to communicate over the phone, those who requested that they no longer be contacted by the study, those who participated in pilot administrations of the CATI instrument, and those who could not be located. The last group included people for whom no phone number could be found, as well as those with unpublished numbers or blocked lines. No proxy interviews were conducted.

Some individuals died after they were interviewed. Therefore, a researcher should not assume that someone whose ID appears in the Mortality File was excluded from interviewing. The cancer status and vital status of people excluded from the interviews were still tracked passively using the Iowa, North Carolina, and national databases available to the study.

2.2 Main Data Collection

The primary data collection activity during Phase III of the AHS was the administration of CATI interviews. The interviews were conducted between November 2005 and February 2010.

2.2.1 CATI Interviews

The Phase III interviews used the same questionnaire for all respondents, although there was some tailoring of which questions were asked based on gender. The CATI interviews, which were written

in Blaise, were constructed in a modular fashion. The questionnaire contained the following major sections:

- Section 1: Introduction and Update of Residential Information
- Section 2. Farming Operations
- Section 3. General Pesticide Usage
- Section 4. Pesticide Names and Frequency of Use[1]
- Section 5. Application Methods and Personal Protective Equipment (PPE) Use for Most Frequently Applied Pesticides
- Section 6. High Pesticide Exposure Events
- Section 7. Non-Farm Occupation Information
- Section 8. Exposures And Important Confounders
- Section 9. Physical Activity
- Section 10. Sun Exposure
- Section 11. Other Agricultural Exposures
- Section 12. Cardiovascular Conditions
- Section 13. Respiratory Conditions
- Section 14. Diabetes
- Section 15. Thyroid Conditions
- Section 16. Neurological Conditions
- Section 17. Allergic Conditions
- Section 18. Infectious Conditions
- Section 19. Autoimmune Conditions
- Section 20. Eye and Ear Conditions
- Section 21. Head Injury
- Section 22. Arthritis and Osteoporosis
- Section 23. Respiratory Symptoms
- Section 24. Neurological Symptoms
- Section 25. Pesticide Conditions
- Section 26. Family History of Disease
- Section 27. Prostate Health Care
- Section 28. Women's Reproductive Health

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[1] Variables from Section 4 are found in the Supplemental Pesticide File. Note that the Supplemental Pesticide File has a separate record for each unique combination of respondent ID, pesticide name, and application target (animal, crop, or non-crop).

The first section verified the identity and demographic information of the respondent and asked about the source of drinking water, with some follow up questions if the source was a private well or spring. The second section asked if the respondent had been actively engaged in farming in any year since the year of enrollment and, if so, what was the most recent year. This section also asked the respondent to list crops and animals raised on his or her farm and gathered information on key farming activities.

Section 3 asked if the respondent was currently a certified (licensed) pesticide applicator and whether he or she personally mixed, loaded, or applied pesticides. If so, the interviewer asked how many years since the last interview the respondent mixed, loaded, or applied pesticides and the average number of days per year in which he or she did so.

Sections 4 through 6 asked for details about which pesticides were used and the respondent's usage of them. These sections were skipped if the person indicated in Section 3 that he or she did not personally mix, load or apply pesticides. The remaining sections asked about life style factors that could influence a person's health, collected data on a number of specific diseases and health conditions, and asked about family history of disease.

2.2.2 Pesticide Use Sections

Section 4 was designed to collect a comprehensive list of pesticides used by the respondent. This was done by asking the respondent to name each pesticide he or she had personally used on crops. After the list of pesticides used on crops was complete, the interviewer asked the respondent to name the pesticides personally applied to animals or in animal confinement areas. When the animal pesticide list was complete, the interviewer asked the respondent to name pesticides personally applied for other types of applications, such as pastures, fence rows, roadsides, around buildings, grain bins, for rodent control or for applications not already mentioned that were not for home and garden use. The interviewer then said, "I would like to ask about some other commonly used pesticides that you have not mentioned," and proceeded to ask individually about each "A-list pesticide" that the respondent used during Phase II of the study that he or she had not yet mentioned. Up to this point in the questionnaire, the interviewer was able to change a pesticide name or add or delete pesticides from the list if the respondent remembered something not mentioned earlier. Once the next question (Q4.5) was asked, the interviewer could not

change previous responses although he or she could create a comment with the relevant information so that a data editor could correct the file later. The questionnaire was programmed in this manner so that the data used to determine the most frequently used pesticide of each type, which was needed in Section 5 of the questionnaire, was not changed later in the questionnaire.

Question 4.5 was, "Are there any other pesticides that you have used that you have not mentioned, not including pesticides for home and garden use?" If the response was, "Yes," the interviewer then went on to collect the name of any such pesticide and whether it was used on crops, animals, or non-crops. When this question was asked, the interviewer could see a list of A-list pesticides that the respondent had reported using in Phase II that had not yet been reported in the current interview. If the respondent stopped naming pesticides without naming one or more of these previously named chemicals, the interviewer prompted the respondent with the pesticide's name.[2]

Questions 4.6 (variable P3_YRSLIFE) and 4.7 (variable P3_DAYSYRLIFE) were then asked for each of the chemicals named so far in the interview:

Q4.6) You mentioned that you have used **{Pesticide Name}**. For how many years over your lifetime have you personally mixed, loaded, handled, or applied this pesticide?
|__|__| [Range: 1 to 96]
97. INCORRECT PESTICIDE
98. REF
99. DK

Q4.7) During the years you applied **{Pesticide Name}**, for how many days per year on average did you personally mix, load, handle, or apply it?
|__|__|__| [Range: 1 to 365]
998. REF
999. DK

Note that although most farming-related items in the questionnaire ask about the person's experience since the last interview; Question 4.6 asks, "For how many years *over your lifetime* have you personally mixed, loaded, handled, or applied this pesticide?" We have provided two different calculations for total number of lifetime days of use for each pesticide. One is the product of the responses to questions 4.6 and 4.7. We created the second variables to be parallel to the data calculation

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[2] After this point in the questionnaire, if the respondent remembered using another pesticide or wanted to correct previously reported information, the interviewer was able to enter the information in a "parallel track" that captured the fact of the pesticide usage. The interviewer also set a flag with one of the values *DELETE, *CHANGE, or *ADD. These flags and comments entered by the interviewer were later reviewed by Data Management staff at the Coordinating Center.

performed for Phase II. For the second calculation, we multiply the number of days reported in question 4.7 by the number of years since the last interview, and add the result to the total number of usage days for the pesticide reported by the respondent in Phases 1 and 2. This is similar to what was done for the Phase II data set. For example, P3_HRB_A_RPT_LIFE_DAYS_1 is the Phase III reported life days for use of Atrazine based on the responses to Questions 4.6 and 4.7 while P3_HRB_A_LIFE_DAYS_1 is the sum of the days the respondent used Atrazine during each of the data collection Phases (Phase 1, Phase II and Phase III).

Section 5 of the questionnaire asks about the application methods the respondent used for handling pesticides since the last interview. Since the Phase II questionnaire responses showed relatively little variation in application methods and PPE use within a class of pesticides this set of questions was asked only once for the most intensively used pesticide indicated by the respondent in each of 6 categories:

- Herbicide to crop
- Insecticide to crop
- Fungicide to crop
- Insecticide to animal
- Pesticide for non crop applications
- Fumigants

Note that because the pesticides mentioned by the applicator in response to question 4.5 were not categorized into any of these 6 categories, they were not considered when determining the most frequently used pesticide. Although it is uncommon for someone to forget the most frequently used pesticide until this point in the questionnaire, it did happen on occasion.

3.   DATA PROCESSING PROCEDURES

A major advantage of collecting data through computer assisted interviewing is that basic checks can be made on the data as it is entered, giving the interviewer fewer opportunities to make errors (impossible values are blocked) and to correct some types of errors immediately ("soft" range checks warn the interviewer of unusually high or low values). Another important advantage is that data files are available in electronic form as soon as the interview is complete.

The questionnaire contained a list of pesticides from which interviewers could select (see the questions labeled with the variable name "P3_PESTICIDE_VERBATIM": questions 4.1a, 4.1c, 4.2a, 4.2c, 4.3a, 4.3c, 4.5b, and 4.5e). If the respondent named a pesticide not on the list, it was keyed in by the interviewer. Westat staff developed a list mapping each verbatim pesticide name to a table of standard pesticide names. When a new verbatim name was encountered, it was sent to experts at NCI and NIEHS for review and was then either associated with an existing standard pesticide name or with a new name that was created to reflect the appearance of a new product not previously encountered during the study. Some verbatim names could not be associated with any known commercial pesticide and were associated with one of the following names as appropriate: unknown herbicide, unknown insecticide, unknown fumigant, unknown fungicide, or unknown pesticide.[3]

3.1   Data Cleaning

The field stations randomly selected five percent of the interviews and reviewed recordings of the interview and the corresponding questionnaire entries. In the rare instances in which problems were found, the field station staff sent a problem sheet describing the issue to the Coordinating Center for resolution.

During the interview, pesticide usage was reported for crops, animals or animal confinement areas, other non-crop or non-animal areas, and pesticides previously identified in phase II. Respondents were given the opportunity to make additions or corrections to what they had reported prior to gathering more specific information about each pesticide reported. An "incorrect pesticide" value was added to the

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[3] Note that the lists of pesticide names used in the questionnaire and the list associating verbatim pesticide names with standard pesticide names were based on those used in Phase II of the study. The revised and expanded verbatim-standard name association list was used in both the July 2010 release of the Phase II data files (release P2REL201007.00) and the Phase III data files.

high usage question series as well as the individual lifetime usage question. Data Management staff at the Coordinating Center reviewed a pesticide report that identified the pesticides recorded during the interview, any add, change or delete flags associated with the pesticides, comments inserted by the interviewer, and any values of "INCORRECT PESTICDE" that were used in the interview. Adjustments to the pesticide table were made as a result of this review and coding instructions relevant to the pesticide table. Updates were also possible as a result of problem sheets related to the interview that had been sent to the Coordinating Center by the field stations.

"INCORRECT PESTICIDE" responses were added to questions 4.6, 5.9, 5.17, 5.28, 5.29 and 5.31 to allow for deletion of pesticide names that were entered earlier in the interview.

Q4.6) You mentioned that you have used **^Pesticide_Verbatim ^Pst_Used_On_Txt**. For how many years over your lifetime have you personally mixed, loaded, handled, or applied this pesticide?

Q5.9) On the days when ^PST.HighCropInsect was applied to crops or other plants, how often did you personally mix it or load it into the application equipment?

Q5.17) On the days when ^PST.HighCropFung was applied to crops or other plants, how often did you personally mix it or load it into the application equipment?

Q5.28 (Since ^DSP.YearOfLastInterview), on days when ^PST.HighNonCropPest was applied, how often did you personally mix the pesticide or load the application equipment yourself?

Q5.29) When you applied ^PST.HighNonCropPest, what application method did you use the most?

Q5.31) We When you applied ^PST.HighFumigant, what application method did you use the most?

The Data Management staff also reviewed all "Other, specify" verbatim responses to determine when they could recoded to one of the existing response choices.

Q1.10) What has been your primary source of drinking water at your current residence?
Q2.3) Excluding gardens for personal use, what crops, including fruits and vegetables, were raised on your farm since ^DSP.YearOfLastInterview?
Q2.5) (Since ^DSP.YearOfLastInterview), what poultry or livestock did you raise on your farm?
Q5.6a) When you applied ^PST.HighCropHerb to crops, was it liquid, granular, powder, or something else?

Q5.7) When you applied ^PST.HighCropHerb to crops, what application method did you use the most?

Q5.7c) When you applied ^PST.HighCropHerb to crops, what application method did you use the second most?

Q5.15) When you applied ^PST.HighCropInsect to crops, what application method did you use the most?

Q5.15c) When you applied ^PST.HighCropInsect to crops, what application method did you use the second most?

Q5.22) When you applied ^PST.HighCropFung to crops, was it liquid, granular, powder, or something else?

Q5.23c) When you applied ^PST.HighCropFung to crops, what application method did you use the second most?

Q5.26) When you applied ^PST.HighAnimalInsect on animals or animal confinement areas, what application method did you use the most?

Q5.26c) When you applied ^PST.HighAnimalInsect on animals or animal confinement areas, what application method did you use the second most?

Q5.29) When you applied ^PST.HighNonCropPest, what application method did you use the most?

Q5.29c) When you applied ^PST.HighNonCropPest, what application method did you use the second most?

Q5.31) We would now like to ask about your use of ^PST.HighFumigant. When you applied ^PST.HighFumigant, what application method did you use the most?

Q5.31c) When you applied ^PST.HighFumigant, what application method did you use the second most?

Q5.34) What type of glove did you normally wear?

Q5.35) What (other) protective equipment did you normally wear (when you mixed herbicides, insecticides, fungicides, or other pesticides)?

Q5.37) What type of glove did you normally wear [when you **applied** pesticides]?

Q6.2) Regarding the most recent [high pesticide exposure] incident, what was the name of the pesticide you were using?

Q26.2) What type(s) of cancer?

Q28.5) Did your periods stop because of … [list]?

Q28.19) Did your periods stop because of… [list]?

When there were a substantial number of similar responses to an "Other, specify" question, we created new codes reflecting these responses and recoded the responses accordingly. A full list of both the old and new codes is contained in Appendix C.

Data management staff at the Coordinating Center repeated both the hard range checks and embedded logics within the instrument. Any unusual values that had been detected by the soft range checks and approved by the field stations were verified. All verbatim responses and comments were reviewed. Any that seemed to need further information had requests sent to the field for clarification and/or adjustment.

Requests to change data, from comments, special codes, and after-the-fact requests, were reviewed and dealt with. Any new issues or discrepancies that arose because of the change request were sent for clarification to the relevant field station until all range checks and logics were resolved or accepted as correct.

3.2 Preparation of Analytic Files

The questionnaire responses from the Iowa and North Carolina field stations were combined into a file for private applicators (P3PrivateApplicator.sas7bdat) and a file with the same data structure. for spouses of private applicators (P3Spouse.sas7bdat).[4] Because a respondent could name any number of pesticides in Section 4, we placed variables representing responses to question in this section in the applicator and spouse supplemental pesticide files, which are named P3PrivAppSuppPest.sas7bdat and P3SpouseSuppPest.sas7bdat, respectively. Note that the supplemental pesticide files have a separate record for each unique combination of respondent ID, pesticide name, and application target (animal, crop, non-crop, or other).

The remainder of this section discusses the following topics:

- Variable Naming Conventions
- Pesticide Exposure Flags
- Pesticide Exposure Algorithms
- Derived Variables
- Missing Value Codes

Each topic is discussed in a separate section below.

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[4] No commercial applicators were interviewed during Phase 3.

3.2.1 Variable Naming Conventions

To the extent possible, variable names were kept as similar to those used for the corresponding variables in Phase I and Phase II of the study. Almost all variables in the Phase III data sets begin with the prefix "P3" to distinguish them from Phase II variable names, which start with the prefixes "A2," "C2," and "S2" and the Phase I variable names, which started with "A," "C," or "S.". The exceptions are the variables PARTID (participant ID), which has the same name and meaning in all AHS data files, and the following pesticide-related variables that appear in both the Phase II and Phase III supplemental files with identical meanings:

- AIName1 – Active ingredient name 1
- AIName2 – Active ingredient name 2
- AIName3 – Active ingredient name 3
- AIName4 – Active ingredient name 4
- PCCODE1 – Pesticide chemical code 1
- PCCODE2 – Pesticide chemical code 2
- PCCODE3 – Pesticide chemical code 3
- PCCODE4 – Pesticide chemical code 4
- PestType – Pesticide type

3.2.2 Pesticide Exposure Flags

There are three sets of pesticide exposure flags in the Phase III data files:

- A-List and B-List Personal Use Indicator Variables;
- Phase III A-List List Lifetime Personal Use Indicator Flags; and
- Phase III Used on Farm Indicator Flags.

Each set of flags is described in a separate section below.

3.2.2.1 **A-List and B-List Personal Use Indicator Variables**

A personal use indicator variable was created for each of the 83 A-list and 40 B-list variables (see Appendix A and Appendix B). Core A-list variables are the 50 chemicals asked about in the Enrollment Questionnaire during Phase I. These were supplemented by 33 additional chemicals of high interest that were reported as being used during the Phase II interviews. B-list chemicals are those not on the A-list that were reported as being used by 300 or more applicators in Phase II. The core A-list variables have "_A_" in their variable names. The 33 additional A-list variables have "_AA_" in their variable names. The B-list variables have "_B_" in their variable names.

For example, P3_FUMIGANT_A_1 is the indicator for personal application of Methyl Bromide (PCCODE = 053201). The flags were set for each applicator based on the active ingredients in pesticides reported by the respondents. If the reported pesticide had the specific A-list or B-list chemical as one of its active ingredients,[5] the indicator flag was set to either 0 or 1. If the respondent indicated that he or she personally mixed loaded or applied the pesticide for zero days, the indicator flag was set to 0. If the respondent reported a positive number of days of use for the pesticide or did not answer the days of per year question (see Section 3.2.3.3), the pesticide exposure indicator flag was set to 1. It the respondent stated that he or she applied a chemical zero days per year for some products and did not give us the number of days for another product containing the chemical, we treated the days per year information as missing and set the exposure indicator flag to 1.This logic is summarized in Table 3–1.

Table 3–1.   Meaning of A-List and B-List Personal Use Indicator Flags

Condition	A-List or B-List Indicator Value (1 = Yes; 0=No)
IF Days per year = Missing	1
IF Days per year = 0	0
IF Days per year > 0	1

3.2.2.2 **Phase III A-List List Lifetime Personal Use Indicator Flags**

A set of lifetime personal indicator flags was created for the A-list variables. For example, P3_FUMIGANT_LY_A_1 is the lifetime indicator flag for personal use of Methyl Bromide during Phase

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[5] Each pesticide name can have up to 4 active ingredients and one PC code is associated with each of the active ingredients.

I, II or III.   If the personal use indicator for the chemicals is true in Phase I, II or III for a participant, then the lifetime indicator for the specific pesticide is set to 1 (true); otherwise it is set to 0 (false). Note that these variables were created only for the 50 chemicals asked about in the Phase I questionnaires.

In the Phase I Enrollment Questionnaire applicators were asked about use of 22 chemicals including the number of years of use and the average number of days per year. They were also asked whether they had mixed, loaded, or applied 28 additional pesticides but were not asked about the amount of use. These 28 pesticides were, however, asked about in a take-home questionnaire which repeated the question about whether the applicator had mixed, loaded, or applied the chemical and also asked about years and days of use. The take-home questionnaire was completed by approximately 40 percent of the applicators. The Phase I A-list indicator used here is derived using both Enrollment Questionnaire and Take Home Questionnaire variables when available; for example, A_HERBICIDE_CD4/ P1_CD_INDS and A_EVER_HERBICIDE4/ P1_EVER_INDS). The logic used is parallel to that used in Phase II.

                    IF   P1_CD_INDS(I) = 1 or
                            P1_EVER_INDS(I) = 1
                    THEN ALIST_P1_INDS(I) = 1 ;
                    ELSE ALIST_P1_INDS(I) = 0 ;

The variables P1_CD_INDS(I), P1_EVER_INDS(I), and ALIST_P1_INDS(I) are temporary arrays of indicators where "I" represents a specific pesticide. P1_CD_INDS(I) is the indicator for chemical I that was asked as part of the set of questions that that asked about years and days of use. P1_EVER_INDS(I) for chemical I that was asked by itself without the years and days questions. ALIST_P1_INDS(I) is the derived indicator for chemical I.

3.2.2.3 Phase III Used on Farm Indicator Flags

In Phase II a separate "used on farm" variable was created to indicate that the respondent reported use of the pesticide, whether or not he or she personally used it. These sets of variables were named in a similar manner as the personal use indicator variables except that "RY" in the variable name was replaced with "UF". In Phase III the used on farm indicator variable is set to 1 if the respondent has reported a pesticide name with a specific A-list active ingredient, otherwise it is set to 0. While the used on farm variables and the personal use indicator variables in Phase II can and do differ, because of the structure of the Phase III questionnaires, the used on farm set of variables in Phase III have exactly the same value as the personal use indicator variables. The used on farm variables have never-the-less been kept for the sake of consistency with Phase II. Thus P3_FUMIGANT_UF_A_1 represents reported use

of Methyl Bromide (PCCODE=053201) in the Phase III in the supplemental file. The Phase III Used on Farm variables may be omitted from future data releases. For this reason when the analyst has a choice of methods for using this information, it would be better to use the corresponding personal use indicator variables such as P3_FUMIGANT_RY_A_1.

3.2.2.4 **Pesticide with Unknown Active Ingredients:**

Some of the pesticide names in the supplemental files have been assigned PC Code indicating an unknown pesticide or an unknown pesticide type:

```
999990 NOT A PESTICIDE
999991  UNKNOWN FUNGICIDE
999992 UNKNOWN FUMIGANT
999993  UNKNOWN HERBICIDE
999994  UNKNOWN INSECTIDE
999995  OTHER TYPE OF PESTICIDE
999999  UNKNOWN PESTICIDE / UNKNOWN TYPE
```

The main datasets continue to have following flag variables to indicate reported use of unknown pesticides:

Table 3–2.   Flags for Unknown Pesticides

Variable Name	Label
P3_unknown_fung	Flag for unknown fungicide
P3_unknown_fum	Flag for unknown fumigant
P3_unknown_herb	Flag for unknown herbicide
P3_unknown_ins	Flag for unknown insecticide
P3_unknown_pest	Flag for unknown pesticide

3.2.3 Pesticide Exposure Algorithms

Exposure to pesticides during farming operations is not simply a matter of the amount of time a person is exposed to pesticides. A farmer spraying crops while riding in a tractor with an enclosed cab and an air filtration system is likely to receive a smaller effective dose of a pesticide per unit time than a farmer using a backpack sprayer to apply a pesticide to trees in an orchard. The intensity level of pesticide exposure is a function of pesticide handling procedures (i.e., mixing, loading, application of pesticides and repairing of equipment) and protective equipment used. Algorithms for estimating exposure intensity are documented in Dosemeci et al. (2002).

Dosemeci et al. (2002) includes two algorithms for estimating the intensity of exposure. The first algorithm is based on questions in the Enrollment Questionnaire and it what is now termed Version 1 of the algorithm. The second algorithm used responses from both the Enrollment Questionnaire and the private applicator and commercial applicator Take Home Questionnaires. Since only 40 percent of the applicators completed the Take Home Questionnaire, this version of the algorithm, which was called "Algorithm 2" in the Phase I documentation, has not been used in analysis and is no longer included in AHS analysis files.

A new version of the intensity algorithm was defined in 2007[6]. This version uses the results of a study of a subset of AHS applicators conducted by EPA that collected extensive biomarker data to calibrate the questionnaire responses[7]. This 'Version 2' of the algorithm should be used in future analyses of AHS data.

The basic concept of intensity adjusted days of exposure to a pesticide can be expressed as

$$\text{Intensity Days} = \text{Total Application Days} * \text{Algorithm Intensity Score}$$

The Algorithm Intensity Score is a function of application methods used and PPE used. The Algorithm Intensity Score calculation is different in Version 1 and Version 2 of the algorithm.

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[6] Coble et al, forthcoming

[7] Thomas, K.W., Dosemeci, M., Coble, J.B., Hoppin, J.A., Sheldon, L.S., Chapa, G., Croghan, C.W., Jones, P.A., Knott, C.E., Lynch, C.F., Sandler, D.P., Blair, A.E., Alavanja, M.C. (2010). Assessment of a pesticide exposure intensity algorithm in the agricultural health study. *J Expo Sci Environ Epidemiol*, 20(6):559-569, Epub 2009 Nov 4.

For Version 1 of the algorithm, a combined PPE factor, which is used with the Repair Score, was defined as the minimum of the PPE_Mix factor and the PPE_Apply factor. The Algorithm Intensity Score is the sum of the product of each score and its corresponding factor.

Algorithm Intensity Score =   [Mix Score] * [PPE_MIX] +

    [Apply Score] * [PPE_APPLY] +

    [Repair Score] * [PPE_COMBINED]

For Version 2, the Algorithm Intensity Scores for each application in the Phase II Supplemental File are calculated as:

Algorithm Intensity score = (Mix score + Apply score + Repair score) * Combined PPE Factor

Subjects with missing values for one or more of these four variables were assigned missing algorithm intensity scores. Subjects for whom the sum of the Mix Score, Apply Score, and Repair Score is zero will also be assigned missing algorithm intensity scores.

Mix scores, apply scores, and repair scores were created representing the pesticide-related activities of mixing pesticides, applying pesticides, and repairing equipment. For each of the six pesticide application categories (herbicide to crop, insecticide to crop, fungicide to crop, insecticide to animal, pesticide for non crop applications, and fumigants) respondents were asked what application methods were used for the most frequently used and next most frequently used pesticides. Respondents were also asked about their use of PPE when mixing, loading, or applying pesticides. Repair information was collected with question 5.39 (variable P3_REPAIRAPPLEQ):

Since ^DSP.YearOfLastInterview, in general, on days when pesticides were applied, how often did you stop to readjust or repair your application equipment? Was it:

    1. Never
    2. Less than half the days
    3. Half or more than half the days
    4. Always
    8. REF
    9. DK

The PPE factor was calculated using a formula which can be informally summarized as :

PPE Factor = 1- (0.6 * protective glove use +
                     0.1 * minimum (sum(Tyvek suit use +
                                                   water proof boot use +
                                                   respirator use +
                                                   face mask use), 3)

where each of the "use" variables has a value of 0 or 1. Note that PPE credit of 0.6 is given for use of protective gloves and 0.1 for use of each of the other kinds of PPE listed up to a maximum of 0.3 for the non-glove types of PPE.

Two PPE factors were calculated, one for mixing and one for applying. The minimum (i.e., more protective) of the two values was used for calculation of the Phase III intensity score. In other words, the combined PPE factor is the minimum of the PPE mix factor and the PPE apply factor

The calculation of the algorithm scores and related variables in the Phase III main applicator and spouse datasets and supplemental datasets was performed in a manner parallel to the logic used for the corresponding Phase II variables with adjustments made to reflect variations in the questionnaires. This section describes the derivation details of the following classes of derived variables:

- Phase III algorithm scores, including the mix scores, apply scores, repair scores and combined PPE factors.
- Intermediate Derived Variables
- Phase III Days per Year of Use.
- Phase III Reported Life Years.
- Phase III Reported Lifetime Days.
- Phase III years of usage
- Phase III Total Days used
- Phase III Intensity Days
- Average Algorithm Intensity Score.
- Reported Lifetime Intensity Days
- Total hours of use since enrollment.
- Algorithm Adjusted Hours.
- A-List Lifetime Indicators.
- Lifetime Days
- Lifetime Intensity Days.

3.2.3.1 **Phase III Algorithm Scores**

The Phase III supplemental datasets include the original version and the version 2 of the algorithm scores that are calculated using following formula:

Original version:

P3_ALGO_SCORE = SUM(P3_MIX_SCORE * P3_PPE_FACTOR_MIX, P3_APPLY_SCORE *
 P3_PPE_FACTOR_APPLY, P3_REPAIR_SCORE *
 P3_PPE_FACTOR_COMBINED);

Version 2:

 P3_V2_ALGO_SCORE = (P3_V2_MIX_SCORE +
 P3_V2_APPLY_SCORE +
 P3_V2_REPAIR_SCORE) *
 P3_V2_PPE_FACTOR_COMBINED;

Parallel to the logic used in phase II, the algorithm score is set to missing for participants for whom the sum of mix score, apply score and repair score is 0.

3.2.3.1.1 Phase III Version 2 Mix Score

The Phase III Version 2 mix score, variable P3_V2_MIX_SCORE, is calculated using responses to the following questions:

P3_CROPMXLD_CROPHRB
Q5.1) On the days when ^PST.HighCropHerb was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

 1. Never (Skip to Q5.3)
 2. Less than half the days
 3. Half or more than half the days
 4. Always
 7. INCORRECT PESTICIDE (Skip to Box 5.2)
 8. REF (Skip to Q5.3)
 9. DK (Skip to Q5.3)

P3_CROPMXLD_CROPINS
Q5.9) On the days when ^PST.HighCropInsect was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

1. Never (Skip to Q5.11)
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.3)
8. REF (Skip to Q5.11)

P3_CROPMXLD_FNG
Q5.17) On the days when ^PST.HighCropFung was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

1. Never (Skip to Q5.19)
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.4)
8. REF (Skip to Q5.19)
9. DK (Skip to Q5.19)

P3_ANIMMXLD_ANIMALINS
Q5.25) These next questions are about your use of insecticides on animals or animal confinement areas. Since ^DSP.YearOfLastInterview, when you applied ^PST.HighAnimalInsect on animals or animal confinement areas, how often did you personally mix the insecticide or load the application equipment yourself? Was it

1. Never
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.5)
8. REF
9. DK

P3_OTHMXLD_NONCROPPEST
Q5.28) These next questions are about the pesticides you applied for purposes other than to crops or animals. (Since ^DSP.YearOfLastInterview), on days when ^PST.HighNonCropPest was applied, how often did you personally mix the pesticide or load the application equipment yourself? Was it:

1. Never
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.6)

8. REF
9. DK

Based on the responses to the mix/load questions mentioned above, mix scores are assigned as shown in Table 3–3.

Table 3–3.   Pesticide Mix Scores Associated with Each Response to Question 5.28

Response	P3_V2_MIX_SCORE
1. Never	0
2. Less than half the days	20
3. Half or more than half the days	50
4. Always	50

3.2.3.1.2   Phase III V2 Apply Score

The Phase III application scores (variable (P3_V2_APPLY_SCORE) values are assigned for each pesticide application reported by a participant in the supplemental file. In Section 5 of the questionnaire, the respondent is asked about the application method used for herbicides, crop insecticides, crop fungicides, animal insecticides, and non-crop applications. The application method used for the most frequently used pesticide in each category was treated as representative of the methods used for all pesticides in the category. The following questions were asked to elicit this information:

Herbicide to crop: Q5.7 and Q5.7a

P3_APPLY_METHOD1
Q5.7) When you applied ^PST.HighCropHerb to crops, what application method did you use the most? Was it:

1. Broadcast (Skip to Q5.7c)
2. Banded, or In-Furrow (Skip to Q5.7c)
3. Hand-held Sprayer (Skip to Q5.7c)
4. Something Else
8. REF (Skip to Q5.7c)

9. DK (Skip to Q5.7c)

Q5.7a) [What method did you use when you applied ^PST.HighCropHerb to crops?] What was it?

Application Method: _____
<<display drop down list - mark one>>

Insecticide to crop: Q5.15 and Q5.15a

Q5.15) When you applied ^PST.HighCropInsect to crops, what application method did you use the most? Was it:

1. Broadcast (Skip to Q5.15c)
2. Banded, or In-Furrow (Skip to Q5.15c)
3. Hand-held sprayer (Skip to Q5.15c)
4. Something Else
8. REF (Skip to Q5.15c)
9. DK (Skip to Q5.15c)

P3_APPLY_METHOD1_NAME
Q5.15a) [When you applied ^PST.HighCropInsect to crops, what application method did you use the most?]   What was it?

   Application Method: _____
   <<display drop down list - mark one>>

Fungicide to crop: Q5.23 and Q5.23a

P3_APPLY_METHOD1
Q5.23) When you applied ^PST.HighCropFung to crops, what application method did you use the most? Was it:

   1. Broadcast (Skip to Q5.23c)
   2. Banded, or In-Furrow (Skip to Q5.23c)
   3. Hand-held Sprayer (Skip to Q5.23c)
   3. Something Else
   8. REF (Skip to Q5.23c)
   9. DK (Skip to Q5.23c)

P3_APPLY_METHOD1_NAME2
Q5.23a) [What method did you use when you applied ^PST.HighCropFung to crops?]
What was it?

   Application Method: _____
   <<display drop down list - mark one>>

Insecticide to animal: Q5.26 and Q5.26a

P3_APPLY_METHOD1
Q5.26) When you applied ^PST.HighAnimalInsect on animals or animal confinement areas, what application method did you use the most? Was it:

   0. DID NOT APPLY (Skip to Q5.27)
   1. Dips, pour-ons (also hand wipes, oral paste, or boluses) (Skip to Q5.26c)
   2. Sprayer or Duster (backpack sprayer, air sprayer) (Skip to Q5.26c)
   3. Something Else
   8. REF (Skip to Q5.26c)
   9. DK (Skip to Q5.26c)

P3_APPLY_METHOD1_NAME

Q5.26a) [What method did you use when you applied ^PST.HighAnimalInsect on animals or animal confinement areas?] What was it?

Application Method: _____

<<display drop down list - mark one>>

Other non-crop pesticide: Q5.29 and Q5.29a

P3_APPLY_METHOD1

Q5.29) When you applied ^PST.HighNonCropPest, what application method did you use the most? Was it:

0. DID NOT APPLY (Skip to Box 5.6)
1. Hand-held Sprayer (gun, wand, boom, or pump) (Skip to Q5.29c)
2. Broadcast from Farm Vehicle (NOT hand-held) (Skip to Q5.29c)
3. Backpack Sprayer (Skip to Q5.29c)
4. Dusting by hand (including powders) (Skip to Q5.29c)
5. Something Else
7. INCORRECT PESTICIDE (Skip to Box 5.6
8. REF (Skip to Q5.29c)
9. DK (Skip to Q5.29c)

P3_APPLY_METHOD1_NAME

Q5.29a) [What method did you use when you applied ^PST.HighNonCropPest?] What was it?

Application Method: _____

<<display drop down list - mark one>>

Fumigants: Q5.31 and Q5.31a

P3_APPLY_METHOD

Q5.31) We would now like to ask about your use of ^PST.HighFumigant. When you applied ^PST.HighFumigant, what application method did you use the most? Was it:

0. DID NOT APPLY (Skip to Box 5.7)
1. Hand-held Sprayer (gun, wand, boom, or pump) (Skip to Q5.31c)
2. Broadcast from Farm Vehicle (NOT hand-held) (Skip to Q5.31c)
3. Backpack Sprayer (Skip to Q5.31c)
4. Dusting by hand (including powders) (Skip to Q5.31c)
5. Something Else
7. INCORRECT PESTICIDE (Skip to Box 5.7)
8. REF (Skip to Q5.31c)
9. DK (Skip to Q5.31c)

P3_APPLY_METHOD1_NAME

Q5.31a) [What method did you use when you applied ^PST.HighFumigant?]
What was it?

Application Method: _____

<<display drop down list - mark one>>

The responses to application method questions mentioned above were then assigned an application method code (P3_Apply_Method1) and an apply score (P3_V2_Apply_Score) using the values in Table 3–4.

Table 3–4.   Application Method Scores Associated with Each Application Method Code

P3_ Code	Method	Apply Score
10	Aerial	10
11	Aerosol Can	50
12	Air blast	150
13	Backpack Sprayer	90
14	Bait Bars Blocks or Cubes	10
15	Banded Application (granular)	20
16	Banded Spray	30
17	Boom on Tractor, Truck, or Trailer	40
18	Broadcast Application	40
19	Dip Animals	70
20	Distributable Tablets Granules Pellets	10
21	Dust Animals	70
22	Ear Tag	10
23	Fog Mist Animals	90
24	Garden Hose	50
25	Gas Canister	20
26	Greenhouse Sprayer	90
27	Hand Held Squeeze or Squirt Bottle	50
28	Hand Spray	90
29	Hand Spreader or Push Spreader	20
30	Hang Pest Strips in Barn	20
31	In Furrow	20
32	Incorporated	20

P3_ Code	Method	Apply Score
33	Inject Animals	20
34	Mist Blower or Fogger	90
35	Personally Applied to Seed	40
36	Planter Box	20
37	Pour Fumigant from Bucket	90
38	Pour on Animals	70
39	Powder Duster	90
40	Pretreated Seed	20
41	Sealed Packets	10
42	Seed Treatment	40
43	Soil Injected or Drilled	40
44	Spray Animals	70
45	Spray Over Rows	30
46	Watering Can or Sprinkling Can	50

3.2.3.1.3   Phase III Version 2 Apply Score for Second Most Used Apply Method

In Phase III the respondents were also asked about the second most method used in section 5 for all the applications mentioned above in section 1.2. Based on the responses to these questions the Phase III version 2 apply score for second most used apply method (P3_V2_APPLY_SCORE_SEC) was calculated in the same way as P3_V2_APPLY_SCORE. The questions used in derivation of this score are:

P3_APPLY_METHOD1_SEC
Q5.7c) When you applied ^PST.HighCropHerb to crops, what application method did you use the second most? Was it:

        1. NONE (Skip to Q5.8)
        2. BROADCAST (Skip to Q5.8)
        3. BANDED, OR IN-FURROW (Skip to Q5.8)
        4. HAND-HELD SPRAYER (Skip to Q5.8)
        5. SOMETHING ELSE
        8. REF (Skip to Q5.8)
        9. DK (Skip to Q5.8)

P3_APPLY_METHOD1_NAME_SEC

Q5.7d) [When you applied ^PST.HighCropHerb to crops, what application method did you use the second most?] What was it?

Application Method: _____
<<display drop down list - mark one>>

P3_APPLY_METHOD1_SEC

Q5.15c) When you applied ^PST.HighCropInsect to crops, what application method did you use the second most?

1. NONE (Skip to Q5.16)
2. BROADCAST (Skip to Q5.16)
3. BANDED OR IN-FURROW (Skip to Q5.16)
4. HAND-HELD SPRAYER (Skip to Q5.16)
5. SOMETHING ELSE
8. REF (Skip to Q5.16)
9. DK (Skip to Q5.16)

P3_APPLY_METHOD1_NAME_SEC

Q5.15d) [When you applied ^PST.HighCropInsect to crops, what application method did you use the second most?] What was it?

Application Method: _____
<<display drop down list - mark one>>

P3_APPLY_METHOD1_SEC

Q5.23c) When you applied ^PST.HighCropFung to crops, what application method did you use the second most?

0. NONE (Skip to Q5.24)
1. BROADCAST (Skip to Q5.24)
2. BANDED OR IN-FURROW (Skip to Q5.24)
3. HAND-HELD SPRAYER (Skip to Q5.24)
4. SOMETHING ELSE
8. REF (Skip to Q5.24)
9. DK (Skip to Q5.24)

P3_APPLY_METHOD1_NAME_SEC

Q5.23d) [What method did you use second most when you applied ^PST.HighCropFung to crops?] What was it?

Application Method: _____
<<display drop down list - mark one>>

P3_APPLY_METHOD1_SEC

Q5.26c) When you applied ^PST.HighAnimalInsect on animals or animal confinement areas, what application method did you use the second most?

1. NONE (Skip to Q5.27)
2. Dips, pour-ons (also hand wipes, oral paste, or boluses) (Skip to Q5.27)
3. Sprayer or Duster (backpack sprayer, air sprayer) (Skip to Q5.27)
4. Something Else
8. REF (Skip to Q5.27)
9. DK (Skip to Q5.27)

P3_APPLY_METHOD1_NAME_SEC

Q5.26d) [What method did you use the second most when you applied ^PST.HighAnimalInsect on animals or animal confinement areas?] What was it?

Application Method: _____
<<display drop down list - mark one>>

P3_APPLY_METHOD1_SEC

Q5.29c) When you applied ^PST.HighNonCropPest, what application method did you use the second most?

0. NONE
1. HAND-HELD SPRAYER (Skip to Q5.30)
2. BROADCAST FROM FARM VEHICLE (Skip to Q5.30)
3. BACKPACK SPRAYER (Skip to Q5.30)
4. DUSTING BY HAND (Skip to Q5.30)
5. SOMETHING ELSE
8. REF (Skip to Q5.30)
9. DK (Skip to Q5.30)

P3_APPLY_METHOD1_NAME_SEC

Q5.29d) [What method did you use the second most when you applied ^PST.HighNonCropPest?] What was it?

Application Method: _____
<<display drop down list - mark one>>

Q5.31c) When you applied ^PST.HighFumigant, what application method did you use the second most?

       0. NONE (Skip to Q5.32)
       1. HAND-HELD SPRAYER (Skip to Q5.32)
       2. BROADCAST FROM FARM VEHICLE (Skip to Q5.32)
       3. BACKPACK SPRAYER (Skip to Q5.32)
       4. DUSTING BY HAND (Skip to Q5.32)
       5. SOMETHING ELSE
       8. REF (Skip to Q5.32)
       9. DK (Skip to Q5.32)

P3_APPLY_METHOD1_NAME_SEC
Q5.31d) [What method did you use the second most when you applied ^PST.HighFumigant?] What was it?

       Application Method: _____
       <<display drop down list - mark one>>

Parallel to the V2_APPLY_SCORE the responses to the second most used application method questions were then assigned an application method code (P3_Apply_Method1_Sec) and an apply score (P3_V2_Apply_Score_Sec) using Table 3–4.

P3_V2_Apply_Score_Sec is not currently being used in the calculation of the algorithm score, it may be incorporated into the calculations in future deliveries..

3.2.3.1.4   PPE Mix

The indicator variables for PPE mix are created using responses to Q5.35 - P3_GOGGLES_MIX, P3_FACE_SHIELD_MIX, P3_TYVEK_MIX, P3_BOOTS_MIX, P3_RESP_MIX, P3_DUST_MASK_MIX and P3_LONG_SLEEVES_MIX. The following indicator variables were created using recoded other specify values - P3_APRON_MIX, P3_CLOTH_COVERALLS_MIX and P3_RAIN_SUIT_MIX.

Q5.35) What (other) protective equipment did you normally wear (when you mixed herbicides, insecticides, fungicides, or other pesticides)? Did you wear: (CHECK ALL THAT APPLY)

       0. NONE P3_NO_PPE_MIX
       1. Goggles P3_GOGGLES_MIX

2. Face Shield P3_FACE_SHIELD_MIX
3. Disposable Coveralls, like Tyvek P3_TYVEK_MIX
4. Rubber boots P3_BOOTS_MIX
5. Respirator with cartridge P3_RESP_MIX
6. Dust mask P3_DUST_MASK_MIX
7. Long-sleeved shirt P3_LONG_SLEEVES_MIX
91. OTHER P3_PPE_OTHER_MIX
98. REF
99. DK

We also created a variable, P3_CHEMGLOVE_PPE_MIX, to represent use of chemically resistant gloves while mixing or loading pesticides. If the response to question 5.34 (P3_GLOVETYP) is 1 (chemically resistant gloves like Nitrile), 2 (rubber or plastic waterproof glove), or 3 (thin disposable glove like latex), then we set P3_CHEMGLOVE_PPE_MIX = 1. Otherwise we set P3_CHEMGLOVE_PPE_MIX = 0.

In addition, we created a variable, P3_OTHEREQUIP_PPE_MIX, to represent use of PPE equipment other than chemically resistant gloves whi8le mixing or loading pesticides. If the response to question 5.35 is in the range 1-6 or if the other specify includes use of aprons or rain suits we set P3_OTHEREQUIP_PPE_MIX to 1. If this was not the case, we set P3_OTHEREQUIP_PPE_MIX to 0.

P3_PPE0_MIX

The indicator flag P3_PPE0_MIX is set to 1 if the respondent did not use any personal protective equipment when mixing pesticides and is set to 0 if he or she did use PPE. The P3_PPE0_MIX flag is set using an intermediate variable MIXPPE, which summarizes the values of all the possible PPE responses. MIXPPE is set using the code:

```
IF      P3_GOGGLES_MIX = MISSING and
        P3_FACE_SHIELD_MIX = MISSING and
        P3_TYVEK_MIX = MISSING and
        P3_BOOTS_MIX = MISSING and
        P3_RESP_MIX = MISSING and
        P3_DUST_MASK_MIX = MISSING and
        P3_LONG_SLEEVES_MIX = MISSING
THEN MIXPPE = 0;

IF      P3_GOGGLES_MIX = 1 or
        P3_FACE_SHIELD_MIX = 1 or
```

P3_TYVEK_MIX = 1 or
P3_BOOTS_MIX = 1 or
P3_RESP_MIX = 1 or
P3_DUST_MASK_MIX = 1 or
P3_LONG_SLEEVES_MIX = 1
THEN MIXPPE = 1;

The value of P3_PPE0_MIX is then set using the responses to the specific PPE questions and the responses to questions asking whether the respondent personally mixed or applied pesticides and the question about whether the respondent loaded pesticides. The value of P3_NO_PPE_MIX is set using the code:

IF P3_NO_PPE_MIX = 1 THEN P3_PPE0_MIX = 1;

IF MIXPPE = 1 THEN P3_PPE0_MIX = 0;

IF MIXPPE = 0 and P3_PERSONALLY_APPLY *(see Section 3.2.3.2.2)* = 1
THEN P3_PPE0_MIX = 1;

IF MIXPPE = 0 and P3_FILL_LOAD *(see Section 3.2.3.2.1)* = 1
THEN P3_PPE0_MIX = MISSING;

IF P3_PPE1_MIX = 0 and P3_PPE2_MIX = 0 and P3_PPE3_MIX = 0
THEN P3_PPE0_MIX = 1;

IF P3_GLOVE_TYPE_1_MIX = 1 or P3_LONG_SLEEVES_MIX = 1 or
P3_CLOTH_COVERALLS_MIX = 1 THEN PPE0_MIX = 1;

Note that conditions later in the list override conditions higher up in the list. Also note that fabric or leather gloves are treated as not providing any protection (i.e., P3_PPE0_MIX is set to 1).

P3_PPE1_MIX:

The variable P3_PPE1_MIX is an indicator flag for use of chemically resistant boots, face shield, or fabric or leather gloves when mixing pesticides. It is set using the code:

IF   P3_BOOTS_MIX = 1 or
P3_FACE_SHIELD_MIX = 1 or
P3_GOGGLES_MIX = 1 or
P3_GLOVE_TYPE_MIX *(see Section 3.2.3.2.3)* = 1
THEN P3_PPE1_MIX = 1 ;

P3_PPE2_MIX:

The variable P3_PPE2_MIX is an indicator flag for use of chemically resistant coveralls or respirator when mixing or loading pesticides. It is set using the code:

    IF   P3_TYVEK_MIX = 1 or
            P3_RESP_MIX = 1 or
            P3_DUST_MASK_MIX = 1 or
            P3_LONG_SLEEVES_MIX = 1 or
            P3_APRON_MIX = 1 or
            P3_RAIN_SUIT_MIX = 1
    THEN P3_PPE2_MIX = 1 ;

P3_PPE3_MIX:

The variable P3_PPE3_MIX is an indicator flag for use of chemically resistant, rubber, or disposable gloves when mixing or loading pesticides. It is set based on the response to question 5.33.

P3_GLOVEMX
Q5.33) Since ^DSP.YearOfLastInterview, when you **mixed and/or loaded** herbicides, insecticides, fungicides or other pesticides, did you normally wear gloves?

        0. NO (Skip to 5.35)
        1. YES
        8. REF (Skip to 5.35)
        9. DK (Skip to 5.35)

The variable is set using the code:

    IF   P3_GloveMX = 1 and
            P3_GLOVE_TYPE_MIX *(see section 3.2.3.2.3)* in (1, 2, 3) or
            P3_GLOVE_TYPE_2_MIX *(see section 3.2.3.2.3)* = 1
    THEN P3_PPE3_MIX = 1;

Phase III PPE Mix Factor:

The PPE Mix Factor is used in the intensity adjusted algorithm scores to reduce the estimated exposure based on the amount of personal protective equipment used. If no PPE is used[8], the factor is set to 1. If several types of PPE are used, the PPE Mix Factor is adjusted accordingly. The original values were set based on an analysis of the available literature. Version 2 of the PPE Mix Factor was created to reflect the knowledge gained from an in-depth study of a subset of Agricultural Health

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[8] Note that some responses to the PPE questions are not considered to be protective. For instance, use of leather gloves does is not treated as providing protection from pesticide exposure while use of chemically resistant gloves is treated as providing protection.

Study applicators who allowed researchers to observe their pesticide handling practices and take a number of biological and environmental samples before and after pesticide operations.[9]

Original Version of Phase III PPE Mix Factor

The original version of the P3_PPE_FACTOR_MIX is calculated using the following logic:

IF P3_PPE0_MIX = 1 THEN P3_PPE_FACTOR_MIX = 1;
IF P3_PPE1_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.8;
IF P3_PPE2_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.7;
IF P3_PPE3_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.6;
IF P3_PPE1_MIX = 1 AND P3_PPE2_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.5;
IF P3_PPE1_MIX = 1 AND P3_PPE3_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.4;
IF P3_PPE2_MIX = 1 AND P3_PPE3_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.3;
IF P3_PPE1_MIX = 1 AND P3_PPE2_MIX = 1 AND P3_PPE3_MIX = 1 THEN P3_PPE_FACTOR_MIX = 0.1;

Version 2 of Phase III PPE Mix Factor

The P3_V2_PPE_FACTOR_MIX is calculated using the following logic:

P3_V2_PPE_FACTOR_MIX =
                (1 - (0.6* CR_GLOVE_MIX + 0.1 * min(SUM_MIX_FINAL, 3)));

Where CR_GLOVE_MIX is an intermediate variable that is derived using the variable P3_GLOVE_TYPE_MIX *(see section 3.2.3.2.3)*:

IF P3_GLOVE_TYPE_MIX = 2 OR 3 OR 4 THEN CR_GLOVE_MIX = 1
ELSE CR_GLOVE_MIX = 0;

And where SUM_MIX_FINAL is an intermediate variable derived using the logic:

SUM_MIX_FINAL =   SUM (P3_TYVEK_MIX,
                        P3_BOOTS_MIX,
                        P3_FACE_SHIELD_MIX,
                        P3_RESP_MIX,
                        P3_APRON_MIX,
                        P3_RAIN_SUIT_MIX) ;

Note that in Version 2 of the Phase III PPE Mix Factor, chemically resistant gloves will reduce the estimated exposure by 60 percent while the other types of PPE each reduce the estimated

---

[9] See Thomas et al (2010).

exposure by 10 percent and are additive up to a point. Two non-glove PPE items will reduce the estimated exposure by 20 percent. Three or more will reduce the estimated exposure by 30 percent.

3.2.3.1.5   PPE Apply

The indicator variables for use of personal protective equipment when applying pesticides are similar to those created for mixing pesticides. They are created using responses to question 5.38.

Q5.38) What (other) protective equipment did you normally wear (when you **applied** pesticides)? Did you wear:

(CHECK ALL THAT APPLY)
0. NONE P3_NO_PPE_APPLY
1. Goggles P3_GOGGLES_APPLY
2. Face Shield P3_FACE_SHIELD_APPLY
3. Disposable Coveralls, like Tyvek P3_TYVEK_APPLY
4. Rubber boots P3_BOOTS_APPLY
5. Respirator with Cartridge P3_RESP_APPLY
6. Dust Mask P3_DUST_MASK_APPLY
7. Long-sleeved shirt P3_LONG_SLEEVES_APPLY
91. OTHER P3_PPE_OTHER_APPLY
98. REF
99. DK

Three indicator variables were created using recoded other specify values:

- P3_APRON_APPLY;
- P3_CLOTH_COVERALLS_APPLY; and
- P3_RAIN_SUIT_APPLY.

We also created a variable P3_CHEMGLOVE_PPE_APPLY, to represent use of chemically resistant gloves while applying pesticides. If the response to question 5.37 (P3_GLOVEAPPLTYP) is 1 (chemically resistant gloves like Nitrile), 2 (rubber or plastic waterproof glove), or 3 (thin disposable glove like latex), then we set P3_CHEMGLOVE_PPE_APPLY = 1.   Otherwise we set P3_CHEMGLOVE_PPE_APPLY = 0.

In addition, we created a variable, P3_OTHEREQUIP_PPE_APPLY, to represent use of PPE equipment other than chemically resistant gloves while applying pesticides. If the response to

question 5.38 is in the range 1-6 or if the other specify includes use of aprons or rain suits we set P3_OTHEREQUIP_PPE_MIX to 1. If this was not the case, we set P3_OTHEREQUIP_PPE_MIX to 0.

P3_PPE0_APPLY

The indicator flag P3_PPE0_APPLY is set to 1 if the respondent did not use any personal protective equipment when applying pesticides and is set to 0 if he or she did use PPE. The P3_PPE0_APPLY flag is set using an intermediate variable APPLYPPE, which summarizes the values of all the possible PPE responses. APPLYPPE is set using the code:

IF   P3_GOGGLES_ APPLY = MISSING and
           P3_FACE_SHIELD_ APPLY = MISSING and
           P3_TYVEK_ APPLY = MISSING and
           P3_BOOTS_ APPLY = MISSING and
           P3_RESP_ APPLY = MISSING and
           P3_DUST_MASK_ APPLY = MISSING and
           P3_LONG_SLEEVES_APPLY = MISSING

THEN APPLYPPE = 0 ;

IF   P3_GOGGLES_ APPLY = 1 or
           P3_FACE_SHIELD_ APPLY = 1 or
           P3_TYVEK_ APPLY = 1 or
           P3_BOOTS_ APPLY = 1 or
           P3_RESP_ APPLY = 1 or
           P3_DUST_MASK_ APPLY = 1 or
           P3_LONG_SLEEVES_ APPLY = 1

THEN APPLYPPE = 1 ;

P3_PPE0_APPLY is then calculated using the following code:

```
IF APPLYPPE = 1 THEN P3_PPE0_APPLY = 0;
IF  APPLYPPE = 0 and
    P3_PERSONALLY_APPLY (see Section 3.2.3.2.2) = 1
THEN P3_PPE0_APPLY = MISSING ;

IF  APPLYPPE = 0 and
    P3_FILL_LOAD (see Section 3.2.3.2.1) = 1
THEN P3_PPE0_APPLY = 1 ;

IF  P3_NO_PPE_APPLY = 1 and
    P3_NO_PPE_APPLY_IND* = 0
THEN PPE0_APPLY = 1 ;

IF  P3_GLOVE_TYPE_1_APPLY = 1 or
    P3_LONG_SLEEVES_APPLY = 1 or
    P3_CLOTH_COVERALLS_APPLY = 1
THEN PPE0_APPLY = 1 ;
```

P3_NO_PPE_APPLY_IND is an intermediate variable that is used in derivation of PPE

APPLY variables but is not included on the delivery file. It is set using the following logic:

```
IF  P3_NO_PPE_APPLY = 1 and
    (P3_GOGGLES_APPLY = 1 or
    P3_FACE_SHIELD_APPLY = 1 or
    P3_TYVEK_APPLY = 1 or
    P3_BOOTS_APPLY = 1 or
    P3_RESP_APPLY = 1 or
    P3_DUST_MASK_APPLY = 1 or
    P3_LONG_SLEEVES_APPLY = 1)

THEN P3_NO_PPE_APPLY_IND = 1 ;

ELSE P3_NO_PPE_APPLY_IND = 0 ;
```

P3_PPE0_APPLY

```
IF  P3_PPE1_APPLY = 0 and
    P3_PPE2_APPLY = 0 and
    P3_PPE3_APPLY = 0
THEN P3_PPE0_APPLY = 1;
```

P3_PPE1_APPLY

The indicator flag for use of chemically resistant boots, face shield, or fabric or leather gloves when applying pesticides is P3_PPE1_APPLY. It is set using the logic:

        IF   (P3_BOOTS_APPLY = 1 or
                P3_FACE_SHIELD_APPLY = 1 or
                P3_GOGGLES_APPLY = 1 or
                P3_GLOVE_TYPE_APPLY *(see Section 3.2.3.2.4)* = 1
        THEN P3_PPE1_APPLY = 1 ;

P3_ PPE2_APPLY

        The indicator flag for use of chemically resistant coveralls or respirator when applying pesticides is P3_ PPE2_APPLY. It is set using the logic:

        IF   P3_TYVEK_APPLY = 1 or
                P3_RESP_APPLY = 1 or
                P3_DUST_MASK_APPLY = 1 or
                P3_APRON_APPLY = 1 or
                P3_RAIN_SUIT_APPLY = 1
        THEN P3_PPE2_APPLY = 1 ;

P3_ PPE3_APPLY

        The indicator flag for use of chemically resistant, rubber, or disposable gloves when applying pesticides is P3_ PPE3_APPLY. It is set using the logic:.

        IF   P3_GloveAppl = 1 and
                P3_GLOVE_TYPE_APPLY *(see Section 3.2.3.2.4)* = 1 or 2 or 3
        THEN P3_PPE3_APPLY = 1 ;

        IF   (P3_GloveApplTyp = 1 or 2 or 3) or
                P3_GLOVE_TYPE_APPLY_TEXT IN ('RUBBER or PLASTIC',
                                                'CHEMICAL RESISTANT',
                                                'DISPOSABLE LATEX')
        THEN P3_PPE3_APPLY = 1 ;

Phase III PPE factor apply

Original version

        The original version of the P3_PPE_FACTOR_APPLY is calculated using the following logic:

IF PPE0_APPLY = 1THEN P3_PPE_FACTOR_APPLY = 1 ;
IF PPE1_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.8 ;
IF PPE2_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.7 ;
IF PPE3_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.6 ;
IF PPE1_APPLY = 1 and PPE2_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.5 ;
IF PPE1_APPLY = 1 and PPE3_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.4 ;
IF PPE2_APPLY = 1 and PPE3_APPLY = 1   THEN P3_PPE_FACTOR_APPLY = 0.3 ;
IF PPE1_APPLY = 1 and PPE2_APPLY = 1 and PPE3_APPLY = 1
                                  THEN P3_PPE_FACTOR_APPLY = 0.1 ;

Version 2

        Version 2 of the Phase III PPE factor is named P3_V2_PPE_FACTOR_APPLY. It is calculated using following formula:

P3_V2_PPE_FACTOR_APPLY   = (1 - (0.6* CR_GLOVE_APPLY + 0.1*MINIMUM (SUM_APPLY_FINAL, 3))) ;

where CR_GLOVE_APPLY is an intermediate variable that is derived based on the responses to question 5.37 and 5.37a which are stored in variable P3_GLOVE_TYPE_APPLY (see Section 3.2.3.2.4). The logic is:

IF P3_GLOVE_TYPE_APPLY = 2 OR 3 OR 4 THEN CR_GLOVE_APPLY = 1;
ELSE CR_GLOVE_APPLY = 0 ;

The intermediate variable SUM_APPLY_FINAL is simply the sum of all of the non-glove PPE factors the flags representing PPE use during application. Since these flags take the value of 0 when the type of PPE represented by the flag is not used and take the value of 1 when that type of PPE is used, the sum is a count of the types on non-glove PPE used by the applicator when applying pesticides.

SUM_APPLY_FINAL = SUM (P3_TYVEK_APPLY,
                              P3_BOOTS_APPLY,
                              P3_FACE_SHIELD_APPLY,
                              P3_RESP_APPLY,
                              P3_APRON_APPLY,

P3_RAIN_SUIT_APPLY) ;

As with the PPE Mix Factor, that in Version 2 of the Phase III PPE Apply Factor, chemically resistant gloves will reduce the estimated exposure by 60 percent while the other types of PPE each reduce the estimated exposure by 10 percent and are additive up to a point. Two non-glove PPE items will reduce the estimated exposure by 20 percent. Three or more will reduce the estimated exposure by 30 percent.

Table 3–5 summarizes all of the PPE variables that appear on the datasets.

Table 3–5.   Phase III PPE Variables

Variable	Content
P3_APPLYPPE	Use PPE when applying pesticides
P3_APRON_APPLY	Q5.38a: Other Specify - Used apron when applying pesticides
P3_APRON_MIX	Q5.35a: Other Specify - Used apron when mixing/loading pesticides
P3_BOOTS_APPLY	Q5.37: Wore chemically resistant boots/shoes when applying pesticides
P3_BOOTS_MIX	Q5.15: Wore chemically resistant boots/shoes when mixing
P3_CHEMGLOVE_PPE_APPLY	PPE indicator for using chemically resistant gloves when applying pesticides
P3_CHEMGLOVE_PPE_MIX	PPE indicator for using chemically resistant gloves when mixing/loading pesticides
P3_CLOTH_COVERALLS_APPLY	Q5.38a: Other Specify - Used cloth coverall when applying pesticides
P3_CLOTH_COVERALLS_MIX	Q5.35a: Other Specify - Used cloth coverall when mixing/loading pesticides
P3_DUST_MASK_APPLY	Q5.38: Wore dust mask when applying pesticides
P3_DUST_MASK_MIX	Q5.35: Used dust mask when mixing/loading pesticides
P3_FACE_SHIELD_APPLY	Q5.38: Wore full face shield when applying pesticides
P3_FACE_SHIELD_MIX	Q5.15: Wore full face shield when mixing or loading
P3_GLOVE_TYPE_APPLY	Q5.36: Glove type worn when applying pesticides (code)
P3_GLOVE_TYPE_APPLY_TEXT	Glove type worn when applying pesticides (description)
P3_GLOVE_TYPE_MIX	Q5.33: Glove type worn when mixing pesticides (code)
P3_GLOVE_TYPE_MIX_TEXT	Glove type worn when mixing pesticides (description)
P3_GLOVEAPPL	Q5.36: Wore gloves when applying pesticides
P3_GLOVEAPPLTYP	Q5.37: Type of glove for Application
P3_GLOVEMX	Q5.33: Wear gloves when mixing pesticides
P3_GLOVETYP	Q5.34: Type of glove for mixing

Variable	Content
P3_GOGGLES_APPLY	Q5.38: Wore goggles when applying pesticides
P3_GOGGLES_MIX	Q5.15: Wore goggles while mixing or loading
P3_LONG_SLEEVES_APPLY	Q5.38: Used long sleeves shirt when applying pesticides
P3_LONG_SLEEVES_MIX	Q5.35: Used long sleeves shirt when mixing/loading pesticides
P3_MIXPPE	Use PPE when mixing or loading pesticides
P3_NO_PPE_APPLY	Indicator for no PPE used while applying
P3_NO_PPE_MIX	Q5.35: PPE wore when mixing
P3_OTHEREQUIP_PPE_APPLY	PPE indicator for using PPE other than chemically resistant gloves when applying pesticides
P3_OTHEREQUIP_PPE_MIX	PPE indicator for using PPE other than chemically resistant gloves when mixing/loading pesticides
P3_OTHGLOVEAPPL	Q5.37a: Type of Glove for Application: other specify
P3_OTHGLOVETYPE	Q5.34a: Type of glove for mixing: other specify
P3_OTHPPE_APPL	Q5.38a: Other PPE used while applying
P3_OTHPPE_MIX	Q5.35a: Other PPE used while mixing
P3_PPE_OTHER_APPLY	Indicator for using other PPE while applying
P3_PPE_OTHER_MIX	Indicator for using other PPE while mixing or loading
P3_RAIN_SUIT_APPLY	Q5.38a: Other Specify - Used rain suit when applying pesticides
P3_RAIN_SUIT_MIX	Q5.35a: Other Specify - Used rain suit when mixing/loading pesticides
P3_REPAIRAPPLEQ	Q5.39: How often did you stop to readjust or repair your application equipment
P3_RESP_APPLY	Wore respirator while applying
P3_RESP_MIX	Q5.1: Used respirator when mixing or loading pesticides
P3_TYVEK_APPLY	Q5.38: Used chemically resistant overalls like Tyvek when applying
P3_TYVEK_MIX	Q5.15: Used chemically resistant overalls like Tyvek
P3_PPE0_APPLY	Indicator flag for no use of PPE when applying pesticides
P3_PPE0_MIX	Indicator flag for no use of PPE when mixing or loading pesticides
P3_PPE1_APPLY	Indicator flag for use of chemically resistant boots, face shield, or fabric or leather gloves when applying pesticides
P3_PPE1_MIX	Indicator flag for use of chemically resistant boots, face shield, or fabric or leather gloves when mixing pesticides
P3_PPE2_APPLY	Indicator flag for use of chemically resistant coveralls or respirator when applying pesticides
P3_PPE2_MIX	Indicator flag for use of chemically resistant coveralls or respirator when mixing or loading pesticides
P3_PPE3_APPLY	Indicator flag for use of chemically resistant, rubber, or disposable gloves when applying pesticides
P3_PPE3_MIX	Indicator flag for use of chemically resistant, rubber, or disposable gloves when mixing or loading pesticides
P3_V2_PPE_FACTOR_APPLY	Version 2 - PPE factor for applying pesticides

Variable	Content
P3_V2_PPE_FACTOR_COMBINED	Version 2 - PPE factor - combined for mixing, loading, and applying pesticides
P3_V2_PPE_FACTOR_MIX	Version 2 - PPE factor for mixing pesticides

3.2.3.1.5.1 **PHASE III V2 REPAIR SCORE**

In Phase III the repair score variable P3_V2_REPAIR_SCORE is derived based on responses to question 5.39:

P3_REPAIRAPPLEQ
Q5.39) (Since ^DSP.YearOfLastInterview), in general, on days when pesticides were applied, how often did you stop to readjust or repair your application equipment? Was it:

1. Never
2. Less than half the days
3. Half or more than half the days
4. Always
8. REF
9. DK

The repair score variable is set to zero if the respondent did not repair pesticide application equipment and is set to 20 if he or she did repair pesticide application equipment. The logic used is:

If P3_REPAIRAPPLEQ = 2 or 3 or 4 THEN P3_V2_REPAIR_SCORE = 20;
If P3_REPAIRAPPLEQ = 1 THEN P3_V2_REPAIR_SCORE = 0;

3.2.3.1.6   PPE Combined Factor

The Version 2 combined factor representing the level of PPE use for mixing, loading, and applying pesticides is the minimum of the PPE mix factor and the PPE apply factor. It is calculated using the code:

P3_V2_PPE_FACTOR_COMBINED =
        MINIMUM (P3_V2_PPE_FACTOR_MIX, P3_V2_PPE_FACTOR_APPLY) ;

3.2.3.2   Intermediate Derived Variables

A number of variables were calculated for later use in the algorithm used to estimate the intensity adjusted exposure scores. These include:

- Indicator Variable for Filling or Loading Equipment with Pesticides;
- Indicator Variable for Personally Applying Pesticides;
- Phase III Glove Types Used in Mixing or Loading Pesticides; and
- Phase III Glove Types Used when Applying Pesticides.

Each of these variables is used directly or indirectly in calculation of the algorithm scores. The derivation details for each of these intermediate variables is discussed in a separate section below.

3.2.3.2.1   Indicator Variable for Filling or Loading Equipment with Pesticides

The indicator variable P3_FILL_LOAD indicates whether the respondent personally filled or load application equipment for crops and noncrops. It is set using responses to the following personally mix or load questions:

P3_CROPMXLD_CROPHRB
Q5.1) On the days when ^PST.HighCropHerb was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

  1. Never (Skip to Q5.3)
  2. Less than half the days
  3. Half or more than half the days

4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.2)
8. REF (Skip to Q5.3)
9. DK

P3_CROPMXLD_CROPINS

Q5.9) On the days when ^PST.HighCropInsect was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

1. Never (Skip to Q5.11)
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.3)
8. REF (Skip to Q5.11)
9. DK (Skip to Q5.11)

P3_CROPMXLD_FNG

Q5.17) On the days when ^PST.HighCropFung was applied to crops or other plants, how often did you personally mix it or load it into the application equipment? Was it:

1. Never (Skip to Q5.19)
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.4)
8. REF (Skip to Q5.19)
9. DK (Skip to Q5.19)

P3_ANIMMXLD_ANIMALINS

Q5.25) These next questions are about your use of insecticides on animals or animal confinement areas. Since ^DSP.YearOfLastInterview, when you applied ^PST.HighAnimalInsect on animals or animal confinement areas, how often did you personally mix the insecticide or load the application equipment yourself? Was it

1. Never
2. Less than half the days
3. Half or more than half the days
4. Always
7. INCORRECT PESTICIDE (Skip to Box 5.5)
8. REF
9. DK

P3_OTHMXLD_NONCROPPEST

Q5.28) These next questions are about the pesticides you applied for purposes other than to crops or animals. (Since ^DSP.YearOfLastInterview), on days when ^PST.HighNonCropPest was applied, how often did you personally mix the pesticide or load the application equipment yourself? Was it:

    1. Never
    2. Less than half the days
    3. Half or more than half the days
    4. Always
    7. INCORRECT PESTICIDE (Skip to Box 5.6)
    8. REF
    9. DK

The value of P3_FILL_LOAD is set using the logic:

IF   P3_CropMxLd_CropHrb in (2,3,4) or
           P3_CropMxLd_CropIns in (2,3,4) or
           P3_CropMxLd_Fng in (2,3,4) or
           P3_AnimMxLd_AnimalIns in (2,3,4) or
           P3_OthMxLd_NonCropPest in (2,3,4)

THEN P3_FILL_LOAD = 1 ;
ELSE P3_FILL_LOAD = 0 ;

3.2.3.2.2   Indicator Variable for Personally Applying Pesticides

The indicator variable P3_PERSONALLY_APPLY indicates whether the respondent personally applied pesticides. It is set using responses to the following personally following questions:

P3_PERSAPPL_CROPHRB
Q5.3) Since ^DSP.YearOfLastInterview, on the days when ^PST.HighCropHerb was applied to crops or other plants, did you personally apply it?

    0. NO (Skip to Box 5.2)
    1. YES
    8. REF (Skip to Box 5.2)
    9. DK

P3_PERSAPPL_CROPINS

Q5.10) How many times per day, on average, did you personally mix this pesticide (^PST.HighCropInsect) or load it into the application tank or bin when applied to crops or other plants?

|__|__| [Range: 1 to 96]
98. REF
99. DK

P3_PERSAPPL_FNG
Q5.19) Since ^DSP.YearOfLastInterview, on the days when ^PST.HighCropFung was applied to crops or other plants, did you personally apply it?

0. NO (Skip to Box 5.4)
1. YES
8. REF (Skip to Box 5.4)
9. DK (Skip to Box 5.4)

The value of P3_PERSONALLY_APPLYis set using the logic:

IF   P3_PersAppl_CropHrb = 1 or
        P3_PersAppl_CropIns = 1 or
        P3_PersAppl_Fng = 1

THEN P3_PERSONALLY_APPLY = 1 ;
ELSE P3_PERSONALLY_APPLY= 0 ;

3.2.3.2.3   Phase III Glove Types Used in Mixing or Loading Pesticides

In derivation of some PPE variables related to the mixing or loading of pesticides, the types of gloves used by the respondents are also taken into account. The information comes from question 5.34 and 5.34a:

P3_GLOVETYP
Q5.34) What type of glove did you normally wear? Was it:

1. Chemical Resistant Glove, like Nitrile (Skip to Q5.35)
2. Rubber or Plastic Waterproof Glove (Skip to Q5.35)
3. Thin Disposable Glove like Latex (Skip to Q5.35)
4. Fabric or Leather (Skip to Q5.35)

91. OTHER, SPECIFY
98. REF (Skip to Q5.35)
99. DK (Skip to Q5.35)

P3_OTHGLOVETYPE
Q5.34a) [What type of glove did you normally wear?]

OTHER, SPECIFY: _____

The responses to these two questions were combined into a single variable named P3_GLOVE_TYPE_MIX. If the response to question 5.34 or the verbatim response to question 5.34a indicated that the respondent used chemically resistant gloves then the value of P3_GLOVE_TYPE_MIX was set to 1. If the responses indicated that the respondent used rubber or plastic waterproof gloves, the value of P3_GLOVE_TYPE_MIX was set to 2. If the responses indicated that the respondent used thin, disposable gloves, the value of P3_GLOVE_TYPE_MIX was set to 3. If the responses indicated that the respondent used fabric or leather gloves, the value of P3_GLOVE_TYPE_MIX was set to 4. Any responses to question 5.34a that could not be mapped to one of these 4 values were set to 91. Thus the values of P3_GLOVE_TYPE_MIX have the following meanings:

1 = Chemical Resistant Glove
2 = Rubber or Plastic Waterproof Glove
3 = Thin Disposable Glove
4 = Fabric or Leather Glove
91 = Other

The variable P3_GLOVE_TYPE_MIX_TEXT contains the corresponding textual descriptions:

- CHEMICAL RESISTANT
- RUBBER OR PLASTIC
- DISPOSABLE LATEX
- FABRIC OR LEATHER
- OTHER

3.2.3.2.4 Phase III Glove Types Used when Applying Pesticides

In derivation of some PPE variables related to the applying of pesticides, the types of gloves used by the respondents are also taken into account. The information comes from question 5.37 and 5.37a, which are the same as the corresponding questions asked about mixing and loading pesticides:

P3_GLOVEAPPLTYP
Q5.37) What type of glove did you normally wear? Was it:

    1. Chemical Resistant Glove, like Nitrile (Skip to Q5.38)
    2. Rubber or Plastic Waterproof Glove (Skip to Q5.38)
    3. Thin Disposable Glove like Latex (Skip to Q5.38)
    4. Fabric or Leather (Skip to Q5.38)
    91. OTHER
    98. REF (Skip to Q5.38)
    99. DK (Skip to Q5.38)

P3_OTHGLOVEAPPL
Q5.37a) [What type of glove did you normally wear?]

    OTHER, SPECIFY: _____

The variables P3_GLOVE_TYPE_APPLY and P3_GLOVE_TYPE_APPLY_TEXT are constructed using logic similar to that for the corresponding variables for glove types used during mixing and loading of pesticides (see Section 3.2.3.2.3)

3.2.3.3 **Phase III Days per Year of Use**

Phase III Days per Year of Use variables (e.g., P3_FUM_A_DAYSPERYR_1 - Average lifetime days per year used Methyl Bromide (PCCODE=053201) reported in Phase III) are calculated using the responses to question 4.7. The sum of the maximum number of days, P3_DAYSYRLIFE pesticides were applied to crops, plus the maximum number of days, P3_DAYSYRLIFE pesticides were applied to animals, plus the maximum number of days, P3_DAYSYRLIFE pesticides were applied to noncrops, plus the maximum number of days, P3_DAYSYRLIFE pesticides were applied to other.

Note that the P3_CRANNC_IND variable, which indicates the general class of items to which a pesticide is applied, can have one of the 4 values:

- Crop,

- Animal,
- Noncrop; and
- Other.

In the small number of cases where no response was collected for P3_CRANNC_IND, if the participant reported the specific pesticide in Phase II, then the Phase II crop/animal/noncrop value most frequently reported by the respondent in Phase II was used to populate the P3_CRANNC_IND variable. For the remaining records with no response for P3_CRANNC_IND, it was assigned the value of "Other.". This was done to ensure that all usage days for a pesticide are taken into consideration when calculating the maximum number of days of use of a pesticide.

P3_DAYSYRLIFE
Q4.7) During the years you applied **^Pesticide_Verbatim ^Pst_Used_On_Txt**, for how many days per year on average did you personally mix, load, handle, or apply it?

|__|__|__| [Range: 1 to 365]
998. REF
999. DK

3.2.3.4 Phase III Reported Life Years

The total years of use of a pesticide over a respondent's lifetime as reported in Phase III (e.g., P3_FUM_A_RPT_LIFE_YRS_1- Years used Methyl Bromide) were calculated for all A-list chemicals using the responses to question 4.6. The value was defined as the sum of the maximum number of years pesticides were used on crops, plus the maximum number of years pesticides were used on animals, plus the maximum number of years pesticides were used onto noncrops, plus the maximum number of years pesticides were used for any other (or an unknown) purpose. The years of application were asked in question 4.6 and captured in variable P3_YRSLIFE.

P3_YRSLIFE
Q4.6) You mentioned that you have used **^Pesticide_Verbatim ^Pst_Used_On_Txt**. For how many years over your lifetime have you personally mixed, loaded, handled, or applied this pesticide?

|__|__| [Range: 1 to 96]
97. INCORRECT PESTICIDE
98. REF

99. DK

3.2.3.5 Phase III Reported Lifetime Days

The Phase III reported lifetime days of use for each A-list pesticide chemical is the product of Days per Year (Section 3.2.3.3) of use and reported life years (Section 3.2.3.4):

Phase III reported lifetime days = Phase III Days per Year of Use * Phase III reported life years

These lifetime days variables have "RPT_LIFE_DAYS" in the variable name. For example, P3_FUM_A_RPT_LIFE_DAYS1 is the reported lifetime days (through Phase III) of use of Methyl Bromide (PCCODE=053201).

3.2.3.6 Phase III Years of Usage

The Phase III Years of Usage variable for each pesticide is derived as the minimum of the number of years since the last interview (NYRS_PH3_LAST), and the responses to question 3.3 ("Since <year of last interview>, for how many years did you personally mix, load, handle or apply any of these chemicals?") and question 4.6 ("For how many years over your lifetime have you personally mixed, loaded, handled, or applied this pesticide?"). The Phase III years of usage variable name associated with a pesticide includes "_A_YRS," "_AA_YRS," or "_B_YRS" in the variable name. For example, P3_FUM_A_YRS_1 is the Phase III years of usage variable for Methyl Bromide.

Since a specific PC Code can appear in the supplemental file multiple times for a participant when the same active ingredient is included in the formulation for more than one pesticide that he or she used, the maximum value for P3_YRSLIFE (the variable holding the response to question 4.6) for each PC Code reported by the participant is used in the calculation of the Phase III years of usage.

3.2.3.7 Number of Years since Last Interview –

The number of years since the last AHS interview, NYRS_PH3_LAST, is calculated by subtracting Phase II interview reference year from the Phase III reference year. When no Phase II

interview was conducted, the value was calculated by subtracting the Phase I reference year from the Phase III reference year. For the purposes of this calculation, the Phase I, II and III reference years were determined using the same logic as that used in Phase II for derivation of NYRS_PH2_PH1:

- If InterviewMonth is between 1 to 10 then ReferenceYear = [InterviewYear – 1].

- If InterviewMonth is 11 or 12 THEN ReferenceYear = InterviewYear

The reference years are set in this manner to ensure that the time period referred to in the farming questions refer to entire planting-harvesting calendar.

3.2.3.8 Phase III Total Days Used

The Phase III total days of use for a pesticide is derived as the product of the Phase III years of usage (see Section 3.2.3.6) and the Phase III days per year (see Section 3.2.3.3):

Phase III total days used = Phase III years of usage* Phase III Days per Year of Use

The total days of use variables include the string "TOTAL_DAYS_USE" in their variable names. For example, P3_FUM_RY_A_TOTAL_DAYS_USE1 represent the Phase III total days of use of Methyl Bromide.

3.2.3.9 Total Hours of Use since Enrollment

P3_TOTAL_HOURS in the supplemental file is days times years during the period that the reported pesticide was used is calculated using the formula:

P3_TOTAL_HOURS = P3_DAYSYRLIFE(Q4.7) * P3_HOURS;

P3_DAYSYRLIFE
Q4.7) During the years you applied **^Pesticide_Verbatim ^Pst_Used_On_Txt**, for how many days per year on average did you personally mix, load, handle, or apply it?

|__|__|__| [Range: 1 to 365]
998. REF
999. DK

P3_HOURS is a derived variable in the supplemental file and holds the hours per day reported in section 5 for the names of the pesticides applied the most days per year in the six categories:

P3_HOURS_CROPHRB
Q5.8) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighCropHerb?

|__|__| HOURS [Range: 1 to 20]
97. LESS THAN ONE HOUR
98. REF
99. DK

P3_HOURS_CROPINS
Q5.16) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighCropInsect?

|__|__| HOURS [Range: 1 to 20]
97. LESS THAN ONE HOUR
98. REF
99. DK

P3_HOURS_FUNGICIDE
Q5.24) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighCropFung (for crops and other plants)?

[ENTER 97 FOR LESS THAN 1 HOUR]
|__|__| HOURS [Range: 1 to 20]
97. LESS THAN ONE HOUR
98. REF
99. DK

P3_HOURS_ANIMALINS
Q5.27) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighAnimalInsect?

> [ENTER 97 FOR LESS THAN 1 HOUR]
> |__|__| HOURS [Range: 1 to 20]
> 97. LESS THAN ONE HOUR
> 98. REF
> 99. DK

P3_HOURS_NONCROPPEST2 above
Q5.30) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighNonCropPest?

> |__|__| HOURS [Range: 1 to 20]
> 97. LESS THAN ONE HOUR
> 98. REF
> 99. DK

P3_HOURS_FUM2 above
Q5.32) For how many hours per day on average did you personally mix, load, handle, or apply ^PST.HighFumigant?

> |__|__| HOURS [Range: 1 to 20]
> 97. LESS THAN ONE HOUR
> 98. REF
> 99. DK

3.2.3.10 **Algorithm Adjusted Hours**

The variable P3_ALGO_INTENSITY_HOURS in the supplemental file is a product of the algorithm score (Section 3.2.3.1) and total hours of use since enrollment (see Section 3.2.3.9).

P3_ALGO_INTENSITY_HOURS = P3_ALGO_SCORE * P3_TOTAL_HOURS ;
P3_V2_ALGO_INTENSITY_HOURS = P3_V2_ALGO_SCORE * P3_TOTAL_HOURS ;

3.2.3.11 **Average Algorithm Intensity Score**

As in Phase II, if different application methods were used, then these separate applications of the same active ingredient may have different intensity scores. When a single applicator reported multiple

uses of the same active ingredient with different intensity scores, a time-weighted average intensity score based on the reported hours per day across all these applications is calculated to obtain a single intensity score for each pesticide per subject. The average intensity score variable names include the characters "AVG_ALG_INTSCORE". For example, Version 2 of the Average algorithm intensity score for Methyl Bromide is P3_V2_FUM_A_AVG_ALG_INTSCORE1. The variables used in the calculation are P3_V2_ALGO_INTENSITY_HOURS and P3_TOTAL_HOURS.

3.2.3.12 Reported Lifetime Intensity Days

The reported lifetime intensity days for each of 50 A-list chemical is the product of reported Phase III lifetime days (Section 3.2.3.5) and the average intensity score (section 3.2.3.11). So for Methyl Bromide the reported lifetime intensity days is calculated as:

P3_V2_FUM_A_RPT_LIFE_INTDAYS_1 =
(P3_FUM_A_RPT_LIFE_DAYS1 * P3_V2_FUM_A_AVG_ALG_INTSCORE1) ;

3.2.3.13 Phase III Intensity Days

The Phase III Intensity Days value for each pesticide is the product of the Phase III total days that the pesticide was used (see Section 3.2.3.8) and the average intensity score for the pesticide (see Section 3.2.3.11). For Methyl Bromide the Phase III intensity days value is calculated as:

P3_V2_FUM_RY_A_INTENSITY_DAYS1=
(P3_FUM_RY_A_TOTAL_DAYS_USE1 * P3_V2_FUM_A_AVG_ALG_INTSCORE1)

3.2.3.14 Phase III Lifetime Days

The Phase III lifetime days values for each of the 50 A-list chemicals about which information was collected in Phase I are derived by adding Phase I days, Phase II days and Phase III days of total days of use (see Section 3.2.3.8). For Methyl Bromide the Phase III the Phase III lifetime days value is calculated as:

P3_FUM_A_LIFE_DAYS_1 = SUM (A_FUMIGANT_LIFE_DAY1,
A2_FUM_RY_A_TOTAL_DAYS_USE1,

P3_FUM_RY_A_TOTAL_DAYS_USE1) ;

The Phase I days of use are derived using the same logic as in Phase II:

A_FUMIGANT_LIFE_DAY1 = A_FUMIGANT_DAY1* A_FUMIGANT_YR1 ;

Phase III lifetime days variables can only be calculated for applicators. In Phase I, spouses were asked whether or not they had personally used the 50 chemicals, but were not asked then number of years and days that they used them.

Note that the Phase III lifetime days values (see Section 3.2.3.5) will often not match the reported lifetime days for reasons described in Section 2.2.2.

3.2.3.15 Phase III Lifetime Intensity Days

The Phase III lifetime intensity days for each of 50 A-list chemical is the product of Phase III lifetime days (section 3.2.3.14) and the average intensity score (section 3.2.3.11). So for Methyl Bromide the Phase III lifetime intensity days value is calculated as:

P3_V2_FUM_A_LIFE_INTDAYS_1 =
(P3_FUM_A_LIFE_DAYS_1 * P3_V2_FUM_A_AVG_ALG_INTSCORE1) ;

As for Phase III lifetime days variables, the Phase III lifetime intensity days variables can only be calculated for applicators. Since the Phase III lifetime days variables are not defined for spouses, neither are the Phase III lifetime intensity days variables.

3.2.3.16 Combined Permethrin Variables

Permethrin use was reported separately for crop and animal applications and a full set of exposure-related variables has been created for each type of application. To facilitate analyses that need to utilize a total Permethrin exposure score, a set of cumulative Permethrin variables have been created (see Table 3–6).

Table 3–6.   Combined Permethrin Variables

Variable Name	Description
P3_INSECTICIDE_A_PERM	Phase III Indicator for personally applied PERMETHRIN (On Crops, Non-Crop and Animal)
P3_INSECTICIDE_LY_A_PERM	Lifetime (Phase 1+ 2 + 3) Indicator for use of PERMETHRIN (On Crops, Non-Crop and Animal)
P3_INS_A_DAYSPERYR_PERM	Average lifetime days per year used PERMETHRIN (On Crops, Non-Crop and Animal)
P3_INS_A_RPT_LIFE_YRS_PERM	Reported life years used PERMETHRIN (Sum of Crop, Non-Crop and Animal)
P3_INS_RY_A_TOTAL_DAYS_USE_PERM	Phase III total days used PERMETHRIN (Sum of Crop, Non-Crop and Animal)
P3V2_INS_RYA_INTENSITY_DAYS_PERM	Phase III intensity weighted days (ver 2) for PERMETHRIN (Sum of Crop, Non-Crop and Animal)
P3V2_INS_A_RPT_LIFE_INTDAYS_PERM	Reported lifetime intensity weighted days (ver 2) used PERMETHRIN (Sum of Crop, Non-Crop and Animal)
P3_V2_INS_A_LIFE_INTDAYS_PERM	Lifetime intensity weighted days (ver 2) used PERMETHRIN (For Crops, Animals and Noncrop)

The following logic was used to create each of variables:

IF P3_INSECTICIDE_A_1 = 1 or P3_INSECTICIDE_A_2 = 1
THEN P3_INSECTICIDE_A_PERM = 1;
ELSE P3_INSECTICIDE_A_PERM = 0 ;

IF P3_INSECTICIDE_LY_A_1 = 1 or P3_INSECTICIDE_LY_A_2 = 1
THEN P3_INSECTICIDE_LY_A_PERM = 1 ;
ELSE P3_INSECTICIDE_LY_A_PERM = 0 ;

P3_INS_A_DAYSPERYR_PERM = SUM(P3_INS_A_DAYSPERYR_1,
                                                        P3_INS_A_DAYSPERYR_2) ;

P3_INS_A_RPT_LIFE_YRS_PERM = SUM(P3_INS_A_RPT_LIFE_YRS_1,
                                                        P3_INS_A_RPT_LIFE_YRS_2) ;

P3_INS_RY_A_TOTAL_DAYS_USE_PERM =
                                SUM(P3_INS_RY_A_TOTAL_DAYS_USE1,
                                        P3_INS_RY_A_TOTAL_DAYS_USE2) ;

P3V2_INS_RYA_INTENSITY_DAYS_PERM =
                                SUM(P3_V2_INS_RY_A_INTENSITY_DAYS1,
                                P3_V2_INS_RY_A_INTENSITY_DAYS2) ;

P3V2_INS_A_RPT_LIFE_INTDAYS_PERM =
                                SUM(P3_V2_INS_A_RPT_LIFE_INTDAYS_1,

$$P3\_V2\_INS\_A\_RPT\_LIFE\_INTDAYS\_2)\ ;$$

$$P3\_V2\_INS\_A\_LIFE\_INTDAYS\_PERM = $$
$$SUM(P3\_V2\_INS\_A\_LIFE\_INTDAYS\_1,$$
$$P3\_V2\_INS\_A\_LIFE\_INTDAYS\_2)\ ;$$

3.2.3.17 Distinguishing Version 1 and Version 2 Algorithm-Related Variable Names

Variable names for version 2 of the algorithm-related variables have the same structure as the original variable names except that they include the characters "V2" in the name. For example, A3_MIX_SCORE is the variable with the mix score using the original version of the algorithm and A3_V2_MIX_SCORE is the name of the corresponding variable using version 2 of the algorithm.

3.2.4   Derived Variables

Derived variables are variables created by combining or manipulating responses to items asked directly in the questionnaires. A number of types of derived variables are included in the data files:

- Conversion of arrays to indicator variables;
- Variables in supplemental files summarized in analysis files;
- Functional and chemical class flags;
- Conversion of multiple response lists to indicator variables;
- Added names of active ingredients corresponding to the PC Codes; and
- Created days per year and hours per year variables.

The derivation of each type is discussed in a separate section below.

3.2.4.1   Conversion of Multiple Response Lists to Indicator Variables

Questions with lists that allow the interviewer to mark all the responses given by a respondent have been converted from lists of variables each of which could take any of the response codes to indicator variables for each possible response. Each indicator variable has the value of 0 if the respondent did not name the item or 1 if he or she did mention it.

The data structures used for data collection during the interviews were effective for that purpose but are awkward to use for the purposes of data analysis. For instance, question 2.3, "Excluding gardens for personal use, what crops, including fruits and vegetables, were raised on your farm since [the year of the last interview]?" lists 42 crops and includes the interviewer instruction "CODE ALL THAT APPLY." The CATI instrument collected these responses in an array. The order of the entries in the array reflected the order in which the respondent named the crops. For analysis purposes, these responses were converted to a set of indicator variables with a separate variable for each crop (e.g., P3_CR_APPLES, P3_CR_ALFALFA, and P3_CR_BARLEY). Each of these variables was set to the value 1 if the respondent named the corresponding crop and left as missing if he or she did not name the crop.

One of the possible responses to this question was "Other, specify." When this response was received the name of the additional crop was recorded in the variable P3_OTHCROP. New indicator variables were created to reflect these responses as well. The full set of crop indicator variables is listed in Appendix C.

3.2.4.2 Variables in Supplemental Files Summarized in Analysis Files

The Private Applicator Supplemental Pesticide File and the Spouse Supplemental Pesticide File contain detailed information on the number of days and hours the respondent applied each pesticide to each crop, animal, or noncrop to which he or she applied it. For each pesticide on the A list, the number of application days and the intensity-adjusted application days have been summarized at the pesticide level and placed on the respondent's record on the main Private Applicator File or Spouse File. Key Phase I exposure variables have also been placed on the Phase III master Private Applicator File[10]

For each of the types of pesticides that a person used, the interviewer asked the respondent " what application method did you use the most?" for the pesticide with the highest number of application days in that category. The interviewer also asked, "What application method did you use the second most?"

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[10] The years of use and days of use variables were not collected for Spouses in Phase I.

Information on use of personal protective equipment (PPE) was collected at the person level so that an adjusted exposure estimate could be made taking these practices into account. The adjustment was made by multiplying the total exposure in hours by an intensity score which was based on applicator behavior. The intensity algorithm used was comparable to that used during Phase I of the AHS (see M. Dosemici et al., 2002). An intensity score was calculated for each of the 83 chemicals on the A list when the data were available on the questionnaire. Since some of the chemicals on the list that were based on the Phase I questionnaire are no longer used, there was no exposure to them and thus no intensity scores were calculated for them. In Phase I, it was not possible to distinguish PPE used while mixing chemicals from that used in applying them. Both types of information were collected in Phase II and in Phase III. Phase III intensity scores use the separate data PPE data for mixing and applying chemicals and a combined PPE score when adjusting repair-related exposure estimates.

3.2.4.3 Functional and Chemical Class Flags

Two sets of related derived variables were also created and placed on the analysis files: chemical class flags and functional class flags. These are shown in Table 3–7 and Table 3–8. The chemical group flags have the same definitions as those on the Phase I data sets.

Table 3–7.   Functional classes

Herbicides (Variable P3_HRB)[11]		
Alachlor products	EPTC products	Pendimethalin products
Atrazine products	Glyphosate products	Petroleum oil/petroleum distillates
Butylate products	Imazethapyr products	Trifluralin products
Chlorimuron ethyl products	Metolachlor products	2,4,5-T
Cyanazine products	Metribuzin products	2,4,5-TP (Silvex)
Dicamba products	Paraquat	2,4-D

Insecticides (Variable P3_INS)		
Aldicarb products	Dichlorvos or DDVP products	Malathion
Aldrin	DDT	Parathion
Carbaryl products	Diazinon products	Permethrin or pyrethroid products
Carbofuran products	Dieldrin	Phorate products
Chlordane	Fonofos products	Terbufos products
Chlorpyrifos products	Heptachlor	Toxaphene
Coumaphos products	Lindane products	Trichlorfon products

Fungicides (Variable P3_FNG)		
Benomyl products	Chlorothalonil products	Metalaxyl products
Captan products	Maneb or mancozeb products	Ziram products

Fumigants (Variable P3_FUM)	
Aluminum Phoshide products	Ethylene dibromide products
Carbon tetrachloride/carbon disulfide	Methyl bromide products

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[11] The prefix "A2" is used in the Private Applicator File. The prefix "C2" is used in the Commercial Applicator File. The prefix "S2" is used in the Spouse File.

Table 3–8.   Chemical classes

Organochlorine Insecticides (Variable P3_OCH)		
Aldrin	Chlordane	DDT
Dieldrin	Heptachlor	Lindane
Toxaphene		

Organophosphate Insecticides (Variable P3_OPH)		
Chlorpyrifos	Coumaphos	Diazinon
Dichlorvos/DDVP	Fonofos	Malathion
Parathion	Phorate	Terbufos
Trichlorfon		

Organothiophosphate Insecticides (Variable P3_OTH)		
Chlorpyrifos	Coumaphos	Diazinon
Fonofos	Phorate	Terbufos

Carbamate Pesticides* (Variable P3_CAR)		
Aldicarb	Carbofuran	Carbaryl
Benomyl		

Phenoxy Herbicides (Variable P3_PNX)		
2,4-D	2,4,5-TP (Silvex)	2,4,5-T

Triazine Herbicides (Variable P3_TRZ)		
Atrazine	Cyanazine	Metribuzin

*Includes insecticides and one fungicide.

3.2.4.4 **Added Names of Active Ingredients Corresponding to the PC Codes**

A set of four variables on the Supplemental Pesticide Files provide the names of the chemicals represented by the PC codes. AIName1 corresponds to PCCode1, AIName2 corresponds to PCCode2, AIName3 corresponds to PCCode3, and AIName4 corresponds to PCCode4. For example, Pursuit Plus contains two chemicals, Imazaquin (PC Code 128848) and Pendimethalin (PC Code 108501), so the PCCode and AIName variables have the values shown in Table 3-8.

Table 3–9.   Values of PC code and active ingredient name variables for Pursuit Plus

Variable	Value
PCCode1	128848
PCCode2	108501
PCCode3	blank
PCCode4	blank
AIName1	IMAZAQUIN
AIName2	PENDIMETHALIN
AIName3	blank
AIName4	blank

3.2.4.5 **Created Days per Year and Hours per Year Variables**

Each record in the Phase III Private Applicator and Spouse Files contains a set of days per year variables for each pesticide on the extended A list -- the list of 83 pesticides consisting of the 50 pesticides included in the Phase I questionnaire supplemented by 33 additional pesticides of high interest reported during Phase II. A corresponding set of 83 hours per year variables was also created.

The days per year variable for a specific respondent and specific pesticide was created by first determining the maximum number of days per year reported by the respondent for a pesticide for each application type (Crop/Animal/NonCrop). The days per year value for that pesticide for that person was calculated as the sum of these three maxima. That is, it was the sum of the maximum reported days per year over all crops for which that respondent used that pesticide, the maximum reported days per year over all animals for which that respondent used that pesticide, and the maximum reported days per year over all noncrops for which that respondent used that pesticide.

The hours per year variable for a specific respondent and specific pesticide was created by multiplying the reported days per year by the reported average hours per day for each reported instance of use of the pesticide and then summing these products over all reports across all application types.

3.2.4.6   Smoking Status and Pack Year Variables

Derived variables were created to represent each respondent's smoking status at the time of the Phase III interview and the number of pack years that he or she smoked.

Smoking Status variable P3_Smoke_Status

The smoking status variable P3_Smoke_Status was created based on the responses to questions 8.6, 8.7, and 8.9 in the questionnaire. The values assigned to the variable are:

1 = Never Smoked

2 = Not Regular Smoker

3 = Past Smoker

4 = Current Smoker

The smoking status questions are:

P3_SMOK100
Q8.6) Have you smoked a total of 100 cigarettes or more during your lifetime?

0. NO (Skip to Q8.14)
1. YES
8. REF (Skip to Q8.14)
9. DK (Skip to Q8.14)

P3_REGSMOK
Q8.7) Have you ever been a regular smoker, that is have you ever smoked at least 3 cigarettes/week for at least 6 months or more?

0. NO (Skip to Q8.14)
1. YES
8. REF (Skip to Q8.14)
9. DK (Skip to Q8.14)

Q8.9) Do you currently smoke every day, some days or not at all?

      1. EVERY DAY (Skip to Q8.11)
      2. SOME DAYS (Skip to Q8.11)
      3. NOT AT ALL
      8. REF (Skip to Q8.11)
      9. DK (Skip to Q8.11)

The logic used to assign the smoking status values is:

If P3_Smok100 (Q 8.6) = 0 then P3_Smoke_Status = 1 /*Never Smoked*/

If P3_Regsmok (Q 8.7) = 0 then P3_Smoke_Status = 2 /*Not Regular Smoker*/

If P3_SmokFreq (Q 8.9) = 1 or 2 then P3_Smoke_Status = 4 /*Current Smoker*/

If P3_SmokFreq (Q 8.9) = 3 then P3_Smoke_Status = 3 /*Past Smoker*/

Else P3_Smoke_Status = Missing.

Pack Years Variable P3_Pack Years

The pack years variable P3_PackYears was created based on the responses to questions 8.6, 8.8, 8.8a, 8.10, 8.10a, 8.11, 8.11, 8.11a, and 8.13. If the response to question 8.6 was 0 (has not smoked a total of 100 cigarettes), the value of P3_PackYears was set to 0. If the respondent has smoked, then we calculated three intermediate variables: Packs, Number of smoking years (NumSmokeYears) and number of non-smoking years (NoSmokYrs) and set P3_PackYears equal to Packs multiplied by the number of smoking years less the number of non smoking years. These three intermediate variables were calculated as follows"

The **packs calculation** was based on the response to question 8.11 and 8.11a and treated 20 cigarettes as one pack:

Q8.11) Thinking about all the years that you smoked, about how many cigarettes or packs per day did you usually smoke on days when you smoked? Please tell me whether you are reporting the number of cigarettes per day or the number of packs per day. [IF NEEDED: One pack usually equals 20 cigarettes.]

|__|__|__| [Range: 1 to 120]
998. REF (Skip to Q8.12)
999. DK (Skip to Q8.12)

P3_SMOKUNIT

Q8.11a) [Thinking about all the years that you smoked, about how many cigarettes or packs per day did you usually smoke on days when you smoked? Please tell me whether you are reporting the number of cigarettes per day or the number of packs per day. [IF NEEDED: One pack usually equals 20 cigarettes.]

UNIT:
1. CIGARETTES
2. PACKS

The logic used is:

If P3_Smok100 (Q8.6) = 0 then packs = 0 ;

Else if P3_SmokUnit (Q 8.11a) = 1 then packs = P3_SmokNum/20 ;

Else if P3_SmokUnit (Q 8.11a) = 2 then packs = P3_SmokNum (Q 8.11);

Else packs = Missing ;

The **number of years smoked calculation** was based on the response to question 8.8, 8.8a, 8.10 and 8.10a. The response to the age questions (Q8.8 and Q8.10) were used when available. When the response to Q8.8 (age when started smoking) was missing and the response to Q8.8a (year when started smoking) was non missing, we used the information in Q8.8a. Similarly, . When the response to Q8.10 (age when stopped smoking) was missing and the response to Q8.10a (year when stopped smoking) was non missing, we used the information in Q8.10a. We could do this because we have the date of birth for almost all members of the cohort:

P3_SMOKAGESTART

Q8.8) How old were you when you first started smoking cigarettes on a regular basis? By regular basis, I mean 3 cigarettes/week for 6 months or more.

|__|__|__| AGE [Range: 1 to 85] (Skip to Q8.9)
998. REF
999. DK

P3_SMOKYRSTART
Q8.8a) What year did you begin smoking?

YEAR: |__|__|__|__| [Range: 1900 to 2020]
9998. REF
9999. DK

P3_SMOKAGESTOP

Q8.10) How old were you when you last smoked cigarettes on a regular basis? By regular basis, I mean 3
cigarettes/week for 6 months or more.

|__|__|__| AGE [Range: 1 to 85] (Skip to Q8.10b)
998. REF
999. DK

P3_SMOKYRSTOP

Q8.10a) What year did you last smoke cigarettes on a regular basis? (IF DK AGE, PROBE FOR YEAR LAST SMOKED.) [IF NECESSARY SAY: By regular basis, I mean 3 cigarettes/week for 6 months or more.]

YEAR: |__|__|__|__| [Range: 1900 to 2020]
9998. REF
9999. DK

The logic used is:

/*Never a smoker*/

If P3_Smoke_Status = 1 then NumSmokeYears = 0 ;

/*Not a Regular smoker*/

Else If P3_Smoke_Status = 2 then NumSmokeYears = 0 ;

/*Current smoker*/

Else If P3_Smoke_Status = 4 and P3_SmokYrStart (Q 8.8a) not in (9999, 9998) then

NumSmokeYears = Age at start of the P3 interview –Age when started smoking;

/*Former smoker*/

Else If P3_Smoke_Status = 3 and P3_SmokYrStart not in (9999, 9998) and

P3_SmokYrStop (Q 8.10a) not in (9999, 9998)

then NumSmokeYears Age when stopped smoking - P3_SmokY Age when started

smoking rStart ;

/*Insufficient information*/

Else numSmokeYears = Missing;

Note that when the age that a participant started smoking or stopped smoking is not available and the year is available, the participant's age is imputed from the year for the purposes of these calculations.

The **number of non-smoking years calculation** was based on the response to question 8.13 and 8.13a:

P3_NOSMOKNUM
Q8.13) During the years between (AGE WHEN FIRST STARTED) and (AGE FROM Q8.7/now), for how many total months or years, did you stop smoking cigarettes?

|__|__|__| [Range: 1 to 120]
998. REF (Skip to Q8.14)
999. DK (Skip to Q8.14)

P3_NOSMOKUNIT
Q8.13a) During the years between (AGE WHEN FIRST STARTED) and (AGE FROM Q8.7/now), for how many total months or years, did you stop smoking cigarettes?
1. MONTHS
2. YEARS

The logic used is:

If P3_NoSmokUnit = 2 (Q8.13) then NoSmokYrs = P3_NoSmokNum (Q8.13);
Else If P3_NoSmokUnit = 1 then NoSmokYrs = P3_NoSmokNum/12;
Else NoSmokYrs = 0;

3.2.5   Missing Value Codes

Missing character values are represented by blanks. Missing numeric values are set to ".D" if the respondent did not know the answer to a question and to ".R" if the respondent refused to answer a question. Inapplicable questions that were skipped because of respondent demographics or responses to previous questions are given the value ".S". All other missing values are set to the standard SAS missing value of ".".

3.2.6 Treatment of Differences among Versions of Modules

Approximately one month after data collection started with the Phase III CATI instrument, the AHS Executive Committee reviewed the data collected to that point and decided to make some minor changes to the questionnaire, which were implemented during the sixth week of interviewing. The changes are documented in the codebooks. Differences among the different versions of the questionnaire modules required a certain amount of recoding of the earlier versions in order to make the responses commensurate with those in the final versions of the modules. The major differences and how they were treated are described below.

Three variables were dropped from the questionnaire:

- P3_HOMEUSE
- P3_LAWNGARDEN
- P3_DAYYRHOUSE

Three variables were introduced in version 2 of the questionnaire, and hence have only missing values from respondents who completed the first version of the questionnaire:

- P3_REGSMOK
- P3_REGSMOKFREQ
- P3_PASTYRWHEEZ_NOCOLD

The following variables were changed in version 2 of the questionnaire:

- P3_DAYSVIG
- P3_TIMEVIG
- P3_TIMEVIGUNIT
- P3_DAYSMOD
- P3_TIMEMOD
- P3_TIMEMODUNIT
- P3_DAYSWALK
- P3_TIMEWALK
- P3_TIMEWALKUNIT

- P3_TIMESIT
- P3_TIMESITUNIT
- P3_SUNEXPO_HRS_V2
- P3_PASTYRWHEEZ_V2

The sun exposure and wheeze questions were changed from continuous variable to categorical variables between Version 1 and Version 2 of the questionnaire:

Version 1 Sun Exposure Question (variable P3_SUNEXPO_HRS):

Q10.1) Now I would like to ask you some questions about how you spend your time outdoors. On average, from March to October, how many hours a day do you generally spend in the sun?

|__|__|
#HOURS

DK
REF

Version 2 Sun Exposure Question (variable P3_SUNEXPO_HRS_V2):

Q10.1) Now I would like to ask you some questions about how you spend your time outdoors. On average, from March to October, how many hours a day do you generally spend outside during daylight hours? Would you say:

1. up to 1 hour,
2. 1-2 hours
3. 3-5 hours
4. 6-10 hours
5. more than 10 hours
8. REF
9. DK

Version 1 Past year Wheeze Question (variable P3_PASTYRWHEEZ):

Q23.9) During the past 12 months, how many episodes of wheezing or whistling in your chest have you had?

1. NONE   (Skip to Q23.11)
2. 1-2
3. 3-6
4. 7-12
5. 13 OR MORE

Version 2 Past year Wheeze question (variable P3_PASTYRWHEEZ_V2):

Q23.9) During the past 12 months, about how many days of wheezing or whistling in your chest have you had?

        0. NONE   (Skip to Q23.11)
        1. 1-2
        2. 3-6
        3. 7-12
        4. 13 OR MORE
        5. VERSION 1 – 1 OR MORE TIMES, BUT SPECIFIC AMOUNT IS UNDETERMINED
        7. NA   (Skip to Q23.11)
        8. REF   (Skip to Q23.11)
        9. DK   (Skip to Q23.11)

In addition the entire Physical Activity Section (Section 9) was replaced. The Version 1 questions focused primarily on the frequency (in stated categories) of certain activities at work, as well as the average number of hours spent in strenuous activity at both work and leisure. Version 2 questions ask for a length of time spent for vigorous, moderate, walking and sitting activities. Only the Version 2 questions are included on the data file. The discontinued version is contained in Appendix D. See Section 9 of the annotated questionnaire for the version of the questions included in the data files.

3.6 Body Mass Index Estimates

Question 8.4 asked respondents for their height, which was record in two variables: one for the portion reported in feet (P3_HGTFT) and one for the portion reported in inches (P3_HGTIN). Question 8.5 asked respondents for their current weight in pounds (P3_WEIGHTNOW). The Phase III Body Mass Index variable (P3_BMI) was calculated by dividing the respondents reported weight by their height in inches and multiplying by 703.

Note that BMI estimates from earlier phases of the study are available in the Demographic File.

4. DATA FILE DESCRIPTIONS

The Phase III data consist of a set of related files which can be linked to each other and to the Phase I and II files by the study IDs of the respondents. The following files are part of the Phase III data:

- Private Applicator File

- Private Applicator Supplemental Pesticide File

- Spouse File

- Spouse Supplemental Pesticide File

Codebooks for each of these files that provide a detailed description of their contents are available for authorized researchers. Each of the Phase III files is discussed briefly in a separate section below.

4.1 Private Applicator File

The Private Applicator File contains the responses to the questions in the Phase III CATI interviews of private pesticide applicators. It contains 24,172 records. Of these; 15,760 are from Iowa farmers and 8,412 are from North Carolina farmers. It also contains a number of derived variables that will be of use to analysts. A number of these record administrative information. The administrative variables are summarized in Table 4-1.

Table 4–1.   Description of administrative variables

Administrative Variable	Description
P3_STATE	Field station administering interview (IA, NC)
P3_START_INTERVIEW_DAT E	Start interview date
P3_RESULT_CODE	Phase III interview result code (1=Complete, 2=Partial complete)
P3_RecordsInSuppFile	Indicator for records in Supplemental Pesticide File (0= No records in the Supplemental Pesticide File - Did not use any pesticides, 1 = At least one record in the Supplemental Pesticide File – Used at least one pesticide).
P3_FILL_LOAD	Indicator for personally fill or load application equipment for crops and noncrops (0 = did not fill or load equipment with pesticides, 1 = filled or loaded equipment with pesticides)
P3_PERSONALLY_APPLY	Indicator for personally apply for crops, animals, and noncrops (0 = did not personally apply pesticides, 1 = personally applied pesticides)
P3_ANIMAL_EVER	Have at least one record with P3_CRANNC_IND = Animal in the Supplemental Pesticide File (0 = did not apply pesticides to animals, 1 = applied pesticides to animals)
P3_CROP_EVER	Have at least one record with P3_CRANNC_IND = Crop in the Supplemental Pesticide File (0 = did not apply pesticides to crops, 1 = applied pesticides to crops)
P3_NONCROP_EVER	Have at least one record with P3_CRANNC_IND = NonCrop in the Supplemental Pesticide File (0 = did not apply pesticides to non crops, 1 = applied pesticides to non crops)

Note that while most of the questions in the CATI questionnaire are directly represented in the file by a single variable, responses to Sections 4 and 5 of the questionnaire have been restructured to make them easier to use in analyses. In particular, indicator variables were created to reflect crops and animals to which pesticides were applied and to reflect which chemicals were used (see Section 3.2.2). Details about specific applications of pesticides have been placed in the Private Applicator Supplemental Pesticide File (see Section 4.2).

Indicator variables were created for each crop, animal, and noncrop; each A-list or B-list pesticide (see Appendix A, Appendix B, and the pesticide classes listed in Table 3–7 (Functional Classes) and Table 3–8 (Chemical Classes). These indicators have the value 1 if the respondent grew the crop or applied the pesticide and 0 if he or she did not do so. There is a separate indicator variable for each of the

crops named in the questionnaire. For example, the indicator variables for apples, alfalfa, and barley are P3_CR_APPLES, P3_CR_ALFALFA, and P3_CR_BARLEY, respectively.

It was not useful to create indicator variables for all of the thousands of pesticides named by the respondents. A pesticide was assigned an indicator variable if it was one of the 50 chemicals listed in the Phase I questionnaires (50 core A-list variables), if it was suspected of having adverse health effects (33 additional A-list variables which have "_AA" in their variable names), or if it was used by 300 or more applicators in Phase II (B-list variables). Because there were many potential crop-pesticide, animal-pesticide, and noncrop-pesticide pairs, more detailed information about pesticides and how they were used was placed in a separate analysis file called the Private Applicator Supplemental Pesticide File, which is described in the next section.

The Private Applicator File contains the indicator variables for the chemicals on the A list and the B list (see Section 3.2.2.1).[12] It also contains indicator variables for the functional and chemical groups with the same list of chemicals as defined in Phase I. Table 4-2 lists the variable names for these indicators.

Table 4–2.   Indicator variables for functional and chemical class groups

Indicator Variable Name	Description
P3_FNG	Pesticide usage/Fungicides
P3_FUM	Pesticide usage/Fumigants
P3_HRB	Pesticide usage/Herbicides
P3_INS	Pesticide usage/Insecticides
P3_CAR	Pesticide usage/Carbamates
P3_OCH	Pesticide usage/Organochlorines
P3_OPH	Pesticide usage/Organophosphates
P3_OTH	Pesticide usage/Organothiophosphates
P3_PNX	Pesticide usage/Phenoxy
P3_TRZ	Pesticide usage/Triazine

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[12]See the appendices for the names of chemicals in the A and B lists.

The master Private Applicator File contains the following set of fields for each of the 83[13] specific pesticides on the A list, as well as the Phase III indicator flags for the pesticides on the B list.[14]

1. Phase III Personal Use Indicator Flag (e.g., P3_FUMIGANT_A_1, which is the indicator flag for Methyl Bromide (PCCode=053201)). --These flags take the values:

    0 = did not report *personal* use of this pesticide
    1 = reported *personal* use of this pesticide

    For A-list or B-list chemicals reported by participant in Phase III, when 0 days are reported the personal use indicator is set to 0, otherwise it is set to 1.

2. Phase III Used on Farm Indicator Flag (e.g., P3_FUMIGANT_UF_A_1, which is the indicator flag for Methyl Bromide (PCCode=053201)). --These flags take the values:

    0 = did not report *any* use of this pesticide
    1 = reported use of this pesticide (whether or not any personal use was reported)

3. Phase III Days per Year of Use (e.g., P3_FUM_A_DAYSPERYR_1) – These variables are the **sum** of the maximum number of days pesticides were applied to **crops**, plus the maximum number of days pesticides were applied to **animals**, plus the maximum number of days pesticides were applied to **noncrops** (e.g., fence rows), plus the maximum number of days pesticides were applied to **other** crop/animal/non-crop indicator.

    In Phase III supplemental file when P3_CRANNC_IND was missing, the participant's information from the Phase II supplemental file was used to populate the value. When information was not available in Phase II, the P3_CRANNC_IND value was set to **other**.

4. Total days of use since enrollment (e.g., P3_FUM_RY_A_TOTAL_DAY_USE1) – These variables are the product of the number of Phase II years times the number of Phase II Days per Year. Phase II years are calculated as the difference between the Phase II reference year and the enrollment year.

5. Average algorithm intensity score for this pesticide calculated from Phase III Supplemental file (e.g., P3_V2_FUM_A_AVG_ALG_INTSCORE1).

6. Phase III Intensity Days (e.g., P3_V2_FUM_RY_A_INTENSITY_DAYS1) –These variables are equal to the total days of use since enrollment times the average algorithm intensity score.

---

[13] Permethrin applied to crops and Permethrin applied to animals are treated as separate pesticides for this purpose. In addition, the variable P3_INSECTICIDE_A_PERM was created to reflect overall Permethrin exposure. It is set to 1 if Permethrin was used for any purpose or 0 otherwise.

[14] The derivation of these variables is discussed in Sections 3.2.2 and 3.2.3.

The master Private Applicator File also contains combined Phase I, Phase II and Phase III pesticide exposure data for each of the pesticides on the A-list:

7. Cumulative Lifetime Days (e.g., P3_FUM_A_LIFE_DAYS_1) – The sum of the Phase I Days, Phase II Days and the Phase III days for the pesticide.

8. Cumulative Lifetime Intensity Days (e.g., P3_V2_FUM_A_LIFE_INTDAYS_1) – The lifetime intensity days for each pesticide is product of cumulative Phase III lifetime days and the average intensity score

4.2 Private Applicator Supplemental Pesticide File

The Private Applicator Supplemental Pesticide File contains one record for each triplet of a participant ID, crop/animal/noncrop to which a pesticide was applied, and pesticide name. There are 110,544 records in the file.

The file contains the pesticide name as recorded by the interviewer; a standardized pesticide name; the specific crop, animal, or noncrop to which the pesticide was applied by the respondent; an indicator variable identifying the target usage as crop, animal, or noncrop; an indicator variable identifying the pesticide type as herbicide, insecticide, fumigant, or fungicide; PC codes for each pesticide (any not needed are set to missing); and the detailed information asked about pesticides applied to crops, animals, and noncrops.

4.3 Spouse File

The Spouse File contains responses to the questions in the Phase III CATI interviews of spouses of private applicators. It contains 19,959 records. Of these, 13,874 are from Iowa spouses and 6,085 are from North Carolina spouses.

Since the same questionnaire was used for both applicators and spouses in Phase III, the structure of the Spouse File is the same as that of the Private Applicator File with the exception that the Spouse File does not include a set of derived variables representing lifetime days of pesticide use and lifetime intensity weighted days of use. For applicators, these variables relied on Phase I variables that

contain the number of years of use and the average numbers of days of use of each pesticide. This information was not collected for spouses in Phase I. Since this quantitative usage information was not collected for spouses during Phase I, the lifetime (Phase 1 + 2 + 3) days and lifetime intensity weighted days could not be calculated for spouse file.

4.4   Spouse Supplemental Pesticide File

The Spouse Supplemental Pesticide File contains one record for each triple of a participant ID, crop/animal/noncrop to which a pesticide was applied, and pesticide name. There are 3,963 records in the file. The structure of the file is the same as the structure of the Private Applicator Supplemental Pesticide File. Refer to the Spouse Supplemental Pesticide Codebook in the appendices for a detailed description of the file.

5.   USAGE NOTES

The purpose of this chapter is to provide guidance to users with respect to issues that they are likely to encounter while analyzing the Agricultural Health Study data files. The following topics are included:

- How to link files for analyses;

- Discrepancies between Phase I and Phase II Files;

- Definition of Exposure Measures;

- Unusual Values;

- Interpretation of Missing Data Patterns;

- Alternate Calculations of Lifetime Days Values; and

- Topics Discussed in Phase I and Phase II User Manuals that May Be of Interest

Each of these topics is discussed in a separate section below.

5.1   How to Link Files for Analyses

All Phase I and Phase II AHS files contain a key variable named PARTID, which is the household identifier assigned at enrollment to a pesticide applicator. The value for PARTID is identical in the Private Applicator Files and Spouse Files for husbands and wives. Since the questionnaire files contain either applicator data or spouse data, PARTID is sufficient to uniquely identify a participant within one of these files.

Several files contain data from both applicators and spouses. These are the Demographic File, the Cancer Registry File, and the Mortality File. The Demographic File contains one record for each member of the AHS cohort. To correctly match records in the Demographic File to one of the questionnaire files, it is necessary to use the variable AP_SPOUSE in conjunction with PARTID. AP_SPOUSE has the value "C" for commercial applicators, "P" for private applicators (farmers), and "S" for spouses of private applicators. The Cancer Registry File, the Mortality File, and the Buccal Receipt File also contain records for both applicators and spouses. As with the Demographic File, to correctly match Phase III questionnaire data to these files, it is necessary to use the variable AP_SPOUSE in conjunction with PARTID. Note that no commercial applicators were interviewed in Phase III, so there is no instance in which a Phase III questionnaire record will match a record which has an AP_SPOUSE value of "C".

5.2   Discrepancies between Phase III Files and Files from Earlier Phases

Analysts should be aware of a number of discrepancies between similar data items in the Phase I, Phase II, and Phase III data files. These are most apparent with Phase I values preloaded into the CATI questionnaire. The preloaded variables in the Phase III questionnaire represent gender, birth date, and enrollment information as it existed in the AHS master Demographic file at the time the CATI interviews were conducted. The values for gender and birth date were verified during the Phase III interview. If the respondent corrected these values, the change was reflected in the Phase III data files, as well as in the Phase II data files. The latest version of the Demographic File represents the best current information available to the study from all sources on participants' demographics. The analyst should

always check the release number of a file when there are apparent discrepancies. Also note that it is AHS policy that release numbers of the underlying data files be included in all reports of study data.

Some information, such as facts about farm wells, was not checked across questionnaires at the time of the interviews. Differences in responses to such questions may represent changes of facts (a new well may have been drilled) or simply changes in responses by respondents that reflect acquisition of new knowledge, lapses in memory at the time of one of the data collection events, or any number of other reasons. Such discrepancies are to be expected in a series of lengthy questionnaires administered approximately 5 years apart. If the number and size of such differences are small, they are likely to have minimal impact on standard errors. If there are many such differences, or if the magnitude is large for a specific variable used in an analysis, the investigator should consider the potential implications for any results and whether or not it is worthwhile attempting to collect additional information from the respondents.

5.3 Unusual Values

As with any large-scale survey, respondents sometimes gave unusually high or low values in response to questions. Many of these were screened out during the interview by soft and hard range checks in the interview instrument. When a soft range check was violated, the interviewer was informed and either corrected his or her keying or asked the respondent to confirm the response. Hard range checks blocked the entry of out of range values.

As discussed in Section 3.1, the Coordinating Center repeated both the hard range checks and embedded logics within the instrument. Any unusual values that had been detected by the soft range checks and approved by the field stations were verified.

While we are confident that unusual values accurately represent what the respondent told the interviewer, analysts should still check for outliers in their analysis variables and consider what, if any, action they need to take to ensure that their analyses are not adversely affected. One set of covariates of interest which has a large number of outliers is the responses to the drinking questions. For instance, there are 9 private applicators who stated that they had 30 or more drinks on a typical weekend. Two respondents claimed 40 drinks.

## 5.4	Interpretation of Missing Data Patterns

Data may have missing values because responses to initial questions caused the interview to branch around some questions, because the respondent stated that he or she did not know an answer, because the respondent refused to answer a question, because the respondent ended the interview early, or because of anomalies introduced while editing the CATI responses. All missing value codes for numeric values are coded with a SAS missing value. This value is ".D" when the respondent's response was "Don't know." The value is ".R" when the respondent refused to answer a question. The value is ".P" when the value is missing because the respondent did not complete the interview.. All other numeric missing value codes are a period (".") with no further distinction. Missing value codes for character variables are blanks.

## 5.5	Alternate Calculations of Lifetime Days Values

In Phase III, we created total lifetime days in two ways: 1) the product of the days per year and the total years reported in Phase III and 2) summing the data from Phases I, II, and III in a manner similar to Phase II. For the second method, we assumed that the pesticide was used in all years between the last interview and the year before the last interview (or the year last applied pesticides) unless the responses to questions 3.3 and 4.6 told us otherwise.

As discussed in Section 3.2.3.6, we calculated at Phase III Years of Usage variable for each pesticide as the minimum of the number of years since the last interview (NYRS_PH3_LAST), and the responses to question 3.3 ("Since <year of last interview>, for how many years did you personally mix, load, handle or apply any of these chemicals?") and question 4.6 ("For how many years over your lifetime have you personally mixed, loaded, handled, or applied this pesticide. We then multiplied this value by the number of days the respondent applied pesticides to create the P3 contribution to lifetime use of that pesticide. This estimate of the number of Phase III days of use for the pesticide was then added to the total lifetime days at the end of Phase II (or Phase I for those who did not complete the Phase II interview) to create a total lifetime days of use for that pesticide.

The rationale for this second method was to maintain the prospective nature of the data collection and to use comparable data for all phases. Recalled data can underestimate past use, and current use patterns may not accurately reflect historic use with regard to days per year applied.

Additionally, for individuals who did not report use of that chemical in Phase III, there was no updating of lifetime use, so data from these individuals would need to use the sum of the Phase I and II data. To keep all data comparable, we created this second variable.

To use Alachlor as an example, the variables P3_HRB_A_RPT_LIFE_YRS_7 and P3_HRB_A_DAYSPERYR_7 contain the values reported during the interview to questions about the total number of years the respondent used Alachlor and the average number of days per year that he or she did so. These values were multiplied together to calculate the total days that the respondent used Alachlor in his or her lifetime, variable P3_HRB_A_RPT_LIFE_DAYS_7. The alternate method first calculated P3_HRB_A_YRS_7, the number of years that the respondent used Alachlor during Phase III and multiplied it by P3_HRB_A_DAYSPERYR_7 to obtain P3_HRB_RY_A_TOTAL_DAYS_USE7, the total days that the respondent used Alachlor during Phase III. This was then added to the corresponding numbers of days of Alachlor usage from Phase I (A_HERBICIDE_LIFE_DAY7) and Phase II (A2_HRB_RY_A_TOTAL_DAYS_USE7) to obtain the alternate estimate for the number of days the respondent used Alachlor during his or her lifetime (variable P3_HRB_A_LIFE_DAYS_7). Analysts will need to determine whether variable P3_HRB_A_RPT_LIFE_DAYS_7 or variable P3_HRB_A_LIFE_DAYS_7 is better to use for a particular analysis.

We also created intensity adjusted lifetime exposure estimates for each of these lifetime exposure days as described in Section 3.2.3.12 and Section 3.2.3.15. Note that the alternate method for estimating lifetime exposure was used only for applicators as years and days of use questions were not asked of spouses during Phase I.

5.6   Topics Discussed in Phase I and Phase II User Manuals that May Be of Interest

There are a number of topics discussed in the *AHS Phase I Data File Users Manual* that are also pertinent to analyses of the Phase III AHS data.

- Identifying Appropriate Reference Groups (see Phase I Manual, Section 5.3)

- Pesticide Grouping Analyses (see Phase I Manual, Section 5.4)

- Pesticides Used in Combination with Other Pesticides (see Phase I Manual, Section 5.7)

5.7   Coding of Frontline

There are a number of pesticides that are named "Frontline." All of them are coded as an herbicide with the exception of products applied to animals. Products applied to animals that were specifically identified by the respondent as "Frontline Plus" are listed as "Frontline Plus" in the Phase 3 Supplemental Peticide Files.   Other Frontline products applied to animals are listed as "Frontline Insecticide." Frontlline Insecticide has the active ingredient Fipronil (PCCode 129121). Frontline Plus has the active ingredients Fipronil (PCCode 129121) and S-Methoprene (PCCode 105402).

6. REFERENCES

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Dosemeci M., Alavanja M. C. R., Rowland A. S., Mage D., Zahm S. H., Rothman N., Lubin J. H., Hoppin J. A., Sandler D. P., Blair A. (2002) A semi-quantitative approach for estimating exposure to pesticides in the Agricultural Health Study. *Annals of Occupational Hygiene, 46(2), 245-260.*

Tukey, J.W. (1977) *Exploratory Data Analysis*, Addison-Wesley, Reading, MA.

U.S. Environmental Protection Agency, Pesticide Product Information System (PPIS), web site: http://www.epa.gov/opppmsd1/PPISdata/index.html

The following publications contain a small selection of Agricultural Health Study papers that have been published. This list is constantly growing. For an up-to-date list of AHS publications, visit our Web page at http://www.aghealth.org/publications.html. As of December 2006, it contains references to more than 70 publications and has links to abstracts and full text versions of the articles for most of them.

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7.   QUESTIONNAIRES AND CODEBOOKS

Copies of the Phase I, Phase II, and Phase III questionnaires can be found on the Agricultural Health Study website at http://aghealth.nci.nih.gov/questionnaires.html.

Codebooks for each of the AHS data file are available for used by qualified researches. For each variable, they list the variable name, indicate whether it is character or numeric, list the question for items drawn directly from the questionnaire or provide a description for derived variables, and give the range of valid values for each variable. For categorical variables, the codebook also specifies the meaning of each value. Frequency distributions are provided for each variable.

There is a separate codebook for each of the Phase III data files:

- Private Applicator File

- Private Applicator Supplemental Pesticide File

- Spouse File

- Spouse Supplemental Pesticide File

Appendix A

Pesticides Included on A List

A-LIST PESTICIDES, GROUPED BY FUNCTIONAL CLASS

50 Key Variables from Phase I

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator Name
Methyl Bromide	053201	P3_FUMIGANT_A_1	A2_FUMIGANT_RY_A_1	A_FUMIGANT_CD1
Aluminum Phosphide	066501	P3_FUMIGANT_A_2	A2_FUMIGANT_RY_A_2	A_FUMIGANT_CD2
Carbon Tetrachloride/ Carbon Disulfide	016501	P3_FUMIGANT_A_3	A2_FUMIGANT_RY_A_3	A_FUMIGANT_CD3
Ethylene-Dibromide	042002	P3_FUMIGANT_A_4	A2_FUMIGANT_RY_A_4	A_FUMIGANT_CD4
Benomyl	099101	P3_FUNGICIDE_A_1	A2_FUNGICIDE_RY_A_1	A_FUNGICIDE_CD1
Chlorothalonil	081901	P3_FUNGICIDE_A_2	A2_FUNGICIDE_RY_A_2	A_FUNGICIDE_CD2
Captain	081301	P3_FUNGICIDE_A_3	A2_FUNGICIDE_RY_A_3	A_FUNGICIDE_CD3
Maneb	014505	P3_FUNGICIDE_A_4	A2_FUNGICIDE_RY_A_4	A_FUNGICIDE_CD4
Metalaxyl	113501	P3_FUNGICIDE_A_5	A2_FUNGICIDE_RY_A_5	A_FUNGICIDE_CD5
Ziram	034805	P3_FUNGICIDE_A_6	A2_FUNGICIDE_RY_A_6	A_FUNGICIDE_CD6
Atrazine	080803	P3_HERBICIDE_A_1	A2_HERBICIDE_RY_A_1	A_HERBICIDE_CD1
Dicamba	029801	P3_HERBICIDE_A_2	A2_HERBICIDE_RY_A_2	A_HERBICIDE_CD2
Cyanazine	100101	P3_HERBICIDE_A_3	A2_HERBICIDE_RY_A_3	A_HERBICIDE_CD3
Chlorimuron-Ethyl	128901	P3_HERBICIDE_A_4	A2_HERBICIDE_RY_A_4	A_HERBICIDE_CD4
Metolachlor	108801	P3_HERBICIDE_A_5	A2_HERBICIDE_RY_A_5	A_HERBICIDE_CD5
EPTC	041401	P3_HERBICIDE_A_6	A2_HERBICIDE_RY_A_6	A_HERBICIDE_CD6
Alachlor	090501	P3_HERBICIDE_A_7	A2_HERBICIDE_RY_A_7	A_HERBICIDE_CD7
Metribuzin	101101	P3_HERBICIDE_A_8	A2_HERBICIDE_RY_A_8	A_HERBICIDE_CD8
Paraquat	061603	P3_HERBICIDE_A_9	A2_HERBICIDE_RY_A_9	A_HERBICIDE_CD9
Petroleum Distillates	063501	P3_HERBICIDE_A_10	A2_HERBICIDE_RY_A_10	A_HERBICIDE_CD10
Pendimethalin	108501	P3_HERBICIDE_A_11	A2_HERBICIDE_RY_A_11	A_HERBICIDE_CD11
Imazethapyr	128922	P3_HERBICIDE_A_12	A2_HERBICIDE_RY_A_12	A_HERBICIDE_CD12
Glyphosate	417300	P3_HERBICIDE_A_13	A2_HERBICIDE_RY_A_13	A_HERBICIDE_CD13
Silvex	082501	P3_HERBICIDE_A_14	A2_HERBICIDE_RY_A_14	A_HERBICIDE_CD14
Butylate	041405	P3_HERBICIDE_A_15	A2_HERBICIDE_RY_A_15	A_HERBICIDE_CD15

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator Name
Trifluralin	036101	P3_HERBICIDE_A_16	A2_HERBICIDE_RY_A_16	A_HERBICIDE_CD16
2,4-D	030001	P3_HERBICIDE_A_17	A2_HERBICIDE_RY_A_17	A_HERBICIDE_CD17
2,4,5-T	082001	P3_HERBICIDE_A_18	A2_HERBICIDE_RY_A_18	A_HERBICIDE_CD18
Permethrin	109701	P3_INSECTICIDE_A_1	A2_INSECTICIDE_RY_A_1	A_INSECTICIDE_CD1
Permethrin	109701	P3_INSECTICIDE_A_2	A2_INSECTICIDE_RY_A_2	A_INSECTICIDE_CD2
Terbufos	105001	P3_INSECTICIDE_A_3	A2_INSECTICIDE_RY_A_3	A_INSECTICIDE_CD3
Fonofos	041701	P3_INSECTICIDE_A_4	A2_INSECTICIDE_RY_A_4	A_INSECTICIDE_CD4
Trichlorfon	057901	P3_INSECTICIDE_A_5	A2_INSECTICIDE_RY_A_5	A_INSECTICIDE_CD5
Lindane	009001	P3_INSECTICIDE_A_6	A2_INSECTICIDE_RY_A_6	A_INSECTICIDE_CD6
Carbofuran	090601	P3_INSECTICIDE_A_7	A2_INSECTICIDE_RY_A_7	A_INSECTICIDE_CD7
Chlorpyrifos	059101	P3_INSECTICIDE_A_8	A2_INSECTICIDE_RY_A_8	A_INSECTICIDE_CD8
Malathion	057701	P3_INSECTICIDE_A_9	A2_INSECTICIDE_RY_A_9	A_INSECTICIDE_CD9
Parathion	053501	P3_INSECTICIDE_A_10	A2_INSECTICIDE_RY_A_10	A_INSECTICIDE_CD10
Carbaryl	056801	P3_INSECTICIDE_A_11	A2_INSECTICIDE_RY_A_11	A_INSECTICIDE_CD11
Diazinon	057801	P3_INSECTICIDE_A_12	A2_INSECTICIDE_RY_A_12	A_INSECTICIDE_CD12
Aldicarb	098301	P3_INSECTICIDE_A_13	A2_INSECTICIDE_RY_A_13	A_INSECTICIDE_CD13
Phorate	057201	P3_INSECTICIDE_A_14	A2_INSECTICIDE_RY_A_14	A_INSECTICIDE_CD14
Aldrin	045101	P3_INSECTICIDE_A_15	A2_INSECTICIDE_RY_A_15	A_INSECTICIDE_CD15
Chlordane	058201	P3_INSECTICIDE_A_16	A2_INSECTICIDE_RY_A_16	A_INSECTICIDE_CD16
Dieldrin	045001	P3_INSECTICIDE_A_17	A2_INSECTICIDE_RY_A_17	A_INSECTICIDE_CD17
DDT	029201	P3_INSECTICIDE_A_18	A2_INSECTICIDE_RY_A_18	A_INSECTICIDE_CD18
Heptachlor	044801	P3_INSECTICIDE_A_19	A2_INSECTICIDE_RY_A_19	A_INSECTICIDE_CD19
Toxaphene	080501	P3_INSECTICIDE_A_20	A2_INSECTICIDE_RY_A_20	A_INSECTICIDE_CD20
Coumaphos	036501	P3_INSECTICIDE_A_21	A2_INSECTICIDE_RY_A_21	A_INSECTICIDE_CD21
Dichlorvos	084001	P3_INSECTICIDE_A_22	A2_INSECTICIDE_RY_A_22	A_INSECTICIDE_CD22

Note: There are two entries for Permethrin. In Phase I a distinction was made between Permethrin for crops and Permethrin for poultry, livestock, or animal confinement areas.

Additional Pesticides of Interest

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator Name
Mancozeb	014504	P3_FUNGICIDE_AA_1	A2_FUNGICIDE_RY_AA_1	NA
Acetochlor	121601	P3_HERBICIDE_AA_1	A2_HERBICIDE_RY_AA_1	NA
Acifluorfen	114401	P3_HERBICIDE_AA_2	A2_HERBICIDE_RY_AA_2	NA
Ametryn	080801	P3_HERBICIDE_AA_3	A2_HERBICIDE_RY_AA_3	NA
Bentazone	275200	P3_HERBICIDE_AA_4	A2_HERBICIDE_RY_AA_4	NA
Bromoxynil	035301	P3_HERBICIDE_AA_5	A2_HERBICIDE_RY_AA_5	NA
Clopyralid	117403	P3_HERBICIDE_AA_6	A2_HERBICIDE_RY_AA_6	NA
Cloransulam-Methyl	129116	P3_HERBICIDE_AA_7	A2_HERBICIDE_RY_AA_7	NA
S-Dimethenamid	120051	P3_HERBICIDE_AA_8	A2_HERBICIDE_RY_AA_8	NA
Fenoxaprop-P-Ethyl	129092	P3_HERBICIDE_AA_9	A2_HERBICIDE_RY_AA_9	NA
Fluazifop-Butyl	122805	P3_HERBICIDE_AA_10	A2_HERBICIDE_RY_AA_10	NA
Fluazifop-P-Butyl	122809	P3_HERBICIDE_AA_11	A2_HERBICIDE_RY_AA_11	NA
Flumetsulam	129016	P3_HERBICIDE_AA_12	A2_HERBICIDE_RY_AA_12	NA
Glufosinate-Ammonium	128850	P3_HERBICIDE_AA_13	A2_HERBICIDE_RY_AA_13	
Imazaquin	128848	P3_HERBICIDE_AA_14	A2_HERBICIDE_RY_AA_14	
Isoxaflutole	123000	P3_HERBICIDE_AA_15	A2_HERBICIDE_RY_AA_15	
Linuron	035506	P3_HERBICIDE_AA_16	A2_HERBICIDE_RY_AA_16	
Nicosulfuron	129008	P3_HERBICIDE_AA_17	A2_HERBICIDE_RY_AA_17	
Sethoxydim	121001	P3_HERBICIDE_AA_18	A2_HERBICIDE_RY_AA_18	
Simazine	080807	P3_HERBICIDE_AA_19	A2_HERBICIDE_RY_AA_19	
Fomesafen	123802	P3_HERBICIDE_AA_20	A2_HERBICIDE_RY_AA_20	
Picloram	005101	P3_HERBICIDE_AA_21	A2_HERBICIDE_RY_AA_21	
Acephate	103301	P3_INSECTICIDE_AA_1	A2_INSECTICIDE_RY_AA_1	NA
Cyfluthrin	128831	P3_INSECTICIDE_AA_2	A2_INSECTICIDE_RY_AA_2	NA
Amitraz	106201	P3_INSECTICIDE_AA_3	A2_INSECTICIDE_RY_AA_3	NA
Disulfoton	032501	P3_INSECTICIDE_AA_4	A2_INSECTICIDE_RY_AA_4	NA
Endosulfan	079401	P3_INSECTICIDE_AA_5	A2_INSECTICIDE_RY_AA_5	NA
Ethoprop	041101	P3_INSECTICIDE_AA_6	A2_INSECTICIDE_RY_AA_6	NA
Pyrethrins	069001	P3_INSECTICIDE_AA_7	A2_INSECTICIDE_RY_AA_7	NA
Pyrethrum	069000	P3_INSECTICIDE_AA_8	A2_INSECTICIDE_RY_AA_8	NA
Tefluthrin	128912	P3_INSECTICIDE_AA_9	A2_INSECTICIDE_RY_AA_9	NA

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator Name
Aliphatic Petroleum Hydrocarbons	063503	P3_INSECTICIDE_AA_10	A2_INSECTICIDE_RY_AA_10	NA
Rotenone	071003	P3_INSECTICIDE_AA_11	A2_INSECTICIDE_RY_AA_11	NA

Appendix B

Pesticides Included on B List

B-LIST PESTICIDES, GROUPED BY FUNCTIONAL CLASS

(Not on A-List and at Least 300 Applicators Used the Pesticide during Phase II)

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator
1,3-Dichloropropene	029001	P3_FUMIGANT_B_1	A2_FUMIGANT_RY_B_1	NA
Chloropicrin	081501	P3_FUMIGANT_B_2	A2_FUMIGANT_RY_B_2	NA
Copper Chloride	008001	P3_FUNGICIDE_B_1	A2_FUNGICIDE_RY_B_1	NA
Copper Sulfate	008101	P3_FUNGICIDE_B_2	A2_FUNGICIDE_RY_B_2	NA
Tebuconazole	128997	P3_FUNGICIDE_B_3	A2_FUNGICIDE_RY_B_3	NA
Diflufenzopyr	005108	P3_HERBICIDE_B_1	A2_HERBICIDE_RY_B_1	NA
2,4-DB	030819	P3_HERBICIDE_B_2	A2_HERBICIDE_RY_B_2	NA
Bromoxinyl Octanoate	035302	P3_HERBICIDE_B_3	A2_HERBICIDE_RY_B_3	NA
Fluometuron	035503	P3_HERBICIDE_B_4	A2_HERBICIDE_RY_B_4	NA
Sodium Bentazon	103901	P3_HERBICIDE_B_5	A2_HERBICIDE_RY_B_5	NA
Clethodim	121011	P3_HERBICIDE_B_6	A2_HERBICIDE_RY_B_6	NA
Flufenacet	121903	P3_HERBICIDE_B_7	A2_HERBICIDE_RY_B_7	NA
Mesotrione	122900	P3_HERBICIDE_B_8	A2_HERBICIDE_RY_B_8	NA
Flumatralin	123001	P3_HERBICIDE_B_9	A2_HERBICIDE_RY_B_9	NA
Clomazone	125401	P3_HERBICIDE_B_10	A2_HERBICIDE_RY_B_10	NA
Imazapyr	128821	P3_HERBICIDE_B_11	A2_HERBICIDE_RY_B_11	NA
Thifensulfuron	128845	P3_HERBICIDE_B_12	A2_HERBICIDE_RY_B_12	NA
Lactofen	128888	P3_HERBICIDE_B_13	A2_HERBICIDE_RY_B_13	NA
Primisulfuron-Methyl	128973	P3_HERBICIDE_B_14	A2_HERBICIDE_RY_B_14	NA
Rimsulfuron	129009	P3_HERBICIDE_B_15	A2_HERBICIDE_RY_B_15	NA
Sulfentrazone	129081	P3_HERBICIDE_B_16	A2_HERBICIDE_RY_B_16	NA
Ioxynil	353200	P3_HERBICIDE_B_17	A2_HERBICIDE_RY_B_17	NA
Fatty Alcohols	079037	P3_HERBICIDE_B_18	A2_HERBICIDE_RY_B_18	NA
Decanol	079038	P3_HERBICIDE_B_19	A2_HERBICIDE_RY_B_19	NA
Maleic Hydrazide	051501	P3_HERBICIDE_B_20	A2_HERBICIDE_RY_B_20	NA
Triclopyr	116001	P3_HERBICIDE_B_21	A2_HERBICIDE_RY_B_21	NA
Ethephon	099801	P3_HERBICIDE_B_22	A2_HERBICIDE_RY_B_22	NA
Bacillus Thuringiensis	006400	P3_INSECTICIDE_B_1	A2_INSECTICIDE_RY_B_1	NA

Active Ingredient	PC Code	Phase III Indicator Name	Phase II Indicator Name	Phase I Indicator
Phosphamidon	018201	P3_INSECTICIDE_B_2	A2_INSECTICIDE_RY_B_2	NA
Dimethoate	035001	P3_INSECTICIDE_B_3	A2_INSECTICIDE_RY_B_3	NA
Phosmet	059201	P3_INSECTICIDE_B_4	A2_INSECTICIDE_RY_B_4	NA
Methomyl	090301	P3_INSECTICIDE_B_5	A2_INSECTICIDE_RY_B_5	NA
Esfenvalerate	109303	P3_INSECTICIDE_B_6	A2_INSECTICIDE_RY_B_6	NA
Lambda Cyhalothrin	128897	P3_INSECTICIDE_B_7	A2_INSECTICIDE_RY_B_7	NA
Tebupirimfos	129086	P3_INSECTICIDE_B_8	A2_INSECTICIDE_RY_B_8	NA
Imidacloprid	129099	P3_INSECTICIDE_B_9	A2_INSECTICIDE_RY_B_9	NA
Diphacinone	067701	P3_RODENTICIDE_B_1	A2_RODENTICIDE_RY_B_1	NA
Warfarin	086002	P3_RODENTICIDE_B_2	A2_RODENTICIDE_RY_B_2	NA
Bromadiolone	112001	P3_RODENTICIDE_B_3	A2_RODENTICIDE_RY_B_3	NA
Brodifacoum	112701	P3_RODENTICIDE_B_4	A2_RODENTICIDE_RY_B_4	NA

Appendix C

Indicator Variables

When the respondent had the option to choose multiple items from a list, the numeric codes corresponding to the responses were stored in an array in the data collection instrument. The entries in the array were in the order in which the respondent named the item. To make these responses easier to analyze, we created an indicator variable or flag for each of the possible responses. An indicator variable/flag is set to the value 1 if the respondent named the corresponding item and is set to zero if he or she did not name the item. One of the responses to these questions is "Other, specify" and a follow-up question was used to capture the name of the new item. As described in the data cleaning section (Section 3.1), data management staff reviewed these responses and created new numeric codes and variables to represent many of the new responses. Question 2.3, which asks the respondent to name the crops raised on the farm, is an example both of indicator variable creation and of the creation of additional codes and variables to reflect the responses to the "Other" question.

The questions with responses converted to indicator variables are:

- Q2.3) Excluding gardens for personal use, what crops, including fruits and vegetables, were raised on your farm?

- Q2.5) What poultry or livestock did you raise on your farm?

- Q26.2) What type(s) of cancer [did your family member have]?

- Q5.35) What (other) protective equipment did you normally wear (when you mixed herbicides, insecticides, fungicides, or other pesticides)?

- Q5.38) What (other) protective equipment did you normally wear (when you **applied** pesticides)?

The indicator variables associated with each of these tables are listed in separate tables below.

C.1   Crop Questions

There are two related crop questions: 2.3, which includes a list of crops, and 2.3a, which collects the verbatim response when the respondent selects the "Other, specify" option.

Q2.3) Excluding gardens for personal use, what crops, including fruits and vegetables, were raised on your farm since ^DSP.YearOfLastInterview?

[CODE ALL THAT APPLY]

10. NONE
11. APPLES
12. ALFALFA
13. BARLEY
…
39. TOBACCO
40. WHEAT
41. NURSERY CROPS
42. PUMPKINS
91. OTHER, SPECIFY
98. Refused
99. Don't Know

Q2.3a) [Excluding gardens for personal use, what crops, including fruits and vegetables, were raised on your farm since ^DSP.YearOfLastInterview?]

OTHER, SPECIFY: _____

The "Other, specify" responses are stored in P3_OTHCROP. The indicator variables representing specific crops raised on farm are shown in Table C-1. The "Notes" column identifies variables that were added as a way to code the "Other, specify" responses.

Table C-1. Indicator variables representing specific crops.

Indicator Variable Name	Crop	Notes
P3_CR_ALFALFA	Alfalfa	
P3_CR_APPLES	Apples	
P3_CR_APRICOTS	Apricots	Added
P3_CR_ASPARAGUS	Asparagus	Added
P3_CR_BARLEY	Barley	
P3_CR_BEANS	Beans	Added
P3_CR_BEETS	Beets	Added
P3_CR_BERMUDAGRASS	Bermuda grass	
P3_CR_BERRIES	Berries	Added
P3_CR_BLACKBERRIES	Blackberries	Added
P3_CR_BLUEBERRIES	Blueberries	
P3_CR_BROCCOLI	Broccoli	Added
P3_CR_CABBAGE	Cabbage	
P3_CR_CANE	Cane	Added
P3_CR_CANTALOUPE	Cantaloupe	Added
P3_CR_CARROTS	Carrots	Added
P3_CR_CHERRIES	Cherries	Added
P3_CR_CHRISTMASTREES	Christmas trees	
P3_CR_COLLARDS	Collards	Added
P3_CR_CORN_FIELD	Corn, field	
P3_CR_CORN_POP	Corn, pop	
P3_CR_CORN_SEED	Corn, seed	
P3_CR_CORN_SWEET	Corn, sweet	
P3_CR_COTTON	Cotton	
P3_CR_CRP	Conservation Reserve Program	Added
P3_CR_CUCUMBERS	Cucumbers	
P3_CR_EGGPLANT	Eggplant	Added
P3_CR_FRUIT	Fruit	Added
P3_CR_GOURDS	Gourds	Added
P3_CR_GRAIN	Grain	Added
P3_CR_GRAPES	Grapes	
P3_CR_HAY	Hay	
P3_CR_HERBS	Herbs	Added
P3_CR_LETTUCE_GREENS	Lettuce	Added
P3_CR_LIMA_BEANS	Lima beans	Added

Indicator Variable Name	Crop	Notes
P3_CR_MELONS	Melons	
P3_CR_MILLET	Millet	Added
P3_CR_MILO	Milo	Added
P3_CR_MUSTARD	Mustard	Added
P3_CR_NECTARINES	Nectarines	Added
P3_CR_NONE	None	
P3_CR_NURSERY_CROPS	Nursery crops	
P3_CR_OATS	Oats	
P3_CR_OKRA	Okra	Added
P3_CR_ONION	Onion	Added
P3_CR_OTHER	Other	
P3_CR_PEACHES	Peaches	
P3_CR_PEANUTS	Peanuts	
P3_CR_PEARS	Pears	Added
P3_CR_PEAS	Peas	Added
P3_CR_PEPPERS	Peppers	
P3_CR_PLUMS	Plums	Added
P3_CR_POTATOES	Potatoes	
P3_CR_PUMPKINS	Pumpkins	
P3_CR_RADISHES	Radishes	Added
P3_CR_RASPBERRIES	Raspberries	Added
P3_CR_RYE	Rye	
P3_CR_SHRUBS	Shrubs	Added
P3_CR_SILAGE	Silage	Added
P3_CR_SNAPBEANS	Snap beans	
P3_CR_SOD	Sod	Added
P3_CR_SORGHUM	Sorghum	
P3_CR_SOYBEANS	Soybeans	
P3_CR_SPINACH	Spinach	Added
P3_CR_SQUASH	Squash	Added
P3_CR_STRWBERRIES	Strawberries	
P3_CR_SWEETPOTATOES	Sweet potatoes	
P3_CR_TOBACCO	Tobacco	
P3_CR_TOMATOES	Tomatoes	
P3_CR_TREE_FORESTRY	Forestry	Added
P3_CR_TREE_NURSERY	Nursery	Added
P3_CR_TREE_NUT	Nut	Added
P3_CR_TREE_ORCHARD	Orchard	Added

Indicator Variable Name	Crop	Notes
P3_CR_TURNIPS	Turnips	Added
P3_CR_VEGETABLES	Vegetables	Added
P3_CR_WHEAT	Wheat	
P3_CR_ZUCHINNI	Zucchini	Added

C.2 Animal Questions

There are two related animal questions: 2.5, which includes a list of animals, and 2.5a, which collects the verbatim response when the respondent selects the "Other, specify" option.

Q2.5) (Since ^DSP.YearOfLastInterview), what poultry or livestock did you raise on your farm?

[CODE ALL THAT APPLY]
10. NONE
11. NON DAIRY CATTLE
12. DAIRY CATTLE
13. HOGS/SWINE
14. POULTRY
15. POULTRY FOR EGGS
16. SHEEP OR GOATS
17. HORSES
91. OTHER, SPECIFY
98. Refused
99. Don't Know

Q2.5a) (Since ^DSP.YearOfLastInterview), what poultry or livestock did you raise on your farm?]

OTHER ANIMAL SPECIFIED:_____

The "Other, specify" responses are stored in P3_OTHANIM. The indicator variables representing specific animals raised on farm are shown in Table C-2. The "Notes" column identifies the one variable (P3_AN_BEES) that was added as a way to code the "Other, specify" responses.

Table C-2. Indicator variables representing specific animals.

Indicator Variable Name	Animal	Notes
P3_AN_NONE	Had no animals on farm	
P3_AN_CATTLE_NONDAIRY	Had nondairy cattle on farm	
P3_AN_CATTLE_DAIRY	Had dairy cattle on farm	
P3_AN_HOGS	Had hogs or swine on farm	
P3_AN_POULTRY	Had poultry on farm	
P3_AN_POULTRY_EGGS	Had poultry for eggs on farm	
P3_AN_SHEEP	Had sheep or goats on farm	
P3_AN_HORSES	Had horses on farm	
P3_AN_BEES	Raised bees on farm	Added
P3_AN_OTHER	Had other animals on farm	

C.3   Family Cancer Question

The family history of disease section of the questionnaire begins with two questions about the history of cancer in the family:

Q26.1) Has your mother, father, sisters, brothers or children related to you by blood ever had cancer?

        0. NO   (Skip to Q26.3)
        1. YES
        8. REF   (Skip to Q26.3)
        9. DK   (Skip to Q26.3)

Q26.2) What type(s) of cancer? [MARK ALL THAT APPLY.]

1. BRAIN
2. BREAST
3. COLON OR RECTAL
4. LEUKEMIA
5. LYMPHOMA
6. LUNG
7. MELANOMA OF THE SKIN
8. PANCREATIC
9. PROSTATE
10. STOMACH
11. BLADDER
12. BONE
13. CERVICAL
14. ESOPHAGUS
15. KIDNEY
16. LIVER
17. MULTIPLE MYELOMA
18. OVARIAN
19. SKIN
20. THYROID
21. UTERINE

The indicator variables representing specific family cancers are shown in Table C-3. All cancers named in the "Other, specify" field were recoded using ICD-O-2 categories as indicated in the table. The "Notes" column identifies the variables that were added as a way to code the "Other, specify" responses.

Table C-3. Indicator variables representing specific family cancers.

Indicator Variable Name	Family Cancer	ICD-O-10 Codes	Notes
P3_FAMCANCER_ANAL	Anal	1543	Added
P3_FAMCANCER_BLADDER	Bladder	1880-1889	
P3_FAMCANCER_BONE	Bone	1700-1709	
P3_FAMCANCER_BRAIN	Brain	1910-1919	
P3_FAMCANCER_BREAST	Breast	1740-1749	
P3_FAMCANCER_CERVICAL	Cervical	1800-1809	
P3_FAMCANCER_COLONRECTAL	Colon or rectal	1530-1539, 1540, 1541, 1548	
P3_FAMCANCER_CONNECTIVE_STISSUE	Connective and other soft tissue	1710-1719	Added
P3_FAMCANCER_DIGESTIVE_TRACK	Digestive track	1590-1599	Added
P3_FAMCANCER_ENDOCRINE_GLANDS	Endocrine glands	1940-1949	Added
P3_FAMCANCER_ESOPHAGUS	Esophagus	1500-1509	
P3_FAMCANCER_EYE	Eye	1900-1909	Added
P3_FAMCANCER_GBLADDER_BDUCTS	Gallbladder, bile ducts	1560-1569	Added
P3_FAMCANCER_GUM	Gum	1430-1439	Added
P3_FAMCANCER_KIDNEY	Kidney	1890-1899	
P3_FAMCANCER_LARYNX_THROATCL	Larynx or throat	1610-1619	Added
P3_FAMCANCER_LEUKEMIA	Leukemia	20400-20891	
P3_FAMCANCER_LIP	Lip	1400-1409	Added
P3_FAMCANCER_LIVER	Liver	1550-1552	
P3_FAMCANCER_LUNG	Lung	1620-1629	
P3_FAMCANCER_LYMPHOMA	Lymphoma	20000-20298	
P3_FAMCANCER_MELANOMA	Melanoma of the skin	1720-1729	
P3_FAMCANCER_MOUTH	Mouth	1440-1459	Added
P3_FAMCANCER_MULTIPLEMYELOMA	Multiple myeloma	20300-20381	
P3_FAMCANCER_NASALCAVITIES_MEAR	Nasal cavities, middle ear, accessory sinuses	1600-1609	Added

Indicator Variable Name	Family Cancer	ICD-O-10 Codes	Notes
P3_FAMCANCER_NASOPHARYNX	Nasopharynx	1470-1479	Added
P3_FAMCANCER_NERVOUS_SYSTEM	Nervous system	1928	Added
P3_FAMCANCER_OTHERFEMALEORGANS	Other female organs	1840-1849	Added
P3_FAMCANCER_OTHERILLDEFINED	Other ill-defined	1950-1959	Added
P3_FAMCANCER_OVARIAN	Ovarian	1830	
P3_FAMCANCER_OVARIES_FTUBES	Ovaries and fallopian tubes	1830-1839	Added
P3_FAMCANCER_PANCREATIC	Pancreatic	1570-1579	
P3_FAMCANCER_PENILE	Penile	1870-1879	Added
P3_FAMCANCER_PROSTATE	Prostate	185	
P3_FAMCANCER_RETROPERITONEUM	Retroperitoneum, peritoneum	1580-1589	Added
P3_FAMCANCER_SALIVARY_GLANDS	Salivary glands	1420-1429	Added
P3_FAMCANCER_SECNEOPLASM_LNODES	Secondary neoplasm, lymph nodes	1960-1969	Added
P3_FAMCANCER_SECNEOPLASM_OSITE	Secondary neoplasm, other sites	1980-1989	Added
P3_FAMCANCER_SKIN	Skin	1730-1739	
P3_FAMCANCER_SMALL_INTESTINE	Small intestine	1520-1529	Added
P3_FAMCANCER_STOMACH	Stomach	1510-1519	
P3_FAMCANCER_TESTICULAR	Testicular	1860-1869	Added
P3_FAMCANCER_THYMUS_HEART	Thymus, heart, mediastinum	1640-1649	Added
P3_FAMCANCER_THYROID	Thyroid	193	
P3_FAMCANCER_TONGUE	Tongue	1410-1419	Added
P3_FAMCANCER_TONSIL	Tonsil	1460	Added
P3_FAMCANCER_UNKNOWN_ILLDEFSITE	Unknown or ill-defined site	1990-1999, 7999	Added
P3_FAMCANCER_UTERINE	Uterine	1820-1828, 179	

C.4   PPE Mix Questions

There are two questions regarding personal protective equipment (PPE) used when mixing pesticides: 5.35, which includes a lists PPE, and 5.35a, which collects the verbatim response when the respondent selects the "Other, specify" option.

Q5.35) What (other) protective equipment did you normally wear (when you mixed herbicides, insecticides, fungicides, or other pesticides)? Did you wear: (CHECK ALL THAT APPLY)

0. NONE
1. Goggles
2. Face Shield
3. Disposable Coveralls, like Tyvek
4. Rubber boots
5. Respirator with cartridge
6. Dust mask
7. Long-sleeved shirt
91. OTHER
98. Refused
99. Don't Know

Q5.35a) [What (other) protective equipment did you normally wear (when you mixed herbicides, insecticides, fungicides, or other pesticides)?]

OTHER, SPECIFY: _____

The "Other, specify" responses are stored in P3_OTHPPE_MIX. The indicator variables representing specific PPE items used during pesticide mixing are shown in Table C-4. The "Notes" column identifies variables that were added as a way to code the "Other, specify" responses.

Table C-4. Indicator variables representing personal protective equipment used while mixing pesticides.

Indicator Variable Name	Protective Equipment Used When Mixing or Loading Pesticides	Notes
P3_APRON_MIX	Apron	Added
P3_BOOTS_MIX	Chemically resistant boots/shoes	
P3_CLOTH_COVERALLS_MIX	Cloth coverall	Added
P3_DUST_MASK_MIX	Dust mask	
P3_FACE_SHIELD_MIX	Full face shield	
P3_GOGGLES_MIX	Goggles	
P3_LONG_SLEEVES_MIX	Long sleeves shirt	
P3_NO_PPE_MIX	None	
P3_PPE_OTHER_MIX	Other PPE	
P3_RAIN_SUIT_MIX	Rain suit	Added
P3_RESP_MIX	Respirator with cartridge	
P3_TYVEK_MIX	Chemically resistant overalls like Tyvek	

C.5   PPE Apply Questions

There are two related questions regarding personal protective equipment (PPE) used when applying pesticides: 5.38, which includes a lists PPE, and 5.38a, which collects the verbatim response when the respondent selects the "Other, specify" option.

Q5.38) What (other) protective equipment did you normally wear (when you **applied** pesticides)? Did you wear:

(CHECK ALL THAT APPLY)

0. NONE
1. Goggles
2. Face Shield
3. Disposable Coveralls, like Tyvek
4. Rubber boots
5. Respirator with Cartridge
6. Dust Mask
7. Long-sleeved shirt
91. OTHER
98. REF
99. DK

Q5.38a) [What (other) protective equipment did you normally wear (when you **applied** pesticides)?]

OTHER, SPECIFY: _____

The "Other, specify" responses are stored in P3_OTHPPE_APPL. The indicator variables representing specific PPE items used when applying pesticides are shown in Table C-5. The "Notes" column identifies variables that were added as a way to code the "Other, specify" responses.

Table C-5. Indicator variables representing personal protective equipment used while applying pesticides.

Indicator Variable Name	Protective Equipment Used When Applying Pesticides	Notes
P3_APRON_APPLY	Apron	Added
P3_BOOTS_APPLY	Chemically resistant boots/shoes	
P3_CLOTH_COVERALLS_APPLY	Cloth coverall	Added
P3_DUST_MASK_APPLY	Dust mask	
P3_FACE_SHIELD_APPLY	Full face shield	
P3_GOGGLES_APPLY	Goggles	
P3_LONG_SLEEVES_APPLY	Long sleeves shirt	
P3_NO_PPE_APPLY	None	
P3_PPE_OTHER_APPLY	Other PPE	
P3_RAIN_SUIT_APPLY	Rain suit	Added
P3_RESP_APPLY	Respirator with cartridge	
P3_TYVEK_APPLY	Chemically resistant overalls like Tyvek	

Appendix D

Original Version of Physical Activity Section

As noted in Section 3.2.6, Treatment of Differences among Versions of Modules, the entire Physical Activity Section of the questionnaire was replaced after the first month of interviewing. The Version 1 questions focused primarily on the frequency (in stated categories) of certain activities at work, as well as the average number of hours spent in strenuous activity at both work and leisure. Version 2 questions ask for a length of time spent for vigorous, moderate, walking and sitting activities. Only the responses to the Version 2 questions are included on the data file.

The discontinued questions are listed below.

P3_CURRHAVEJOB
Q9.1) Now I am interested in your physical activity, first while working. By work, we mean to include farm work, full time or part time work, in a job for pay or in unpaid work such as housework. Including any work you already told me about, do you currently have a job?

        0. NO (Skip to Q9.6)
        1. YES
        DK   (Skip to Q9.6)
        REF   (Skip to Q9.6)

P3_FREQSITATWORK
Q9.2) While working, how frequently do you sit (for example, at a desk, or driving)? Would you say . . .
        1. never
        2. seldom, less than 2 hours per day
        3. sometimes, 2 to less than 4 hours per day
        4. often, 4 to less than 6 hours per day, or
        5. always, 6 or more hours per day
        6. DOESN'T WORK
        DK
        REF

P3_FREQWALKATWORK
Q9.3) While working, how frequently do you walk? Would you say . . .

        1. never
        2. seldom, less than 2 hours per day
        3. sometimes, 2 to less than 4 hours per day
        4. often, 4 to less than 6 hours per day, or
        5. always, 6 or more hours per day
        6. DOESN'T WORK
        DK
        REF

P3_FREQLIFTATWORK

Q9.4) While working, how frequently do you personally lift heavy loads or do heavy manual labor? Would you say . . .

1. never
2. seldom, less than 2 hours per day
3. sometimes, 2 to less than 4 hours per day
4. often, 4 to less than 6 hours per day, or
5. always, 6 or more hours per day
6. DOESN'T WORK
DK
REF

P3_STRENACTV_WORK

Q9.5) **While working**, on average, how many hours per week do you spend doing strenuous activities (so that your heart beats rapidly)?

|__|__|
#HOURS
DK
REF