DRAFT

IMPROVING ACCURACY AND REDUCING COSTS OF ENVIRONMENTAL BENEFIT ASSESSMENTS

Volume III

Estimating Benefits of Reducing Community Low-Level Ozone Exposure

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Estimating Benefits of Reducing Community Low-Level Ozone Exposure

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NOTICE

This document is a preliminary draft. It has not been formally released by the U.S. Environmental Protection Agency and should not at this stage be construed to represent Agency policy. It is being circulated for comments on its technical merit and policy, implications.

CHAPTER 1

INTRODUCTION AND EXECUTIVE SUMMARY

This volume is a progress report on continuing research into the dollar value of health benefits of reducing ozone levels. Previous research aimed at estimating ozone-related health benefits have focused mainly on measures of illness. For example, Gerking and Stanley (1986) examined the connection between the health of St. Louis residents, the ozone levels they face and their consumption of medical care. Additionally, Portney and Mullahy (1983) consider the impact of rising ozone levels on health measures such as restricted activity days, bed disability days, and work loss days among respondents in the 1979 national Health Interview Survey. Unfortunately, studies in this vein easily may overlook the health benefits arising from reductions in subclinical or minor symptomatic discomforts of ozone. Reducing these discomforts, which include chest pain, headache, and general malaise, is a potentially large source of dollar benefits for two interrelated reasons. First, as discussed more fully in Gerking et al. (1984), symptomatic discomforts can occur even in healthy adults at ambient ozone levels below the present federal standard of .12 ppm. Second, these discomforts are experienced by a large share of the exposed population. As a consequence, willingness to pay to avoid them may be substantial and should be taken into account in

the regulatory impact assessment process. The willingness to pay to avoid the symptoms of ozone exposure will be estimated using two approaches: (1) the averting behavior method (ABM), based on excess medical expenses and changes in activities induced by ozone exposure, and (2) the contingent valuation method (CVM). The particular ABM approach proposed is based on a generalization of the model used by Gerking and Stanley and the origin of the CVM approach considered lies in the work of Loehman et al. (1979). Consideration of the case of ozone, therefore, will serve the following three purposes: (1) advancing the state of the art in applying two benefit estimation techniques, (2) developing cross-comparisons of their cost-effectiveness, and (3) obtaining policy relevant ozone benefit estimates. This volume should be viewed as an interim report on the progress to date in achieving these three goals.

Most of the progress to date has been made in the following areas: (1) the design and pretesting of data collection instruments, (2) the recruitment of subjects and collection of baseline data, (3) a very preliminary analysis of these data, and (4) refinements in the averting behavior theory. Two data collection instruments have been designed: the background and follow-up surveys included as Appendices A and B, respectively.

Following recruitment, the background survey is administered in the participant's hone. The background survey (see Appendix A) is designed to collect data, including: (1) the respondent's baseline health status, (2) typical and recent contacts with the health care delivery system, (3) leisure-time activities, changes in those activities, (these changes are potential averting behaviors) and a direct question about the respondent's

averting behaviors, (4) a checklist of 26 symptoms to determine if the respondent has experienced any of them in the two days preceding the day of the survey, (5) a contingent valuation of those symptoms, (6) home environment characteristics (including presence and use of air conditioning, another possible averting activity), (7) occupational information, and (8) standard demographic data. The background survey was developed based on experience in previous studies, literature review, the health and ozone telephone conference described in Gerking et al. (1984), and reviews by experts on the ozone and health relationship and questionnaire experts. Additionally, the survey was pretested in the field.

The follow-up survey is designed to collect at regular intervals much of the same type of information collected in the baseline instrument. Information will be collected on the subject's symptoms, work and leisure activities including travel and time spent outdoors, illness, work loss, and medication used or medical visits. A contingent valuation question elicits information regarding willingness to pay to avoid each symptom experienced during the two day period covered by the survey. In the course of each interview, the subject will be asked his/her opinion of the air quality for the day of the call and the previous day. Because of the close similarity between the background and follow-up surveys, the latter was not pretested separately.

In addition to the design of data collection instruments and the actual collection of baseline data, a very preliminary analysis of baseline data has been performed. Although the first follow-up questionnaires were administered during the last week in August, no data from them are

available for report here. Information derived from field records of completions is the most complete; information obtained by tallying completed forms is next; and information from computer runs of temporary data sets is necessarily the least complete (though probably the most interesting). All data are based on at least 120 questionnaires.

Table 1 shows the field status of the project as of August 26. As shown, 136 baseline interviews had been completed and 13 additional interviews have been scheduled. The number of persons refusing to participate (13) in the study is quite low and is less than 10 percent of the number of completed interviews. Among 134 respondents whose completed questionnaires have been examined, all are Caucasian as is most of the Glendora population. There are 12 female household heads in the group, again similar to the distribution of household heads by gender in that population.

TABLE 1. STATUS OF RECRUITMENT AND COMPLETION OF BASELINE INTERVIEWS; GLENDORA, AUGUST 26, 1985

BASELINE INTERVIEWS	NUMBER
COMPLETED	136
SCHEDULED	13
STILL ATTEMPTING TO CONTACT	22
REFUSED TO PARTICIPATE	13
INELIGIBLE:	
MOVED FROM AREA	47
RETIRED	3
DECEASED	2

As previously indicated, all persons in the Glendora Chronic Obstructive Respiratory Disease (CORD) population known to have asthma, bronchitis, or emphysema and/or have impaired lung function (FEV, less than

70 percent of expected) were invited to participate in the study. At present, there are at least 28 such individuals in the sample: 16 individuals with asthma, 1 with chronic bronchitis, 2 with emphysema, 8 with asthma and bronchitis or emphysema, and 1 with bronchitis and emphysema. All of these individuals were identified using data from previous CORD studies. A few additional individuals with disease or otherwise impaired lung function may be identified through the baseline interview. Such an identification has not yet been completed as joint analysis of a number of questionnaire items must be performed. In any event, every effort will continue to be made to include individuals in this category in order to meet the goal stated in Gerking et al. (1984) that they represent 30 percent of the total sample. Additionally, a preliminary tally of the leisure activities questions reveals that there are 39 persons who report regularly exercising heavily or for long duration out of doors. Therefore, since 28.6 percent of the current sample is composed of those who regularly exercise heavily and the goal stated in Gerking et al. (1984) is 30 percent, no special steps apparently are necessary to identify persons in this category.

Of the 26 health symptoms considered in the baseline questionnaire, not all can be linked to ozone exposure on the basis of medical evidence. Of 124 completed baseline questionnaires, 51 (or 41 percent) respondents reported having one or more symptoms. Of course, not all of the symptoms are ozone specific. There were 73 reports of symptoms regarded as definite ozone symptoms among the 174 reports (by 51 persons) and 51 of the 174 reports involved symptoms regarded as non-related to ozone.

With respect to the fourth area of progress, refinements in the theory of averting behavior, several generalizations of the models in Gerking and Stanley and Gerking et al. were suggested by the nature of this study. These extensions of previous averting behavior models included: (1) an analysis of multiple symptoms and averting behaviors, (2) consideration of two classes of symptoms, those related and those unrelated to ozone, (3) allowing for averting behaviors and ozone to be direct sources of utility or disutility, and (4) accounting for ozone-induced changes in the labor-leisure decision. For each of these generalizations, a willingness to pay expression was derived. Much of the appeal of the ABM in its past applications can be traced to the simplicity of the expression for willingness to pay and the limited amount of information needed to estimate this expression. Thus a major focus of the theoretical work was to determine the informational requirements to estimate willingness to pay in each of the four cases above. To summarize the theoretical results, estimation of the bid requires information only on market and technological parameters if the number of averting behaviors which affect only ozone-related symptoms is at least as great as the number of ozone-related symptoms.

The remainder of this volume is organized as follows. Chapter 2 presents the theoretical refinements of the ABM. Data collection and the sampling plan are described in Chapter 3, while Chapter 4 presents a very preliminary analysis of some of the baseline information collected to date.

CHAPTER 2

INFORMATIONAL REQUIREMENTS TO ESTIMATE WILLINGNESS TO PAY USING THE AVERTING BEHAVIOR METHOD

2.1. INTRODUCTION

The empirical implementation of the averting behavior method (ABM), which determines its usefulness in generating policy relevant benefit estimates, depends in large measure on the estimation of a bid, or willingness to pay, for small changes in the ambient levels of pollutants faced by households. Part of the appeal of the ABM lies in the simplicity of the expression for this bid and the straightforward estimation procedures that can be employed as a result. In past applications of the ABM, expressions for this bid typically have consisted of a ratio of the price of an averting behavior to its marginal product in the household technology, multiplied by the marginal product of the relevant pollutant in that technology. Given observable prices and an estimable technology, the estimation of this type of bid is relatively straightforward. This attractive simplicity, however, is based on a model having a particular specification of household technology and tastes. This specification includes the following three factors: (1) one household output of interest, (2) one or two averting behaviors, which are modelled as inputs in the technology and which have no direct influence on utility, and (3) no direct sources of disutility from the pollutant.

This simple specification of the averting behavior model has been useful to the problems to which it has been applied, but has masked both

the generality and the limitations of the technique. Many more complicated specifications of household technology and tastes-reduce to a simple, estimable bid, suggesting a wide range of applicability for the ABM. In certain other specifications, however, the estimation of the bid is more complicated, thus calling into question, for these cases, the appeal of the ABM as a simple and straightforward benefit estimation technique.

In the context of the present study of health and ozone, for example, there are at least three ways in which the above specification might have to be modified. Preliminary discussions with epidemiologists and other medical scientists (see Gerking et al., 1984) suggest that there may be as many as 15 symptomatic effects (outputs) of ozone exposure in addition to any clinical health outputs. The actual existence of even a few of these outputs would suggest the possibility that some inputs could jointly produce more than one output. An averting activity taken to reduce chest pain, for instance, also might reduce cough. This type of joint production will complicate the estimation of the bid, but this same jointness may be used to generate a new implication of the model. Second, a possible way to avoid ozone exposure is to change the time, location or intensity of leisure activities. Such changes could well be direct sources of utility or disutility, and this type of jointness is known to complicate the home production model on which the ABM is based (Pollack and Wachter, 1975). Third, ozone is a major component in smog and thus may be a source of aesthetic or other disutility unrelated to health. Sources of disutility from ozone other than those operating through the health and symptom technology may present difficulties in interpreting the bid.

The question arises, then, as to how seriously these intricacies would complicate the estimation and interpretation of the willingness' to pay expression. The purpose of this chapter is to analyze the information required to estimate willingness to pay (WTP) in the context of an averting behavior model. Special attention will be paid to the simplicity of the expression for-the bid and the ability to replace marginal utility terms with market and technological parameters. If the utility terms can be eliminated from the WTP expression, then information is required only on the market and technological constraints. This information is relatively easier to discover than information regarding preferences.

The remainder of this chapter is organized into five sections. Section 2 attempts to define formally the concept of an averting behavior. Section 3 reviews the ABM literature. In Section 4, a general averting behavior model is presented and analyzed; additional extensions of this model are treated in Section 5. Conclusions follow in Section 6.

2.2. WHAT IS AN AVERTING BEHAVIOR?

An averting behavior is defined here as any action taken to avoid or mitigate the effects of an adverse change, or to augment the effects of a favorable change, in environmental quality. Clearly, whenever such behaviors are important, the estimation of "dose-response" functions outside the context of a model of human behavior is inappropriate, because the response of the physical or biological system in question depends in part on the behavior of the economic agents who exercise some degree of control over the system. The specification and implementation of models which explicitly account for the behavior of economic agents in response to changes in environmental quality will be called the averting behavior

method, or ABM. The purpose of this chapter to investigate how the specification of these models affects their implementation.

A key factor in the ABM, obviously, is the specification of averting behaviors. One way of formalizing the above definition of averting behavior is to consider an averting action as an adjustment in behavior in response to an exogenous change in the environment: an averting activity is in the nature of a comparative static derivative. A second way to formalize this conception of averting behavior is to consider the individual as faced with a finite set of alternative activities, locations, and time periods, with the discrete choice from among these alternatives conditioned on environmental quality. The exposition of this chapter will proceed in terms of comparative statics, owing to the familiarity and intuitive appeal of this approach. The averting behavior model then becomes simply an extension of the comparative statics methodology of economics. In addition to the usual comparative statics derivatives of choice variables with respect to prices and income, we consider the optimal responses of choice variables to exogenous changes in environmental quality.

The importance of averting behaviors is directly related to the freedom the individual has to adjust his behavior, that is, on the extent of the substitution opportunities available to him. Examples of adjustments in behavior considered here are changes in time spent outdoors, changes in the use of air conditioning and air purifying systems, travel to less polluted areas, and changes in the labor-leisure decision. A more detailed discussion of the averting behaviors expected and actually found in this study is presented in the chapter on data collection.

2.3. A REVIEW OF THE AVERTING BEHAVIOR AND HEALTH LITERATURE

Averting behavior models have been used in the context of air pollution and household cleanliness (Courant and Porter, 1981; Harford, 1984; Watson and Jaksch, 1982) as well as being applied to the problems of air pollution and human health (Cropper, 1981; Gerking and Stanley, 1986; Harrington and Portney, 1982). Due to the nature of the present project and the similarity among the averting behavior models named above, only two of those models dealing with air pollution and health will be reviewed here. A primary goal of these models is the derivation of the compensating variation (CV) in income necessary to maintain a constant level of utility despite a change in ambient air pollution levels. Because this approach to calculating WTP explicitly holds utility levels constant, it is a theoretically correct measure of the monetary value to the consumer of a change in air pollution. The derivation of the CV in an averting behavior context will be illustrated now by an examination of the Gerking and Stanley model.

2.3.1 Averting Behavior and Health Models

Gerking and Stanley generalize Cropper's approach by treating health not only as an investment good, which contributes to increased income, but additionally as a consumption good which has a direct impact on utility. The former authors, however, focus on only one time period rather than on the multiperiod framework examined by Cropper. The utility function in the Gerking and Stanley model, then, is

$$U = U(X, H) \tag{1}$$

where X denotes a class of goods that yield direct satisfaction but do not affect health, and H denotes the consumer's stock of health capital. This

health stock is treated as an endogenous variable which is produced according to the relation

$$H = H(M;\ \alpha, \delta) \tag{2}$$

where M denotes consumption of medical care, a denotes air pollution, and 6 denotes a vector of other exogenous variables, such as education, which may influence the efficiency of health production, and where $H_M > 0$, $H_\alpha < 0$, $H_\delta \gtrless 0$.

In addition to the production constraint in equation (2), the individual faces the following money and time constraints:

$$XPx+MPM= I +A \tag{3}$$

$$XT_x + MTM + TW + TL = T \tag{4}$$

$$WT_w = I. \tag{5}$$

In these equations, P_i represents the money price of commodity i, and T_i, the time required to consume one unit of commodity i (i = X, M), A denotes an exogenously determined amount of asset income, I denotes wage income, W denotes the wage rate, T_W denotes time spent working, T denotes total time available, and TL denotes time lost from market and non-market activities. TL is determined by the health stock:

$$T_L = G(H) \tag{6}$$

where $G_H < 0$. Equations (3), (4), (5), and (6) can be combined into the "full-income" budget constraint

$$Xq_x + Mq_M + WG(H) = WT + A \tag{7}$$

where $q_i = (P_i + WT_i)$, i = X, M.

The consumer is assumed to maximize utility subject to equations (2) and (7). After substituting the health production function into the utility function, the Lagrangian is

$$L = U(X, H(M; a, 6)) + \lambda [WT + A - Xq_x - Mq_M - WG(H(M; \alpha, \delta))] \quad (8)$$

where λ is the Lagrangian multiplier, and the first order conditions are

$$U_X - \lambda q_x = 0 \quad (9)$$

$$U_H H_M - \lambda (q_M + WG_H H_M) = 0 \quad (10)$$

plus equation (7). The utility maximization described above markedly differentiates the Gerking and Stanley model from the dose-response function approach that is common in the econometric health epidemiology literature. Gerking and Stanley reject the assumption that the individual behaves as if he does not care about or cannot affect his health responses to air pollution. Rather, those authors assume that the individual behaves as if he purposefully chooses his consumption of medical care in order to produce the level of health that, together with his chosen consumption of the composite good, maximizes his utility. This maximization, of course, is subject to the health and full income constraints.

The model just presented can be manipulated as follows to derive the CV expression for WTP. First, totally differentiate both the utility function and the full income budget constraint with respect to air pollution, holding all prices and available time constant, to obtain

$$\frac{dU}{d\alpha} = U_X \frac{\partial X}{\partial \alpha} + U_H H_M \frac{\partial M}{\partial \alpha} + U_H H_\alpha \quad (11)$$

$$\frac{d(WT)}{d\alpha} = 0 = -\frac{\partial A}{\partial \alpha} + q_X \frac{\partial X}{\partial \alpha} + q_M \frac{\partial M}{\partial \alpha} + W(G_H H_M \frac{\partial M}{\partial \alpha} + G_H H_\alpha). \quad (12)$$

Substituting from the first order conditions into equation (11) returns the individual to his original, constrained maximal indifference curve. The resulting expression may be solved for $q_x(\partial X/\partial \alpha)$ and substituted into equation (12) to yield the following expression for marginal WTP:

$$\frac{\partial A}{\partial \alpha} = - \frac{q_M}{H_M} H_\alpha . \qquad (13)$$

The CV expression above reveals both the key role of averting behavior (medical care) and the simplicity of the expression for the bid. The greater the effectiveness of medical care at the margin, and the lower its full price, the less the individual is willing to pay for a reduction in air pollution levels. The simplicity of the expression for WTP and the fact that all utility terms have been eliminated makes empirical implementation straightforward. Herein lies the appeal of the ABM: in addition to allowing for human behavior responses to pollution, the model reduces the complex issue of marginal health benefit estimation to a simple expression.

Harrington and Portney arrive at a similar expression for WTP. The motivation for those authors' approach can be understood by recalling that the derivation of the bid described above involved holding utility constant at its constrained maximum. This suggests that the indirect utility function, which gives the constrained maximum of utility for any values of the parameters, would be a useful tool. Moreover, that derivation effectively was a proof of the envelope theorem for the particular case under consideration. The envelope theorem (Silberberg, 1971, 1973) states that the derivative of the indirect utility function with respect to a parameter is equal to the derivative of the Lagrangian with respect to that parameter. The indirect utility function associated with the Gerking and Stanley model is:

$$\phi(q_M, q_X, W, T, A, \alpha, \delta) = \max \{U(X,H) | (WT+A=Xq_X+Mq_M+WG(H)\}. \qquad (14)$$

By the envelope theorem and equation (8),

$$\frac{\partial \phi}{\partial \alpha} = \frac{\partial L}{\partial \alpha} = U_H H_\alpha + \frac{\partial A}{\partial \alpha} - \lambda W G_H H_\alpha. \quad (15)$$

Holding indirect utility constant and using equation (10) yields the expression for the bid in equation (13).

Turning to the specifics of the Harrington and Portney model, let (direct) utility be represented by:

$$U = U(X, L, S) \quad (16)$$

where X is as defined previously,[1] L represents leisure time and S, sick time. Sick time is produced according to the relation:

$$S = S(D, \alpha) \quad (17)$$

where a is as defined above and D represents defensive expenditures, which can shorten the duration of sickness. Medical expenses (M) are assumed to depend on the duration of sickness:

$$M = M(S(D, P)). \quad (18)$$

Maximization of expression (16) subject to equations (17) and (18), and a set of money and time constraints similar to those in Gerking and Stanley yields indirect utility ϕ as a function of the parameters of this model. Harrington and Portney then derive the following expression for the WTP for a reduction in pollution:

$$\frac{\partial A}{\partial \alpha} = - \frac{\partial \phi / \partial \alpha}{\partial \phi / \partial A} = - \frac{S\alpha}{S_D}. \quad (19)$$

In the Harrington and Portney model, the health production is represented by S(.) and averting behavior, by D. Bearing this in mind along with the fact that D is defined in monetary, rather than real, terms, the similarity between equations (19) and (13) is apparent.

2.3.2 A Critique

The two models discussed above are useful for at least two reasons: (1) the direct consideration given to the actions that individuals may take to defend against the adverse health effects of pollution, and (2) the simplicity of the expressions for WTP. These models, however, need to be developed more fully in a number of ways. First, as discussed in the introduction to this chapter, it may not be possible to capture the adverse health effects of air pollution with one health output. Second, as discussed in Section 2, the concept of averting behavior needs to be developed beyond medical care and defensive expenditures. Third, some consideration needs to be given to the possibility of averting behaviors directly impacting utility. Harrington and Portney, as well as Chestnut and Violette (1984), conjecture that this jointness will complicate the model, but the analysis to follow will demonstrate that this is not necessarily the case. Finally, these models do not allow for additional sources of disutility from air pollution other than those operating through the health technology. It is necessary to account for this possibility so that the relationship between the health benefit expression to other types of benefits is clear. The following two sections are devoted to exploring the implications on the information required to estimate the bid arising from these complications.

2.4. A BASIC AVERTING BEHAVIOR MODEL

2.4.1 Extending the Gerking-Stanley Model

This section develops the basic model of the present chapter, which represents a generalization of the work of Gerking and Stanley. The first generalization of those authors' model is to allow for a number of

subclinical or minor symptomatic discomforts of ozone exposure in addition to any clinical health effects of exposure. Suppose there are J such symptom and health outputs S^1, S^2, ..., S^J. The individual is assumed to produce desired amounts of these outputs by the use of I inputs Vl,... V^I. These inputs may include medical care, exercise, time spent outdoors, etc. In addition to these endogenous inputs, the production of the health and symptom outputs is influenced by the exogenous variables α, β, and δ. The variable a denotes a vector of ambient air pollution concentrations exclusive of ozone, β denotes ozone concentrations, and δ denotes a vector of social and demographic variables.

The health and symptom technology is represented by the set of equations

$$S^j = S^j(V^1, \ldots, V^I; \alpha, \beta, \delta) \quad j\text{-}1, \ldots, J \tag{20}$$

where some of the partial derivatives of any S^j may be zero. This specification of the health and symptom technology does not preclude jointness in production since any input may enter several of the production functions; however, equations (20) do embody the assumption that all health and symptom outputs are separable. This is unlikely to be the case, since the occurrence of symptoms depends in part on a person's chronic health status. Additionally, certain symptoms of ozone exposure, such as cough, may aggravate other symptoms, such as chest pain. One could account for possible nonseparabilities in production by specifying that a subset of the outputs was functionally related to other outputs; however, that specification is not pursued here. That specification would not change the expression for WTP, and thus would not change the nature of the results of this chapter. Those results involve the relationship between the number of

averting inputs and the number of production relations in the model. Here, there are J production functions (one for each health or symptom output) and I averting behaviors.

Equation (20) reveals that, although air pollution is exogenous, symptoms are endogenous in this model. Another way to formulate the model would be to make symptoms dependent on exposure, with exposure a function of ambient pollution levels and averting behaviors undertaken to reduce exposure. The results of such a model are the same as the results of this model.

The basic form of the utility function to be considered is

$$U = U(X, S^1, \ldots, S^J), \tag{21}$$

although some attention will be devoted to generalizing this function to allow some of the endogenous and exogenous inputs to affect utility directly. Consumers are assumed to maximize utility subject to the production constraints (20), given values of α, β, and δ, and the following "full income" budget constraint (Becker, 1965; Grossman, 1972):

$$WT + A = Xq_x + \sum_{i=1}^{I} V^i q_i + WG(S^1, \ldots, S^J). \tag{22}$$

The only variables in equations (21) and (22) not previously defined are the $q_i = (P_i + WT_i)$, which represent the full prices of inputs V^i, where P_i denotes the money price of V^i and T_i denotes the time required to consume one unit of V^i ($i = 1, \ldots, I$).

Substituting the production constraints (20) into the utility function (21), and maximizing the resulting expression subject to the budget constraint (22) implies that the following conditions hold:

$$
\begin{aligned}
U_X - \lambda q_X &= 0 \\
\sum_{j=1}^{J} U_j S_1^j - \lambda\left[q_1 + W \sum_{j=1}^{J} G_j S_1^j\right] &= 0 \\
&\vdots \\
\sum_{j=1}^{J} U_j S_I^j - \lambda\left[q_I + W \sum_{j=1}^{J} G_j S_I^j\right] &= 0
\end{aligned}
\tag{23}
$$

plus the constraint (22), where λ is the Lagrange multiplier associated with the constraint, and where $U_x = \partial U / \partial X$, $U_j = \partial U / \partial S^j$, $G_j = \partial G / \partial s^j$, and $S_i^j = \partial S^j / \partial V^i (j = 1, \ldots, J; i = 1, \ldots, I)$.

The first of the necessary conditions in equations (23) is standard. To interpret the remaining equations, consider a small change in some input, say V^l. This change in V^1 produces a change in some or all of the symptoms S^j, and these changes in symptoms in turn influence both utility and the time lost from market and nonmarket activities. The first term on the left hand side, then, sums the marginal utilities of this change in symptoms resulting from a change in V^1. The term in brackets measures the monetary cost of the change in V^1, which consists of the full unit price of V^1 plus the value of the change in time lost due to the change in V^1. Thus, this first order condition means that the individual equates the marginal benefits of a change in V^1 to the marginal cost of a change in V^l, and the remaining conditions in equations (23) are interpreted similarly.

A CV expression for the WTP for reduced ozone concentrations may be derived from the model presented above by a straightforward adaptation of the Gerking and Stanley procedure, or by direct application of the envelope theorem. In any case, the resulting expression is

$$\frac{\partial A}{\partial \beta} = -\frac{1}{\lambda}\sum_{j=1}^{J} U_j S_\beta^j + W\sum_{j=1}^{J} G_j S_\beta^j. \qquad (24)$$

Because the individual is able to optimally choose the levels of the endogenous variables V^i (i = 1, . . . , I), he can defend himself optimally against the adverse health and symptom effects of ozone exposure. Hence, the expression for WTP contains only the direct effects of exposure $S_\beta^j = \partial S^j / \partial \beta$ (j = 1, . . . ,J). The first term on the right hand side of (24) represents the marginal utility gain from a small decrease in ozone levels, converted to monetary terms by dividing by the marginal utility of full income, and the second term represents the marginal decrease in time lost from market and nonmarket activities, valued at the wage rate.

The empirical implementation of the bid in equation (24) is hampered by the presence of unobservable marginal utility terms. Estimation of this bid is simplified greatly if these marginal utility terms can be replaced with market and technological parameters. The question to be answered is, what additional conditions must be imposed on the model to convert equation (24) to a simple, easily estimable bid, like equations (13) and (19).

2.4.2 Estimating Willingness to Pay

To make estimation of the WTP expression (24) straightforward, the J marginal utility ratios U_j / λ (j = 1, . . . , J) must be eliminated. It is sufficient to solve for each of these ratios individually in terms of market and technological parameters. Turning to the first order conditions (23), since the U_j. appear in all but the first of these equations; we may regard the remaining first order conditions (excepting the constraint) as a system of I equations in J unknowns, and arrange this system as

$$\begin{bmatrix} s_1^1 & s_1^2 & \cdots & s_1^J \\ s_2^1 & s_2^2 & \cdots & s_2^J \\ \cdots & \cdots & \cdots & \cdots \\ s_I^1 & s_I^2 & \cdots & s_I^J \end{bmatrix} \begin{vmatrix} U_1/\lambda \\ \vdots \\ U_J/\lambda \end{vmatrix} = \begin{vmatrix} q_1 + W\Sigma G_j s_1^j \\ q_2 + W\Sigma G_j s_2^j \\ \vdots \\ q_I + W\Sigma G_j s_I^j \end{vmatrix} \tag{25a}$$

or

$$\left[s_i^j\right] \left[U_j/\lambda\right] = \left[q_i + W\Sigma G_j s_i^j\right], \tag{25b}$$

where all sums run from j = 1, . . . , J. Thus, the question is whether the matrix equation (25) contains enough information to solve for the unknowns U_j/λ (j = 1, . . . , J).

According to a theorem of linear algebra, the system of equations (25) has solutions if and only if the rank of the augmented matrix $[s_i^j : q_i + W\Sigma G_j s_i^j]$ has the same rank as the coefficient matrix $[s_i^j]$. (That is, the right hand side of equation (25) is not linearly independent of the left.) This restriction is assured if the first order conditions hold. If in addition these ranks are equal to J, then each of the unknowns U_j/λ may be found entirely in terms of market and technological parameters. Since the rank of a matrix cannot exceed the lesser of its row or column dimensions, this means that $I \geq J$. Thus, two conditions are sufficient to replace the marginal utility terms in the WTP expression (24): (1) the first order conditions with respect to the inputs of the health and symptom technology must hold, and (2) the number of these inputs must be at least as great as the number of health and symptom production functions in the model; that is, the number of averting behaviors must not be exceeded by the number of health effects of ozone exposure.

To illustrate the method of simplifying the bid in equation (24), consider the cases $I < J$, $I = J$, and $I > J$ in succession. If $I < J$, then there are fewer equations than unknowns in the system (25), and no unique solution for the U_j/λ in terms of market and technological parameters can be found. Thus, if the number of averting behaviors is less than the number of health and symptom production functions, then the marginal utility terms cannot be eliminated from the WTP expression.

Next, suppose that the number of health and symptom outputs is equal to the number of averting behaviors, which is equal to the ranks of the coefficient and augmented matrices. That is, $I = J$ and there are J independent first order equations in J unknowns. Using Cramer's rule to solve for U_1/λ yields

$$\frac{U_1}{\lambda} = \frac{1}{|S_i^j|}[(q_1 + W\Sigma G_j S_1^j)C_1^1 + \ldots + (q_I + W\Sigma G_j S_I^j)C_I^1] \qquad (26)$$

where $|S_i^j|$ is the determinant of the coefficient matrix and C_i^1 is the cofactor of the element in the i^{th} row and first column of $[S_i^j]$. Expanding the above expression, and using elementary theorems regarding cofactor expansion, one obtains

$$\frac{U_1}{\lambda} = \frac{\sum_{i=1}^{I} q_i C_i^1}{|S_i^j|} + WG_1. \qquad (27)$$

In general, for the case $I = J$,

$$\frac{U_j}{\lambda} = \frac{\sum_{i=1}^{I} q_i C_i^j}{|S_i^j|} + WG_j \qquad j = 1, \ldots, J. \qquad (28)$$

Thus expression (24) for WTP reduces to

$$\frac{\partial A}{\partial \beta} = - \frac{1}{|S_i^j|} \cdot \sum_{j=1}^{J} \left[\sum_{i=1}^{I} q_i C_i^j \right], \tag{29}$$

a function only of market and technological parameters. For the case I = J, this result gives the minimum information necessary to estimate WTP for the health benefits of ozone exposure: we need to know the full prices and the health technology.

Finally, consider the case where the number of averting behaviors exceeds the number of health and symptom production functions, that is, I > J. If the rank of the coefficient matrix is equal to J, then there are J independent equations to use in solving for the J unknown marginal utility ratios. Given that all I first order conditions on the inputs hold, however, there is some choice as to which J of these I equations to use in solving for the unknowns. In other words, there are a number of (J x J) matrices that can be formed by deleting rows of $[S_i^j]$; any one of these could be employed in the method of solution which led to equation (29).[2] Thus, in the case I > J, there are a number of expressions for WTP similar to equation (29). Thus, the first order conditions provide more information than necessary to compute the bid as an additive function of market and technological parameters: J pieces of information are needed, but I (> J) are available. This additional information would allow the researcher to choose the most reliable information to use in computing the bid. For example, if data on some full price, say q_l, were felt to be inaccurate, then the first order condition on V^l would be one of those excluded in solving for WTP. Alternatively, this additional information could be used to test the model, as described in the next subsection.

In summary, estimation of WTP in the context of an averting behavior model is hampered by the presence of unobservable marginal utility terms in the bid, whenever the number of health and symptom outputs exceeds the number of averting behaviors. The prospects for empirical implementation of the model are enhanced considerably if the number of averting behaviors is at least as great as the number of health and symptom outputs. In this case, the marginal utility terms which appear in the bid may be replaced with observable market and technological parameters. Moreover, the resulting expression for WTP is additive. Estimation then is relatively straightforward. If the number of averting behaviors equals the number of health and symptom outputs in the model, then the individual's utility maximization (or cost minimization) problem provides the minimum amount of information necessary to eliminate the marginal utility terms in the WTP expression. If the number of averting behaviors exceeds the number of health and symptom outputs, then the first order conditions contain additional information which may be used in a number of ways. One way in which this additional information might be useful is in giving the researcher some choice as to which pieces of information to use in computing WTP. Another use of this additional information, described more fully below, is to generate an implication of the model which may be used as a test of the model. or as an a priori restriction to improve the efficiency of estimation.

2.4.3 A New Refutable Hypothesis

To the extent that I > J (the number of averting behaviors exceeds the number of health and symptom production functions), the model contains more information than the minimum necessary to estimate the bid. This

additional information may be used either as a test of the model or as an econometric restriction to improve the efficiency of estimation. Recall that the elimination of the marginal utility terms in the bid uses two facts: (1) the first order conditions hold, and (2) there are J independent first order conditions on the inputs. If I > J, however, the model implies that I first order conditions hold; hence any subset of J of these could be used in solving for the bid. The restriction that the various resulting expressions for the bid be equal then is equivalent to the restriction that each of the I first order conditions on the inputs holds. Thus, this restriction is a refutable implication of the model. Alternatively, this restriction could be imposed a priori to increase the efficiency of estimation.

2.4.4 A Dual Interpretation

There is an additional interpretation of the restriction $I \geq J$ that may shed more light on this restriction and on the averting behavior model as a whole. Incidentally, this interpretation suggests an alternative estimation strategy.

Another way to formulate the consumers problem, often used in the household production literature, is in two stages. In the first stage, the minimum total cost of achieving given levels of health and symptom outputs is determined, while in the second stage the utility maximizing levels of these outputs are chosen, along with the consumption of the composite good X. If $C(q_1, \ldots, q_I, W, T, A, a, \beta, \lambda)$ is the minimum cost function defined by the solution to the first stage problem, then it can be shown that

$$\frac{U_j}{\lambda} = \frac{\partial C}{\partial S^j} \qquad j = 1, \ldots, J, \tag{30}$$

$$\frac{\partial A}{\partial \beta} = \frac{\partial C}{\partial \beta} \tag{31}$$

The first of these conditions merely states that the consumer equates the marginal benefits of each symptom to the marginal cost of its production. The second condition indicates that WTP for decreased ozone levels is equal to the partial derivative of the minimum total cost function with respect to ozone. This result is due to the fact that ozone is playing the role of a fixed factor of production in the theory of the firm; the imputed value of ozone in production then is given by its effect on costs. Because ozone affects the individual in this model only through its impact on health production, then the entire benefit of ozone reduction is captured by the reduction in the costs of achieving a given level of health. This result suggests estimation of the cost function as an alternative implementation strategy.

Turning now to the interpretation of the restriction $I \geq J$, note that there are I choice variables in the cost minimization problem, namely the inputs $V^1, \ldots V^I$. There are J independent output constraints in this problem. Hence for a meaningful solution to exist, it must be true that $I \geq J$. Taking this interpretation a step further, recall that if $I > J$, the additional information can be used to test whether the first order conditions on the inputs in equation (23) hold. These conditions are equivalent to the first order conditions on the inputs in the cost minimization problem, and thus the test of the equality of the expressions for the bid amounts to a test for cost minimization.

2.5. VARIATIONS ON THE AVERTING BEHAVIOR THEME

In this section three variations of the previous section's basic

averting behavior model are presented. The first variation considers the case where there are two classes of symptoms: those that are related to ozone and those that are not. The second variation allows the inputs of the health and symptom technology, both the endogenous $V^1, \ldots, VI$ and the exogenous β, to be direct sources of utility (or disutility). The final variation considers possible changes in the labor-leisure decision due to changes in ozone levels. Each of these extensions to the model has direct empirical relevance for this project. The first is relevant because data are being collected on ozone and non-ozone symptoms. The second variation is potentially important because many averting behaviors such as staying indoors or driving to the beach may involve direct changes in utility levels. Moreover, allowing for additional sources of disutility from ozone beyond those operating through the health technology indicates how the WTP for health benefits is related to other estimates of consumer benefits from ozone reduction. Finally, labor-leisure substitutions are considered because pretesting of survey instruments suggested that this may be a response to pollution for some people.

2.5.1 Two Classes of Symptoms

When the model allows for two classes of symptoms, those that are related to ozone and those that are not, two subcases arise. The simplest case is when some averting behaviors affect only the ozone symptoms and other averting behaviors affect only the non-ozone symptoms. A second case would occur if some averting behaviors affect both types of symptoms. In each of these cases, the WTP expression reflects only the ozone symptoms, but the conditions for replacing the marginal utility terms in the bid must be reinterpreted.

First, continue to assume that there are J symptoms of ozone exposure and I inputs into these symptom production functions, but suppose there is an additional set of symptoms unrelated to ozone: $S^{J+1}, \ldots, S^{K}$. Further suppose that the choice inputs into the production of these symptoms are entirely separate from the inputs of the ozone-related symptoms:

$$S^k = Sk(V^{I+1}, \ldots, V^H; \alpha) \quad k = J + 1, \ldots, K. \tag{32}$$

The utility function includes these symptoms, as does the time lost function. The full income budget constraint also must be modified to account for expenditures on $V^{1+1}, \ldots, V^H$.

Naturally, the symptoms which are entirely unrelated to ozone do not influence the WTP for ozone reductions; hence the bid remains

$$\frac{\partial A}{\partial \beta} = -\frac{1}{\lambda}\sum_{j=1}^{J} U_j S_\beta^j + W\sum_{j=1}^{J} G_j S_\beta^j. \tag{24 repeated}$$

There remain J marginal utility terms to replace, and I first order equations involving these terms. Thus the restriction $I \geq J$ remains valid, but it must be reinterpreted: the number of ozone related averting behaviors is at least as great as the number of ozone-related symptoms.

The simplicity of the first case above is a result of the separability between the two classes of symptoms. This separability would not occur if some inputs affected both ozone and non-ozone symptoms, as in the following specification of the technology:

$$S^j = s^j(V^1, \ldots, VI, V^{I+1}, \ldots, V^H; \alpha, \beta, \delta) \quad j = 1, \ldots, J \tag{33}$$
$$S^k = s^k(V^{I+1}, \ldots, V^H, V^{H+1}, \ldots, V^N; \alpha) \quad k = J + 1, \ldots, K.$$

Equation (24) for WTP remains valid for this model, and the condition $I \geq J$ still is sufficient to replace the marginal utility terms with market and technological parameters. That is, if the number of averting behaviors

which affect only the ozone symptoms is greater than the number of these symptoms, then only information on market and technological constraints is required to estimate the bid. If I < J, however, there remains some hope of solving for the relevant marginal utility terms. All the first order conditions on the inputs may be regarded as a system of N equations in the K unknowns $U_1/\lambda, \ldots, U_K/\lambda$. Thus if these first order conditions hold and $N \geq K$, the marginal utility terms appearing in the bid may be replaced with market and technological parameters.

In summary, the consideration of two classes of symptoms, namely those related and those unrelated to ozone, requires only a slight modification of the conclusions of the previous section. All that is needed to estimate the bid is information on the market and technological constraints facing the individual, if (1) first order conditions hold, and one of the following: (2) the number of. averting behaviors affecting only ozone-related symptoms is at least as great as the number of ozone-related symptoms, or (3) the total number of averting behaviors is at least as great as the total number of symptoms.

2.5.2 Inputs Jointly Produce Utility

As noted above, it is possible that the inputs jointly produce utility. Consider first the endogenous inputs, and suppose a subset of these inputs directly affect utility. Formally, let

$$S^j = S^j(V^1, \ldots, V^I, V^{I+1}, \ldots, V^H; \alpha, \beta, \delta) \quad j=1, \ldots, J \tag{34}$$

$$U = U(X, S^1, \ldots, S^J, V^{I+1}, \ldots, V^H). \tag{35}$$

Thus the inputs $V^{I+1}, \ldots, V^H$ are direct sources of utility. Harrington and Portney, and Chestnut and Violette, conjecture that this jointness will hamper estimation of WTP. That conclusion may have resulted from the fact

that there was one averting behavior and one output in the model those authors considered. In such a model, if the averting behavior entered the utility function, it would in fact be impossible to eliminate the marginal utility terms from the bid. In the more general system of equations (34) and (35), however, this need not be the case.

This model yields a bid identical to expression (24), but note that each of the necessary conditions on the last (H - I) inputs now will include an additional unobservable marginal utility term $\partial U / \partial V^h$ ($h = I + 1, \ldots, H$). Thus there are only I first order equations useful in solving for the unknowns U_j / λ in the expression for willingness to pay, and the requirement for straightforward estimation is $I \geq J$: the number of averting behaviors which do not affect utility must be at least as great as the number of symptoms of ozone exposure.

Next, consider the case where ozone has other adverse effects, not operating through the health and symptom technology, on the individual's welfare. These effects might include the disutility of smog or of reduced visibility. If these effects are captured by entering β directly into the utility function, the CV bid becomes

$$\frac{\partial A}{\partial \beta} = -\frac{1}{\lambda}\sum_{j=1}^{J} U_j S_\beta^j + W\sum_{j=1}^{I} G_j S_\beta^j - \frac{1}{\lambda}U_\beta \qquad (36)$$

which, if the number of averting behaviors not affecting utility exceeds the number of production constraints, can be expressed as

$$\frac{\partial A}{\partial \beta} = -\frac{1}{|S_i^j|}\sum_{j=1}^{J}\sum_{i=1}^{I} q_i C_i^j - \frac{1}{\lambda}U_\beta \qquad (37)$$

Note that since these other sources of disutility enter the bid additively, they may not present a great problem for the ABM. The bid derived from the

ABM can be interpreted as the marginal value of the health benefits of reduced ambient ozone, which may be added to other types of benefits to the consumer. If, however, health effects were not separable from these other effects of ozone, as would be the case if the perception of smog or reduced visibility were an output which could be avoided in some of the same ways that the health symptoms of ozone exposure are avoided, by staying indoors or leaving town, for instance, then these outputs are produced jointly with the health and symptom outputs of ozone. Ignoring these outputs amounts to a misspecification of the model and of WTP, because the optimal choice of averting inputs is not based solely on health considerations, as the model would indicate.

2.5.3 Labor-Leisure Substitutions

For those who are able, to some extent, to choose their hours of work, a possible averting behavior is a change in the allocation of time between labor and leisure. For example, those who work in air conditioned or other relatively pollution-free environments might choose to substitute labor for leisure if ozone levels increased. Presumably, such substitutions would be made in order to maximize utility and as a result, like all other optimal responses to ozone, these effects would not appear in the bid. This can be demonstrated directly by modifying the basic model to allow leisure time to enter the utility function, or by making time an input into the production functions; the derivation, however, is omitted.

2.6. CONCLUSIONS

This chapter began with a consideration of the nature of averting behavior. It was found that a useful definition equates averting behaviors with changes in choice variables in response to changes in pollution

levels. Next, existing averting behavior models were reviewed and generalized to allow for multiple inputs and outputs. The purpose of the chapter was to determine the conditions under which the WTP for reduced ozone levels would be a function of market and technological parameters, so that estimation of WTP would be relatively straightforward. These conditions vary slightly according to the nature of the model, but they may be summarized as follows. If the first order conditions on the health and symptom inputs hold, and if the number of averting behaviors which affect only ozone-related symptoms is at least as great as the number of health and symptom outputs, then WTP will be a function only of market and technological parameters. If the former number exceeds the latter, the model contains additional information which may be used to increase the efficiency of estimation or to test the model.

ENDNOTES TO CHAPTER 2

1. Actually Harrington and Portney define X as expenditures on, rather than consumption of, other goods.

2. More specifically, there are

$$\binom{I}{J} = \frac{I!}{J!(I - J)!}$$

ways to solve for the bid.

CHAPTER 3

DATA COLLECTION AND SAMPLING METHODS

3.1 SOURCE OF SUBJECTS

The population which serves as the source of subjects for this research is the population studied by Detels et al. (1979, 1981) in the Chronic Obstructive Respiratory Disease (CORD) study (see also, Rokaw et al., 1980; and Tashkin et al., 1979). The principal and co-principal investigators for this project have both participated in the CORD studies since their inception in 1972; Dean Detels is a co-investigator in the proposed study.

The CORD study includes approximately 15,000 persons, who were aged 7 and above, at the time of the first mobile lung function laboratory determinations in the early 1970s. These individuals were residents of a specific census tract in one of four communities in the Los Angeles area which were selected because of historical exposure to different levels and types of air pollution, because of their demographic similarity to each other (median income, proportion home owners, median age, percent white, etc.) and because of proximity to an air monitoring station of the South Coast Air Quality Management District (SCAQMD). All residents of households in the selected area, exclusive of children under 7 years of age and individuals physically unable to climb the 10 steps to the laboratory, were invited to participate in the study. About eighty percent of the invited residents actually participated in the study.

Measurements, including a battery of lung function tests and a detailed questionnaire on symptoms, smoking, residence and occupational histories and demographic information, were made in a mobile lung function laboratory which was located convenient to the population to be studied.

Approximately five years after the first set of measurements in each community, a second round of measurements was performed. Measurements made were the same, the questionnaire was modified to update information already collected. A third visit was made to all communities except Glendora. In this visit, limited measurements were made on study participants who were available and willing to come to the mobile laboratory for the measurements during the few weeks of the study. The four communities and information about the CORD studies in each are given below.

Burbank (East San Fernando Valley); moderate oxidant pollution; 3,226 persons studies in 1973; 2,733 of these in 1978, 1,084 in 1983.

Lancaster (Antelope Valley, edge-of Mohave Desert, higher altitude than the rest) selected for the study because of "clean air," Lancaster experienced a rise in oxidant air pollution that is only slightly lower than that of Burbank;. 4,584 persons studied in 1973, 2,544 of these in 1979, 1,103 in 1982.

Long Beach (coastal community south of Los Angeles, oil drilling and refineries); particulate and sulfur oxide pollution; 3,797 persons studies i 1974, 1,828 of these in 1980 and 1,024 in 1983.

Glendora (East San Gabriel Valley); high levels of oxidant pollution with some sulfates; 3,858 persons studies in 1977, 2,117 of these in 1982.

3.2 SELECTION OF COMMUNITY

Of the four CORD communities, two were selected for inclusion in the proposed study: Burbank and Glendora. Glendora has much the higher oxidant pollution levels, though this may be somewhat confounded by the higher sulfate levels. The Glendora CORD population had its second round

of measurements more recently, in 1982. In addition, two other studies of sensitive individuals (persons with CORD and self-identified pollution responders") have been performed in Glendora in the last two years.

Burbank has more moderate levels of ozone pollution with less contamination with sulfates. The second round of measurements was earlier, in 1978, though the later restudy of available participants was done in 1983. Because the Burbank studies were started five years earlier, the population is five years older. No additional studies of sensitive individuals have been done by us.

A panel of scientists (see Appendix D of Gerking et al.) with investigative experience in health effects of oxidant air pollution recommended that Glendora be selected, primarily on the basis of the higher levels of air pollution. The panel suggested that the Glendora pollution levels offered more "criteria days" and more opportunity to observe more noticeable health effects.

In the selection of the community, we are endeavoring to obtain information about a problem that is national in scope, albeit a particular problem in California. The levels of ozone pollution in Burbank are closer to those found elsewhere in the country. The levels in Glendora are high even for the South Coast Air Basin. Relative representativeness would be sacrificed to obtain more-clearly observable differences.

The frequency of poor air quality in Glendora may also lead to permanent accommodation on the part of residents, including indoor areas for physical activity and recreation, thus minimizing the changes in behavior one might expect in response to high levels of ozone. Residents of both communities are studied, so that these questions can be addressed.

Therefore, with attention to the panel's recommendation, we propose to use both the Glendora and the Burbank CORD population in this study. Approximately 150 individuals from Glendora and approximately 100 individuals from Burbank ultimately will be included in the study. By utilizing residents in both communities, the following advantages are available:

1) Burbank levels of air pollution are closer to those possible in other areas of the U.S. outside California, while Glendora offers the opportunity to study both more frequent and higher levels of ozone pollution.

2) Burbank levels of air pollution, and the number of exceedance days, may have invoked less permanent accommodation; the existence of such permanent accommodation can be better identified in Glendora.

3) The population in Burbank is less politically sensitized to the presence and problem of air pollution; the averting behaviors induced by the politicization in Glendora can be explored.

4) Use of both communities will allow comparison of same day reports of individuals at different levels of pollution, thereby avoiding the compounding effect of time of year which itself could affect types of activities independent of pollution.

3.3 SAMPLING

Using the Burbank and Glendora CORD populations, individuals are being selected for recruitment into the study. Selection is restricted to those still living in the same census tract in the area, or, if they have moved, in the same proximity to the air quality monitoring station.

Because of the confounding associated with smoking, only those individuals who are non-smokers, or who are former smokers who have not smoked for at least two years, are eligible to participate. It would be interesting to determine the combined, perhaps synergistic, effects of ozone exposure and cigarette smoking and perhaps the effect of ozone level

on cigarette smoking. However, the sample size proposed for this study is not sufficiently large for this objective, given the number of important variables associated with smoking such as number of years smoked, daily amount of consumption, characteristics of cigarettes used, etc.

Subjects were identified as potentially eligible for recruitment if they are presently between 25 and 59 years of age. Children will be excluded as primary respondents because of the problems of interviewing them on the phone. Age 25 was selected as the lowest level because lung development is completed by that age, and individuals at that age are more likely to be settled than younger adults. Age 59 has been selected as the upper limit so as to restrict the sample to those drawn from the prime working population.

Because of the economic nature of this study, one additional eligibility criterion is imposed. All subjects will be household heads working at least 1600 hours per year at a regular job. A wage rate can be calculated for such workers from which a value of time can be computed. That value of time is needed in order to implement the ABM approach discussed in Section 2.1. The definition of a head of household was that used in the CORD study: an adult male was considered the head of the household of a nuclear (or extended) family, if one was present. An adult female was considered to be the head of the household if an adult male was not present. (The term "adult" did not include grown children of the female head of household.)

Sampling was stratified by measures of sensitivity or vulnerability. Approximately 60 percent of the sample (about 150 persons) will be selected from the sensitive and vulnerable category, while the remainder of the

sample is randomly selected from individuals having normal respiratory function. Two types of sensitive and vulnerable individuals are considered in this study:

1) Individuals who regularly engage in outdoor occupational or recreational activity which results in high minute ventilation (deep and fast breathing). Such individuals are expected to be more vulnerable to possible adverse effects of air pollution.

2) Individuals who have obstructive respiratory disease (asthma, emphysema, and bronchitis) or who have impaired lung function (FEV less than 70 percent of expected).

The rationale for dividing the sensitive and vulnerable individuals into these two categories is contained in Gerking et al. (1984, Appendix E). Approximately 75 persons will be selected in each of these two categories. Individuals in the first category will be identified using-the background questionnaire (see Section 3.7). Individuals in the second category are identified from previous CORD data. Every effort is being made to include all known diseased or impaired CORD subjects living in Glendora and Burbank in the study.

3.4 RECRUITMENT

Study participants were recruited, in order, from the sampling lists. Recruiting for a particular group will be stopped when the desired number of the group have agreed to participate.

The initial step in recruiting consisted of a letter from Dean Detels as principal investigator of the CORD study, explaining the new study, encouraging their participation and explaining that the individual would be called in the next week regarding the new study.

The second step was a phone call. During this call, the study was more fully explained, questions were answered, required eligibility

criteria were ascertained (non-smoking, still live in the area, working full time) and agreement to participate was obtained. Following the agreement, an in-person baseline, interview was scheduled.

Following recruitment, a letter was sent acknowledging the participant's agreement, and describing the study and the terms of payment. A copy of this letter, with a return envelope, was included for the subject to sign, record his or her social security number for payment, and return. If the copy was not returned by the time of the baseline interview, the data collector obtained the signature at that time.

Recruitment of subjects will continue until the required group sizes are completed. To reduce waiting time, recruitment can proceed simultaneously on enough individuals to fill any specified group. However, to avoid bias involved in recruiting the "easier" subjects, no one on a randomized list, beyond the number needed for the group, may be recruited until a refusal, ineligibility or transfer occurs among those within the number needed. That is, if 30 persons are needed for a given group, recruitment may proceed simultaneously on the first 30 persons on the randomized list. Person number 31 may not be recruited until it is known that one of the first 30 is not a participant.

Individuals definitely declining to participate on the first phone call are not contacted further. Their identity is retained only to preclude further contact in recruitment. Following recruitment, only a deeply encoded identification number, demographic and other CORD variables, and the fact of refusal is maintained. This file will be used solely to characterize non-respondents and refusals. No cross-identification to the

CORD files will be possible without the equation of the deep encoding, to which access is limited to the investigators only.

3.5 PAYMENT OF SUBJECTS

The number of contacts required with this panel of subjects necessitates paying them if continued participation is to be assured. We propose to, pay each individual the sum of $45.00 for the full course of contacts. We anticipate about eight follow-up contacts in addition to the background interview; hence this payment amounts to $5.00 per contact. If the subject misses one or more contacts, $5.00 will be deducted from the $45.00 for each contact missed.

3.6 CORD MEASURES

A great deal of information was collected on each of the potential study subjects during their two or three contacts with CORD and the mobile lung function laboratory. As explained above under selection and sampling, certain of these measures and responses are being used to determine study eligibility and subgrouping. These include age, sex, smoking -behavior, physician diagnosed asthma, chronic bronchitis, or emphysema, reported symptoms and FEV_1 as a percent of predicted FEV_1.

Other CORD measures will be used to determine the frequency and distribution of responses among these individuals. This information will be used to estimate possible frequency and distribution in the study. Also, these variables can be used to characterize those not selected, refusals and non-respondents in comparison with those who do participate.

CORD data available will be reviewed. Those variables which are not being repeated in the present study, especially physical measurement

including common lung function tests, will be incorporated in the baseline file for the participants. Similarly, historic information on residence and occupation and exposure information, such as fuels used in heating and cooking, will be incorporated.

To the extent possible, transforms, scales and reclassified or reduced variables will be used, where these will be equally well or better serve the proposed study, thus protecting the primary cord data for further analysis by COED investigators. Data collected in the current study which is useful in the analysis or interpretation of COED data will be shared with COED investigators.

3.7 BASELINE

Following recruitment, the background survey is administered in the participant's home. The background survey (see Appendix A) is designed to collect both baseline and follow-up type data, including: (1) the respondents baseline health status, (2) typical and recent contacts with the health care delivery system, (3) leisure-time activities, changes in those activities, and a direct question about the respondent's averting behaviors, (4) a checklist of symptoms, (5) a contingent valuation of those symptoms which were experienced in the two days preceding the day of the survey,, (6) home environment characteristics, (7) occupational information, and (8) standard demographic data.

Health status data are collected by repeating the National Heart, Lung, and Blood Institute symptom and respiratory disease questions. A medical history is obtained of diseases and medications which may imply a special sensitivity. Information is collected regarding typical usage of

health care facilities along with the associated money and time costs. In addition, any recent contacts with the health care system are recorded.

Leisure activities and changes in those activities over the two days preceding the survey data are covered in detail in an attempt to measure the extent of averting behavior in response to ozone levels. The amount of time spent outdoors and the number of trips outside the area are included since changes in these variables also are likely averting behaviors. Additionally, respondents are asked what, if anything, they do to avoid exposure to air pollution. This question is included in case some important averting. responses were overlooked in the design of the survey.

A list of 26 symptoms, including those which may result from ozone exposure and some which may not, is checked to discover whether the respondent has ever had these symptoms, and whether he has had them during the past two days. For each symptom experienced in the past two days, a contingent valuation question asks the maximum amount of money the respondent would have been willing to pay to have avoided that symptom on the day it was experienced.

Characteristics of the home environment include presence and use of air conditioning, purifying, and filtering (these are also potential averting responses to increased ozone levels), presence of ozone-producing devices (ionizers), fuel used for cooking and heating, character and extent of insulation, extent of traffic within one block of house, and use of air conditioned cars.

Detailed occupational and demographic information are collected, including income, education, occupation, industry and characteristics of the work environment which may affect respiratory health and symptoms.

The baseline data collection instrument is included in Appendix A. This instrument was developed based on experience in previous studies, literature review, the health and ozone telephone conference mentioned previously and reviews by experts on the ozone and health relationship as well as by questionnaire experts. Additionally, the background survey was pretested extensively in the field.

3.8 FOLLOW-UP

The follow-up survey, included as Appendix B, is designed to collect at regular intervals much of the same type of information collected in the baseline instrument. Information will be collected on the subject's symptoms, work and leisure activities including travel and time spent outdoors, illness, work loss, and medication used or medical visits. A contingent valuation questions elicits information regarding willingness to pay to avoid each symptom experienced during the two day period. In the course of each interview, the subject will be asked his/her opinion of the air quality for the day of the call and the previous day.

Each subject will be phoned twice within each calendar month during the late summer and fall, and once each month thereafter until February, 1986. The calls will be approximately two weeks apart during autumn and one month apart during the winter. A calling schedule will be computer designed for each day, to maximize days with ozone exposure and to balance weekday and weekend reports.

Data will be collected about the day of the call and the previous day. It is anticipated that if the day before the previous day was a weekend day, it will be better recalled by the subject than if it were another weekday. This is because of the change of activity associated with weekend

days, which may be different from one another. However, data will always be collected for the two day period; the day-of-the-week effect will be accounted for in the analysis.

Data will be collected by study staff specifically trained to use the instrument. Time of day of collection will range from late afternoon into the evening and will be specifically negotiated with each individual. At each contact the data collector will ask if the time is convenient. If it is not, the data collector will arrange to call back, at another agreed upon time. Weekend calls will be made on Saturdays during the day, for the most part. A general idea of a convenient time for calls is obtained at baseline; at each contact the data collector will first ascertain if the time is convenient. If it is not the data collector will call back.

In order to complete the study with as little inconvenience to the subjects as possible, thereby reducing the drop-but rate, we plan to have the follow-up contact take approximately 20 minutes for data collection. If the subject has a great deal to report, it may, of course, take longer to complete. Our experience has been that a data collection contact that is extended by the subject's information is not regarded as long by that subject.

Because of the time limitation, standard update items, independent of the air quality, may be asked only every other month. If a change has occurred, the time of that change will be ascertained.

3.9 AIR POLLUTION MEASURES

Air quality measures presently are being obtained from two sources: the monthly print out of daily maximum hourly and average hourly values of ozone and other pollutant specific measures from the South Coast Air

Quality Measurement District and the full tape of measures from the California Air Resources Board. The Los Angeles Times reports the levels of three pollutants from stations around the country each day, showing clean air standard level, and first and second stage alerts. The Azusa station, within a mile of which our participants live, is located between Pasadena and Riverside and, because of topography, is probably worse than either. (Informal daily survey shows that this July and August, despite 'unusually low temperatures, a large proportion of the days has exceeded the clean air standard. First stage alerts have not been uncommon.)

The pollution measure used will be the maximum hourly average for pollutants measured on a continuous basis, and the most recent measurement for those measured over a time period. This initial information will allow planning for calls in the telephone follow-up for the evening and the next day as well as providing an initial air quality input into the data file. The pollution exposure data matched to the individuals in the sample will take account of the differing locations where they live and work as well as the relative amounts of time spent in each location.

Data tapes of air monitoring station measurements will be obtained as they become available on a quarterly basis. These tapes include additional information, are "cleaned" data and are, of course, computer readable. Data from these tapes will be identical with published air quality data. Cleaning and appropriate adjustment may result in some deviation from the daily and monthly figures described above. These data tapes will be used as the source of air pollution information in the major analysis.

While the primary focus of the present study is on ozone as a pollutant, the free living population in any area-is exposed to other pollutants at the same time. There may be a combination of effects from these pollutants. It is, therefore, necessary to include other pollutants in the analysis. All measured pollutants will be examined for inclusion, which will be based on the inter-correlation of the pollutants in time and the potential confounding resulting from similar health effects associated with different pollutants.

3.10 DATA MANAGEMENT

After the data are collected, the data collection instruments will be visually checked for completeness to identify any problems in a timely manner, Any necessary coding and registering of responses will be completed at that time. All forms will be key entered and will be 100 percent verified. Subsequent to key entry, records will be entered into the mainframe computer where initial computer editing will be accomplished including range and consistency checks.

Errors discovered through any of these procedures will be referred back to the data collector, checked against the original instruments or checked with the respondent as appropriate. Unresolved, unacceptable values will be declared missing through error.

Newly collected data will be added to already collected data on the same subjects through computer linkage programs. Thus, the initial data file will include CORD and recruitment data; baseline data will be concatenated with it, as will monthly follow-up data, etc. Following linkage, consistency checks across time will be performed.

Subfiles of the main data tapes, including scales, transformation, specifically limited numbers of data items or subsets of subjects, will be created for analysis as needed.

A special subfile will be created and maintained for study management. Subject contact will be managed by computer. Lists of subjects to be contacted in a given time period, subjects overdue for contact, subjects requiring contact on some particular type of day, etc. will be printed out. This file will be separated from the main file and will include name, address, phone number and other identifiers. These confidential data will protected by a deeply encoded identification number, thus preventing linkage of identifiers to personal data by unauthorized persons.

CHAPTER 4

A VERY PRELIMINARY ANALYSIS

Summarized here are some very preliminary results from the baseline questionnaire. The baseline data collection effort, as of August 26, was not quite complete in Glendora and was about to begin in Burbank. The first follow-up questionnaires were administered during the last week in August; however, no data from them are available for report here.

A word is in order about the total number of observations on which each of the results tables is based, which disconcertingly changes from table to table. This is because of the very preliminary state of the data, and the different data management status of the baseline forms, Information derived from field records of completions is the most complete; information obtained by tallying completed forms is next; and information from computer runs of temporary data sets is necessarily the least complete (though probably the most interesting). All data are based on at least 120 questionnaires.

Table 1 shows the field status of the project as of August 26. As shown, 136 baseline interviews had been completed and 13 additional interviews have been scheduled. The number of persons refusing to participate (13) in the study is quite low and is less than 10 percent of the number of completed interviews. Among 124 respondents whose completed questionnaires have been examined, all are Caucasian as is most of the Glendora population. There are 12 female household heads in the group,

again similar to the distribution of household heads by gender in that population.

As previously indicated, all persons in the Glendora CORD population known to have asthma, bronchitis, or emphysema and/or have impaired lung function (FEV, less than 70 percent of expected) were invited to

TABLE 1. STATUS OF RECRUITMENT AND COMPLETION OF BASELINE INTERVIEWS; GLENDORA, AUGUST 26, 1985

BASELINE INTERVIEWS	NUMBER
COMPLETED	136
SCHEDULED	13
STILL ATTEMPTING TO CONTACT	22
REFUSED TO PARTICIPATE	13
INELIGIBLE:	
MOVED FROM AREA	47
RETIRED	3
DECEASED	2

participate in the study. At present, there are at least 28 such individuals in the sample: 16 individuals with asthma, 1 with chronic bronchitis, 2 with emphysema, 8 with asthma and bronchitis or emphysema, and 1 with bronchitis and emphysema. All of these individuals were identified using data from previous CORD studies. A few additional individuals with diseased or otherwise impaired lung function may be identified through the baseline interview. Such an identification has not yet been completed as joint analysis of a number of questionnaire items must be performed. In any event, every effort will continue to be made to include individuals in this category in order that they represent 30 percent of the total sample. Additionally, a preliminary tally of the leisure activities questions reveals that there are 39 persons who report regularly exercising heavily or for long duration out of doors. Therefore,

since 28.6 percent of the current sample is composed of those who regularly exercise heavily, no special steps apparently are-necessary to identify persons in this category.

Of the 26 health symptoms considered in the baseline questionnaire, not all can be linked to ozone exposure on the basis of medical evidence. A panel of experts on the health effects of ozone (see Gerking et al., Appendix D) were asked to assess the likelihood that these symptoms were associated with ozone exposure. These likelihoods are expressed in three categories: (1) definitely associated (D), probably associated, (P), and not associated (N). This classification scheme is applied to the list of 26 symptoms shown in Table 2. That table also shows frequency of reports of each symptom as tabulated from the baseline questionnaires. The symptoms are ordered by frequency of occurrence, rather than the order in which they were asked. Eye irritation, as might be expected, is first, headache is second and tiredness third. Of 124 completed baseline questionnaires, 51 (or 41 percent) respondents reported having one or more symptoms. Of course, not all of the symptoms are ozone specific. There were 73 reports of symptoms regarded as definite among the 174 reports (by 51 persons) and 51 of the 174 reports involved symptoms regarded as non-related.

TABLE 2. FREQUENCY OF OCCURRENCE OF SYMPTOMS;
GLENDORA, AUGUST 26, 1985

RELATEDNESS TO OZONE*		SYMPTOM	FREQUENCY
(P)	1	Eye irritation	17
(D)	15	Headache	16
(N)	16	Tiredness	14
(D)	13	Cough	12
(P)	9	Runny nose	12
(N)	3	Eyes sens. to br. 1t.	12
(P)	14	Phlegm	11
(D)	24	Chest tight	9
(N)	5	Voice husky	9
(D)	6	Sinus pain	8
(D)	12	Out of breath	7
(D)	4	Irritated throat	7
(N)	2	Not see as well	7
(D)	23	Wheezing	6
(D)	11	Cannot breath deep	6
(N)	22	Ringing/ears	4
(P)	8	Dry nose	4
(P)	26	Swollen glands	3
(N)	19	Nausea	3
(D)	10	Pain w/deep breath	2
(P)	25	Fast heart beat	1
(N)	21	Pain in *ears*	1
(N)	20	Chills/Fever	1
(P)	18	Spaced-out	1
(P)	17	Dizziness	1

*
D = Definite
P = Probable
N = Not Related

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APPENDIX A

BACKGROUND QUESTIONNAIRE

R.I.D.#: _____ CONFIDENTIAL

RESPONDENTS NAME: _____
RESPONDENTS PHONE #: _____ / _____
area code
RESPONDENTS ADDRESS _____
_____
city zip code
INTERVIEWER: _____ I.D.#: _____

DATE	DAY	TIME	RESULT	COMMENTS
1.		AM PM		
2.		AM PM		
3.		AM PM		
4.		AM PM		
5.		AM PM		
6.		AM PM		
7.		AM PM		
8.		AM PM		
9.		AM PM		
10.		AM PM		
11.		AM PM		
12.		AM PM		

Good morning (afternoon, evening). I'm (...) from the _____
We're conducting a survey for the _____ , which deals with

(i) how air pollution might affect you

(ii) how you might change your daily activities to avoid exposure on bad days.

You may recall that your household received a (letter/phone call) about this very important study. Please be assured that all information provided is confidential and your name will not be identified with the study.

First, I would like to ask you some questions about your health.

1. In general, would you say that your health is:

Excellent	1
Good	2
Fair, or	3
Poor?	4

2. Have you ever been told by a doctor that you had asthma?

YES. . . ASK A.	l
NO . . . SKIP TO Q3	2

A. How old were you when you were first told that you had asthma?

RECORD AGE: _____

B. Have you taken medication for it during the past year?

YES	1
NO	2

C. When was your last asthma attack?

RECORD _____ / _____
MONTH YEAR

IF LAST ATTACK WITH THE PAST 2 YEARS	ASK D
IF LAST ATTACK 3 YEARS OR MORE	SKIP TO Q3

D. Do you know what brings on your attacks? PROBE

_____

_____

_____

3. Have you ever been told by a doctor that you had chronic bronchitis?

YES ASK A	l
NO . . . SKIP TO Q4	2

A. How old were you when you were first told you had chronic bronchitis?

RECORD AGE: _____

B. Have you taken medication or done anything special for the bronchitis during the past year?

YES 1
NO 2

C. When was the last time you were sick with bronchitis?

RECORD: _____ / _____ / _____
YEARS MONTHS WEEKS

4. Have you ever been told by a doctor that you had emphysema?

YES...ASK A.. 1
NO ... SKIP TO Q5 2

A. How old were you when you were first told you had emphysema?

RECORD AGE: _____

B. Have you taken any medicine or had treatment for the emphysema during the past year?

YES l
NO 2

C. When was the last time it really bothered you?

RECORD: _____ / _____ / _____
YEARS MONTHS WEEKS

5. Have you ever been told by a doctor that you had any other respiratory or lung disease?

YES ...ASK A. l
NO . . . . SKIP TO Q6 2

A. What were you told? PROBE

_____

_____

B. How old were you when you were first told that you had other respiratory or lung diseases?

RECORD AGE: _____

C. Do you take medication for it?

YES 1
NO 2

6. Have you ever been told by a doctor that you had hay fever?

YES . ..ASK A.....l
NO . . . . SKIP TO Q7 2

A. How old were you when you were first told you had hay fever?

RECORD AGE: _____

B. Do you take any medication for your hay fever?

YES 1
NO 2

7. In the past year, how many times have you visited a doctor or a health care facility as a patient? Please include visits to eye doctors, chiropractors, and psychiatrists. Do not include visits to the dentist.

OF VISITS _____

8. Was this a typical number of visits for you? How many visits to doctors or health care facilities do you typically make in a year?

OF VISITS _____

9. Do you have a regular doctor?

IF NO: SKIP TO Q13

YES l
NO . . . . . SKIP TO Q13 2

10. When you go to your regular doctor, how long do you usually wait for health care services?

OF MINUTES _____

11. On average, how long does it take you to get to your regular doctor's office or clinic?

OF MINUTES _____

12. About how much do you pay your regular doctor or health car provider for an office visit. Include only your out-of-pocket expenses..

$ _____

13. When was the last time you saw a doctor for a specific health problem, such as an illness, accident or injury?

OF MONTHS _____
NEVER . . SKIP TO Q14 . . 90

A. What was the problem?

_____

_____

_____

IF R SAW A DOCTOR, YESTERDAY OR DAY BEFORE YESTERDAY ASK:

(a) Where did you go?

DOCTOR'S OFFICE 1
EMERGENCY 1
HOSPITAL 2
CALLED DOCTOR 3

(b) How much time did it take to get this medical attention?

_____

(c) What will be your out-of-pocket expense for this medical attention?

$ _____

14. During the last year, since_____, 1984, were you in the hospital as a patient overnight or longer? Do not include maternity, accident or injury.

YES . . .ASK A l
NO . . . SKIP TO Ql5 2

A. How many times, separated by at least one day, were you admitted to a hospital to stay overnight or longer, since_____, 1984. Again, do not include maternity, accident or injury.

RECORD #:_____

B. What was the matter? RECORD UP TO THREE MENTIONS.

1. _____
2. _____
3. _____

Now some questions about your respiratory health.

15. Do you usually cough first thing in the morning in bad weather?

YES 1
NO 2

16. Do you usually cough at other times during the day or night in bad weather?

YES l
NO 2

17. Do you cough on most days for as much as 3 months of the year?

YES 1
NO 2

IF COUGH IS REPORTED (Q15 - Q17) . . . . ASK Q18
IF NO COUGH IS REPORTED (Ql5 - Q17) . . ASK Ql9

18. How long have you had the cough -- about how many years?

YEARS_____

19. Do you usually bring up phlegm, sputum or mucous from your chest first thing in the morning in bad weather?

YES 1
NO 2

20. Do you usually bring up phlegm, sputum or mucous from your chest at other times during the day or night in bad weather?

YES 1
NO 2

21. Do you bring up phlegm, sputum or mucous from your chest on most days for as much as 3 months of the year?

YES 1
NO 2

IF "YES" TO ANY Ql9 - Q21 . . . . . ASK Q22 IF "NO" TO ALL Q19 - Q21 . . . . . SKIP TO INSTRUCTION BELOW Q22

22. How long have you raised phlegm, sputum or mucous -- about how many years?

YEARS_____

IF COUGH OR PHLEGM (MUCOUS) REPORTED Ql5 - Q21 . . ASK Q23 IF NEITHER REPORTED Ql5 - Q21 . . . . . SKIP TO Q24

23. Does most of this coughing and/or phlegm come during one season of the year?

YES...ASK A l
NO . . . SKIP TO Q24 2

A. When? CODE ALL MENTIONS

SUMMER 1
FALL 2
WINTER 3
SPRING 4
ALL YEAR 5

24. In the past three years, have you had a period of increased cough and phlegm lasting for three weeks or more?

YES . . .ASK A 1
NO . . . SKIP TO Q25 2

A. Have you had more than one such three-week period?

YES 1
NO 2

25. Does your breathing ever sound wheezing or whistling?

YES . . .ASK A l
NO . . . SKIP TO Q26 2

A. On how many days has this happened during the past year?

RECORD DAYS: _____
DON'T KNOW 98

26. Have you ever had attacks of shortness of breath with wheezing?

YES 1
NO 2

27. Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?

YES . . .ASK A l
NO . . . SKIP TO Q28 2

A. Do you get short of breath walking with other people of your own age on level ground?

YES 1
NO 2

B. Do you have to stop for breath when walking at your own pace on level ground?

YES 1
NO 2

28. Do you suddenly become short of breath when taking it easy (not exercising)?

YES . . . ASK A l
NO . . . SKIP TO Q29 2

A. How many days did this happen during the past year?

RECORD DAYS_____
DON'T KNOW 98

29. During the past 3 years how much trouble have you had with illnesses such as chest colds, bronchitis or pneumonia? Would you say:

A LOT .. ASK A. l
SOME, OR . . .ASK A. 2
VERY LITTLE? . SKIP TO Q30 . . . 3

A. During the past 3 years, how often were you unable to do your usual activities because of illness such as chest colds, bronchitis or pneumonia?

RECORD DAYS _____

Now I'd like to ask you about the things you do regularly in your leisure time.

30. A. What were your regular leisure or non-work related activities in the past month? list - (PROBE)

1. _____
2. _____
3. _____
4. _____
5. _____

(If more than 5, use the five that the respondent does most often)

Activity #1

B. About how many hours per week (including transportation) did you _____?

C. How many times a week did you _____?

D. Where do you usually _____?
(What area or community)

For "AT HOME" code "1"
For "GLENDORA" or "EAST SAN GABRIEL VALLEY" code "2"
All others leave blank _____

E. What is the usual time of day when you do this activity _____?

Morning . . . . . 1 yes - 2 no
Afternoon . . . . . 1 yes - 2 no
Evening . . . . . 1 yes - 2 no
Night . . . . . 1 yes - 2 no
No particular time 1 yes - 2 no

F. What days of the week did you usually do this activity _____?

Monday . . . . . 1 yes - 2 no
Tuesday . . . . . 1 yes - 2 no
Wednesday . . . . . 1 yes - 2 no
Thursday . . . . . 1 yes - 2 no
Friday . . . . . 1 yes - 2 no
Saturday . . . . . 1 yes - 2 no
Sunday . . . . . 1 yes - 2 no

G. What does it usually cost to do this activity (including transportation) per month?_____
each time?_____

H. How much of the time did you _____ outdoors?

1 . . . . . Always
2 . . . . . Most of the time
3 . . . . . Half of the time
4 . . . . . Some of the time
5 . . . . . Never

(Interviewer - for questions I thru J record the response for "yesterday" in the appropriate column then repeat the questions for "day before yesterday".)

I. How many hours did you_____ Yesterday Day Before Yesterday
Yesterday/Day Before Yesterday? Yesterday

(Interviewer - if zero GO TO J) _____ _____

i. What did it cost you to_____
Yesterday/Day Before Yesterday? _____ _____

ii. Did you put significantly less effort than planned or usual into_____ Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes - 2 no

iii. Did you change the planned or usual time of day of_____
Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes - 2 no

iv. Did you change the planned or usual location of_____
Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes - 2 no

J. How many hours had you planned to_____ Yesterday Day Before Yesterday

_____ _____

Activity #2

B. About how many hours per week (including transportation) did you_____?

C. How many times a week did you_____?

D. Where do you usually_____?
(What area or community)

For "AT HOME" code "1"
For "GLENDORA" or "EAST SAN GABRIEL VALLEY" code "2"
All others leave blank _____

E. What is the usual time of day when you do this activity_____?

Morning . . . . . 1 yes - 2 no
Afternoon . . . . . 1 yes - 2 no
Evening . . . . . 1 yes - 2 no
Night . . . . . 1 yes - 2 no
No particular time 1 yes - 2 no

F. What days of the week did you usually do this activity_____?

Monday . . . . . 1 yes - 2 no
Tuesday . . . . . 1 yes - 2 no
Wednesday . . . . . 1 yes - 2 no
Thursday . . . . . 1 yes - 2 no
Friday . . . . . 1 yes - 2 no
Saturday . . . . . 1 yes - 2 no
Sunday . . . . . 1 yes - 2 no
No particular day . 1 yes - 2 no

G. What does it usually cost to do this activity (including transportation) per month_____?
each time_____?

H. How much of the time did you_____ outdoors?

1 . . . . . Always
2 . . . . . Most of the time
3 . . . . . Half of the time
4 . . . . . Some of the time
5 . . . . . Never

(Interviewer - for questions I thru J record the response for "yesterday" in the appropriate column then repeat the questions for "day before yesterday".)

	Yesterday	Day Before Yesterday
I. How many hours did you_____ (Interviewer - if zero GO TO J)	_____	_____
i. What did it cost you to_____ Yesterday/Day Before Yesterday?	_____	_____
ii. Did you put significantly less effort than planned or usual into_____Yesterday/Day Before Yesterday?	1 yes - 2 no	1 yes - 2 no
iii. Did you change the planned or usual time of day of_____ Yesterday/Day Before Yesterday?	1 yes - 2 no	1 yes - 2 no
iv. Did you change the planned or usual location of_____ Yesterday/Day Before Yesterday?	1 yes - 2 no	1 yes - 2 no
J. How many hours had you planned to_____	_____	_____

Activity #3

B. About how many hours per week (including transportation) did you_____?

C. How many times a week did you_____?

D. Where do you usually_____?
(What area or community)

For "AT HOME: code "1"
For "GLENDORA" or "EAST SAN GABRIEL VALLEY" code "2"
All others leave blank _____

E. What is the usual time of day when you did this activity_____?

Morning . . . . . I yes - 2 no
Afternoon . . . . . 1 yes - 2 no
Evening . . . . . 1 yes - 2 no
Night . . . . . 1 yes - 2 no
No particular time 1 yes - 2 no

F. What days of the week did you usually do this activity_____?

Monday . . . . . 1 yes - 2 no
Tuesday . . . . . 1 yes - 2 no
Wednesday . . . . . 1 yes - 2 no
Thursday . . . . . 1 yes - 2 no
Friday . . . . . 1 yes - 2 no
Saturday . . . . . 1 yes - 2 no
Sunday . . . . . 1 yes - 2 no
No particular day . 1 yes - 2 no

G. What does it usually cost to do this activity (including transportation) per month_____?
each time_____?

H. How much of the time did you_____ outdoors?

1 . . . . . Always
2 . . . . . Most of the time
3 . . . . . Half of the time
4 . . . . . Some of the time
5 . . . . . Never

(Interviewer - for questions I thru J record the response for "yesterday" in the appropriate column then repeat the questions for "day before yesterday".)

I. How many hours did you_____ Yesterday/Day Before Yesterday?

Yesterday	Day Before Yesterday
_____	_____

(Interviewer - if zero GO TO J)

i. What did it cost you to_____ Yesterday/Day Before Yesterday? _____ _____

ii. Did you put significantly less effort than planned or usual into_____ Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes - 2 no

iii. Did you change the planned or usual time of day of_____ Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes - 2 no

IV. Did you change the planned or usual location of_____ Yesterday/Day Before Yesterday?

1 yes - 2 no 1 yes -2 no

J. How many hours had you planned to_____ Yesterday Day Before Yesterday

_____ _____

31. Regarding yesterday and the day before, were there any other major changes in the activities you had planned?

(If Yes) What were they?_____

_____

YES 1
NO 2

32. Are there any activities that you do regularly most of the year but not in the summer (June-September)?

(If Yes) What?_____

_____

YES 1
NO 2

Why not in summer? Is it due to heat, humidity, smog or something other than weather? _____

_____

_____

_____

Heat . . . . . 1 yes - 2 no
Humidity . . . . 1 yes - 2 no
Smog . . . . . 1 yes - 2 no
Other . . . . . 1 yes - 2 no

33. A. How many hours do you spend outdoors on a typical

Workday _____ hours
Nonworkday _____ hours

B. Did you spend the usual amount of time outside?

Yesterday Yes 1
Day Before No . . ASK C . 2

C. How many hours did you spend outdoors?

Yesterday _____ hours
Day Before _____ hours

D. Did you stay in bed any more or less than usual yesterday?

More 1
Less 2
No 3

(a) How much more (or less)? _____

(b) Why did you spend more (less) time in bed yesterday? _____

_____

DAY BEFORE YESTERDAY?

More 1
Less 2
No 3

(a) How much more (or less)? _____

(b) Why did you spend more (less) time in bed day before yesterday? _____

E. Did you take any more medication than usual?

Yesterday?

YES 1
NO 2

Day Before Yesterday? YES l
NO 2

F. How many hours did you spend at work?

YESTERDAY _____ HOURS
DAY BEFORE _____ HOURS

FOR EACH DAY NOT WORKED, ASK G

G. Did you make a recreation trip outside the area, such as to the mountains, or to the beach or some other recreational area?

YES . . . ASK i and ii . . 1
NO . . . SKIP TO Q34 . . . 2

i. Where did you go? Please name the community or area.

_____

ii. How many nights were you away from home? _____ NIGHTS

Now I would like to ask you some questions about symptoms you may have when it's smoggy.

34. Do you have any symptoms when it's smoggy?

YES. . . ASK A. l
NO SKIP TO Q35 . . . 2
DON'T KNOW . SKIP TO Q35 . 8

A. What symptoms do you have?

_____

_____

35. Were you at home yesterday? (More than 4 hours between 10-4)

1 yes - 2 no

A. Now, using a scale of l-10, 10 being the very best and 1 the very worst, how would you rate the air quality outside your home yesterday?

RECORD # _____

36. Now I'd like to read you a list of symptoms other people sometimes have. As I read each one, please tell me if you yesterday or the day before yesterday. READ A-Z. CODE IN APPROPRIATE COLUMN.

	YESTERDAY		DAY BEFORE YESTERDAY	
	YES	NO	YES	NO
a. (Did/Do) your eyes feel irritated?	1	2	1	2
b. (Did/Do) you feel that you (could/do) not see as well as usual?	1	2	1	2
c. (Were/Are) your eyes unusually sensitive to bright light?	1	2	1	2
d. (Was/Is) your throat irritated?	1	2	1	2
e. (Was/Is) your voice husky or (did/do) you lose your voice?	1	2	1	2
f. (Did/Do) you have sinus pain or discomfort?	1	2	1	2
g. (Did/Do) you have a nosebleed?	1	2	1	2
h. (Was/Is) your nose dry and painful?	1	2	1	2
i. (Was/Is) your nose runny?	1	2	1	2
j. (Did/Do) you have pain when you (took/take) a deep breath?	1	2	1	2
k. (Did/Do) you feel that you (could/can) not take a deep breath?	1	2	1	2
1. (Did/Do) you get out of breath easily?	1	2	1	2
m. (Did/Do) you have a cough?	1	2	1	2
n. (Did/Do) you bring up sputum (phlegm) from your chest?	1	2	1	2
o. (Did/Do)‘you have a headache?	1	2	1	2
p. (Did/Do) you get tired easily?	1	2	1	2
q. (Did/Do) you feel faint or dizzy?	1	2	1	2
r. (Did/Do) you feel spaced-out or disoriented?	1	2	1	2
s. (Did/Do) you feel nauseated (sick to your stomach)?	1	2	1	2

	YESTERDAY		DAY BEFORE YESTERDAY	
	YES	NO	YES	NO
t. (Did/Do) you have chills or fever? Which one_____?	1	2	1	2
u. (Did/Do) you have pain in your ears?	1	2	1	2
v. (Did/Do) you have ringing in your ears?	1	2	1	2
w. (Did/Does) your breathing sound wheezing or whistling?	1	2	1	2
x. (Did/Does) your chest feel tight?	1	2	1	2
y. (Did/Do) you feel that your heart was beating very fast at time when you were resting?	1	2	1	2
z. (Did/Do) you have swollen glands?	1	2	1	2

IF "YES" TO ANY SYMPTOM IN Q36 . . . ASK Q37

IF "NO" TO ALL SYMPTOMS IN Q36 . . . SKIP TO Q37

37. A. How much of the day did_____bother you? (Code all mentions)

		Letter of Symptom									
Morning	YES	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2
Afternoon	YES	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2
Evening	YES	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2
Night	YES	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2

B. During the time you had_____would you say it was constant or on-and-off?

	Letter of Symptom									
Constant	1	1	1	1	1	1	1	1	1	1
On-and-Off	2	2	2	2	2	2	2	2	2	2

C. In general how heavily were you exerting yourself when you first noticed _____?

	Letter of Symptom									
At rest	1	1	1	1	1	1	1	1	1	1
Lightly exerting yourself	2	2	2	2	2	2	2	2	2	2
Moderately exerting yourself . . .	3	3	3	3	3	3	3	3	3	3
Heavily exerting yourself, or . . .	4	4	4	4	4	4	4	4	4	4
Other . . . . . SPECIFY _____	5	5	5	5	5	5	5	5	5	5
Don't Know	9	9	9	9	9	9	9	9	9	9

READ SENTENCE BELOW FIRST

D. How much would you pay?

RECORD LETTER _____

E. What do you think caused it?

	Letter of Symptom									
Weather	1	1	1	1	1	1	1	1	1	1
Smog	2	2	2	2	2	2	2	2	2	2
Both	3	3	3	3	3	3	3	3	3	3
Other	4	4	4	4	4	4	4	4	4	4

One way to find out how valuable better health is to you is to ask you how much you are willing to pay for it. Suppose you could have avoided the symptom(s) you have experienced by the payment of a sum of money. Please look at this card (HAND CARD Q6D).

Which sum of money most closely represents the maximum amount you would have been willing to pay to have avoided (...) yesterday/day before yesterday? INSERT EACH SYMPTOM IN TURN FOR (...). When you have decided, give me the letter next to the amount.

Did you answer $0.00 because you feel avoiding the symptom has no value to you?

YES 1
NO 2

38. Did the air quality yesterday affect what you did?

YESTERDAY			DAY BEFORE YESTERDAY		
A.LOT	A LITTLE	NO	A LOT	A LITTLE	NO
1	2	3	1	2	3

PROBE _____

39. As I mentioned at the beginning of the interview, we are interested in how people change their activities when pollution is bad. When the air is smoggy, do you normally change your activities at all? For example, do you stay indoors more, or use air conditioning more? Do you travel to less polluted areas, like the beach? Do you buy or use any products, or do anything at all to try to avoid air pollution or the symptoms of air pollution?

YES . . ASK A . . 1
NO 2

A. What do you do differently?

_____

The next questions I have today are about your home.

40. How large is your house? (Number of bedrooms)
(apt.) _____

41. Is your home insulated?

YES... ASK A l
NO . . . SKIP TO Q42 2
DON'T KNOW SKIP TO Q42 8

A. Is it insulated in:

The attic, or 1
the walls? 2
BOTH. 3

B. Do you know what material was used?

YES . . . . . ASK A 1
NO . . . . . SKIP TO Q42 . 2

a. What was it? _____

42. What fuel do you use for cooking? CODE ALL MENTIONS

GAS 1
ELECTRICITY 2
BOTTLED GAS 3
OTHER 4
SPECIFY _____

43. What fuel do you use for heating your home?

GAS 1
ELECTRICITY 2
BOTTLED GAS 3
SOLAR HEAT 4
OTHER . . . . . S
SPECIFY _____

44. Is your home air conditioned?

YES. . . ASK A. 1
NO . . . SKIP TO Q45 . . . 2

A. Is it:

Central Air, or . . SKIP TO C 1
Room by Room Air? . ASK B 2

B. How many units do you have?

RECORD _____

C. Is it:

Refrigerated, or 1
Evaporative (swamp)? 2

D. How much do you use your air conditioner during the summer?

Almost all the time 1
Usually 2
Sometimes 3
Almost never 4

E. Does your air conditioning system include some type of special air purifyfng unit?

YES . . .ASK F l
NO SKIP TO Q45 2
DON'T KNOW . SKIP TO Q45 3

F. What type of special air purifying unit do you have? (CODE ALL MENTIONS)

Electronic air purifier 1
High particulate filter 2
Charcoal filter 3
Something else 4
- S P E C I F Y_____
Don't Know 9

G. Is regular maintenance performed on your purifying system?

YES l
NO 2

H. Did you obtain a tax deduction for the installation of your air purifying system?

YES . . . . ASK a l
NO 2

a. Approximately, how much did this deduction reduce your taxes?

$ _____

I. Can you operate your air purification system without running your air conditioner or heater?

YES. . . . ASK a l
NO 2

a. How often do you operate your purifying system without the air conditioner or heater?

RECORD _____

45. Do you have a portable air purifier?

YES . . . . ASK a l
NO . . . . SKIP TO Q46 2

a. How often do you use it?

RECORD _____

46. Do you have an ionizer or air energizing machine?

YES . . . . ASK a 1
NO . . . . SKIP TO Q47 2
DON'T KNOW . SKIP TO Q47 8

a. How often do you use it?

RECORD _____

47. What kind of car do you usually drive?

MAKE _____

YEAR _____

A. About how many miles per gallon does this car get?

RECORD _____ mpg

48. Is your car air conditioned?

YES . . . . ASK A 1
NO . . . . SKIP TO Q48B 2

A. How often do you use the air conditioning when driving in summer?

ALMOST ALL THE TIME 1
USUALLY 2
SOMETIMES 3
ALMOST NEVER 4

B. About how many miles do you drive your car during a typical week?

RECORD _____

The last set of questions is about you and your job.

49. What is your date of birth? _____

50. Are you currently:

MARRIED 1
SEPARATED 2
DIVORCED 3
WIDOWED, OR 4
NEVER MARRIED, OR 5
SOMETHING ELSE? 6
SPECIFY _____

51. What is the highest grade in school you completed and received credit for? CODE ONE

00 01 02 03 04 05 06 07 08 09 10 11 12

COLLEGE/OTHER POST HIGH SCHOOL SCHOOLING 13 14 15 16

POST GRADUATE SCHOOL 17 18 19 20 OR MORE

A. Have you had any trade, technical or vocational training?

YES 1
NO 2

B. ASK EVERYONE: What degrees or diplomas, if any, do you have? CODE HIGHEST DEGREE

High School Degree (Equivalent) . . 01
Junior College Degree (A.A.) 02
Bachelors Degree (B.A., B.S.) . . . 03
Masters Degree (M.A., M.S.) 04
Doctorate (Ph.D.) 05
Professional (M.D, J.D., D.D.S.,) . 06
None 90
Other 96

52. What is your current employment status, are you:

Working full-time 1
Working part-time 2
Unemployed and looking for work 3
Unemployed and not looking for work . . . 4

53. Out next set of questions is about your job. If you have more than one job, we only need to know about your main job.

A. What kind of business or industry do you work in?

RECORD RESPONSE_____

CIRCLE CORRECT CATEGORY

AGRICULTURE OR FORESTRY 1
MINING 2
CONSTRUCTION 3
MANUFACTURING 4
WHOLESALE OR RETAIL TRADE 5
TRANSPORTATION, COMMUNICATIONS, OR PUBLIC UTILITIES 6

FINANCE, INSURANCE, OR REAL ESTATE 7
SERVICES 8
GOVERNMENT 9
OTHER 10
- SPECIFY _____

B. What type of work do you do in your job?

RECORD RESPONSE _____

CIRCLE CORRECT CATEGORY

SERVICE WORKER	(Food service workers, Cleaning service workers, Dental assistants, Policemen) 1
LABORER	(Longshoremen, Construction workers, Loggers, Garbage collectors) 2
TRANSPORTATION OPERATOR	(Bus drivers, Taxicab drivers, Truck drivers, Railroad switch operators) 3
EQUIPMENT OPERATOR	(Textile workers, Drillers, Photographic processors, Smelters) 4
CRAFT WORKER	(Carpenters, Machinists, Bakers, Tailors, Repairmen, Mechanics) 5
CLERICAL WORKER	(Cashiers, tellers, Secretaries, Receptionists, Telephone operators, Dispatchers) 6
SALES WORKER	(Advertising agents, Real estate agents, Sales clerks, Sales representatives, Vendors) . . . 7
MANAGER OR ADMINISTRATOR	(Bank officers, Purchasing agents, Restaurant managers, School administrators) 8
PROFESSIONAL OR TECHNICAL	(Accountants, Engineers, Physicians, Teachers, Entertainers) 9
FARMWORKER	(Farmers, Farm laborers, Farm Supervisors) 10

C. Please name the community where you place of work is located.

_____

For "AT HOME" code "1"
For "GLENDORA" or "EAST SAN GABRIEL VALLEY" code "2"
All others leave blank

_____

D. How many weeks per year do you actually work on your main job? (Or, if this is a new job, how many weeks of work per year does your main job require?)

_____ WEEKS

E. How many hours do you work each day of the week?

Monday _____
Tuesday _____
Wednesday _____
Thursday _____
Friday _____
Saturday _____
Sunday _____

54. How do you usually go to and from work? Do you:

	YES	NO
Drive?	1	2
Carpool?	1	2
Vanpool?	1	2
Motorcycle or Moped?	1	2
Public transportation?	1	2
Walk?	1	2
Bicycle;	1	2
Some other way?	1	-

SPECIFY: _____

55. How long do you spend commuting each day? Would you say:

Less than 15 minutes 1
16 to 30 minutes 2
31 to 60 minutes, or 3
over 60 minutes? 4

56. How many hours, on the average, do you spend outdoors during your working day?

RECORD HOURS _____

57. Do you travel during the day as part of your work?

YES . . . ASK A 1
NO . . . SKIP TO Q57 . . . 2

A. When you travel, do you use:

A car, ... 1
Public transportation, or . 2
Walk? 3
Other 4
SPECIFY _____

B. How long do you usually spend traveling during a working day?

RECORD _____

58. Is your place of work air conditioned?

YES 1
NO 2

59. Are you exposed to anything at work which affects your breathing?

YES . . . ASK A 1
NO . . . SKIP TO Q60 . . . 2

A. What are you exposed to? _____

_____

60. How are paid?

1 HOURLY WAGE
2 SALARY
3 OTHER (i.e., Piece Work,.Commissions, Tips, etc.)

→(IF SALARY OR OTHER) Please look at this card (HAND CARD Q5lFSAL) and tell me the letter of the income category that includes your annual gross (i.e., before deductions and taxes) income from your main job.

RECORD LETTER _____

If you work more hours than average during some week, do you get paid anything at all for those hours?

1 YES
2 NO

→(IF YES) Which of the following best describes how you get paid for those overtime hours?

1 EQUIVALENT TO STRAIGHT TIME HOURLY WAGE
2 EQUIVALENT TO TIME AND A HALF
3 EQUIVALENT TO DOUBLE TIME
4 EQUIVALENT TO TRIPLE TIME

Approximately, how many hours of overtime do you work in an average week?

_____ HOURS

SKIP TO Q61

→(IF HOURLY) Please look at this card (HAND CARD Q5lFWAGE) and tell me the letter of the wage category that includes your hourly wage for regular or "straight" time work.

RECORD LETTER _____

Do you ever have the opportunity to work overtime on your main job?

1 YES .
2 NO

→(IF YES) Which of the following most closely describes your hourly wage rate for those overtime hours?

1 STRAIGHT TIME
2 TIME AND A HALF
3 DOUBLE TIME
4 TRIPLE TIME

Approximately, how many hours of overtime do you work in an average week?

_____ HOURS

CARD Q51FSAL

A. Less than $6,000
B. $ 6,000 - 6,999
c. $ 7,000 - 7,999
D. $ 8,000 - 8,999
E. $ 9,000 - 9,999
F. $10,000 - 10,999
G. $11,000 - 11,999
H. $12,000 - 12,999
I. $13,000 - 13,999
J. $14,000 - 14,999
K. $15,000 - 17,499
L. $17,500 - 19,999
M. $20,000 - 22,499
N. $22,500 - 24,999
0. $25,000 - 27,499
P. $27,500 - 29,999
Q. $29,999 - 34,999
R. $35,000 - 39,999
S. $40,000 - 44,999
T. $45,000 - 49,999
U. $50,000 - 54,999
V. $55,000 - 59,999
W. $60,000 - 69,999
X. $70,000 - 79,999
Y. $80,000 - 89,999
Z. $90,000 - 99,999+

CARD Q5lFWAGE

A.	Less than $3.00			R.	$11.00	-	11.49
B.	$ 3.00	-	3.49	S.	$11.50	-	11.99
C.	$ 3.50	-	3.99	T.	$12.00	-	12.99
D.	$ 4.00	-	4.49	U.	$13.00	-	13.99
E.	$ 4.50	-	4.99	V.	$14.00	-	14.99
F.	$ 5.00	-	5.49	W.	$15.00	-	15.99
G.	$ 5.50	-	5.99	X.	$16.00	-	16.99
H.	$ 6.00	-	6.49	Y.	$17.00	-	17.99
I.	$ 6.50	-	6.99	Z.	$18.00	-	18.99
J.	$ 7.00	-	7.49	AA.	$19.00	-	19.99
K.	$ 7.50	-	7.99	BB.	$20.00	-	20.99
L.	$ 8.00	-	8.49	CC.	$21.00	-	21.99
M.	$ 8.50	-	8.99	DD.	$22.00	or more	
N.	$ 9.00	-	9.49				
0.	$ 9.50	-	9.99				
	$10.00	-	10.49				
Q.	$10.50	-	10.99				

61. A. Now, thinking about the members of this household, how many people, including yourself, received income from any source such as wages, salary, social security, pensions, welfare, or alimony during 1984?

RECORD #_____PERSONS

B. (HAND APPROPRIATE INCOME CARD - USE CARD #52B-2)
Please look at this card and tell me the letter of the income group that includes the total income for your entire family, in this household, before taxes in 1984?

CARD #1:

A 01	N 14
B 02	O 15
C 03	P 16
D 04	Q 17
E 05	R 18
F 06	S 19
G 07	T 20
H 08	U 21
I 09	V 22
J 10	W 23
K 11	X 24
L 12	Y 25
M 13	Z 26

C. How many people, including yourself, are supported with this income?

RECORD #_____

CARD Q6D

A.	$0.00	K.	$5.00	V.	$16.00	FF.	$45.00	PP.	$200.00
B.	$ .50	L.	$6.00	W.	$18.00	GG.	$50.00	QQ.	$250.00
C.	$1.00	M.	$7.00	X.	$20.00	HH.	$60.00	RR.	$300.00
D.	$1.50	N.	$8.00	Y.	$22.00	II.	$70.00	SS.	$350.00
E.	$2.00	0.	$9.00	Z.	$24.00	JJ.	$80.00	TT.	$400.00
F.	$2.50	P.	$10.00	AA.	$26.00	KK.	$90.00	UU.	$450.00
G.	$3.00	R.	$11.00	BB.	$28.00	LL.	$100.00	VV.	$500.00
H.	$3.50	S.	$12.00	CC.	$30.00	MM.	$125.00	XX.	$1000.00
I.	$4.00	T.	$13.00	DD.	$35.00	NN.	$150.00	ZZ.	More than $1000.00
J.	$4.50	U.	$14.00	EE.	$40.00	00.	$175.00		

62. A. As you recall, we mentioned that we're interested in people's health over time. We will be contacting you again in the next month to ask you briefly about your health and your activities. Is there a day or time that is especially good for me to call?

Record Day _____
Record Time _____

B. Can you tell me the name of someone not living at this address who would know how to reach in case you move?

NAME _____

ADDRESS _____

_____

PHONE # _____

C. Is there an alternate phone number at which we could reach you?

( )

For Interviewer Only

COMMENTS:

Anything unusual about respondents health or activities?

_____
_____
_____
_____

SEX: Male . . 1 Female . . 2

RACE: Caucasian . . 1 Black . . 2 Oriental . . 3 Hispanic . . 4

Other . . 5

HOUSING TYPE: House . . 1 Apt . . 2 Condominium . . 3 Other . . 4

Specify _____

WITHIN 2 BLOCKS OF MAJOR STREET: Yes . . 1 No . . 2

APPENDIX B

FOLLOWUP QUESTIONNAIRE

I would like to know about changes in your life since (...) when we last talked. (INSERT DATE OF INTERVIEW FOR (...).)

1. Do you still live at (...)? (INSERT FULL ADDRESS FOR (...).)

YES . . . . . 1 GO TO Q2
NO . . . . . 2 GO TO A

A. What is your new address?

_____ / _____
/ STREET / APT. #I

_____
CITY

B. When did you move? _____ / _____ / _____
DAY / MONTH / YEAR

C. How large is your house (apt.)? (number of bedrooms)_____

D. Is your home insulated?

YES . . . . ASK a 1
NO SKIP TO E . . . 2
DON'T KNOW . SKIP TO E . . 8

a. Is it insulated in

The attic, or 1
the walls? 2
BOTH 3

b. Do you know what material was used?

YES . . . . ASK (i) 1
NO . . . SKIP TO E 2

(i) What was it? _____

E. What fuel do you use for cooking? CODE ALL MENTIONS

GAS 1
ELECTRICITY 2
BOTTLED GAS 3
OTHER 4
→ SPECIFY _____

F. What fuel do you use for heating your home?

GAS. 1
ELECTRICITY 2
BOTTLED GAS 3
SOLARHEAT 4
OTHER 5
SPECIFY_____

G. Is your home air conditioned? YES . . . . . ASK a 1
NO . . . SKIP TO Q2 . . . 2

a. Is it: Central air, or . . . SKIP TO c . . . 1
room by room air? . . ASK b 2

b. How many units do you have? RECORD_____

c. Is it: Refrigerated, or 1
Evaporative (swamp)? . . . 2

d. How much do you use your air conditioner during the summer?

Almost all the time 1
Usually 2
Sometimes 3
Almost never 4

e. Does your air conditioning system include some type of special air purifying unit?

YES . . . . . ASK f 1
NO SKIP TO Q2 . 2
DON'T KNOW . . SKIP TO Q2 3

f. What type of special air purifying unit do you have? (CODE ALL MENTIONS)

Electronic air purifier 1
High particulate filter 2
Charcoal filter 3
Something else 4
SPECIFY_____
Don't Know 9

g. Is regular maintenance performed on your purifying system?

YES 1
NO 2

h. Did you obtain a tax deduction for the installation of your air purifying system?

YES . . . . ASK (i) 1
NO 2

(i) Approximately, how much did this deduction reduce your taxes? $_____

i. Can you operate your air purification system without running your air conditioner or heater?

YES . . . . ASK (i) 1
NO 2

(i) How often do you operate your purifying system without the air conditioner or heater? RECORD_____

2. A. Since we talked last, have you either seen or talked with a doctor for any medical problem?

YES . . . . GO TO (i) . . . 1
NO . . . . SKIP TO B . . . 2

(i) What was the problem?_____
_____

(ii) Did you see or talk with a doctor yesterday or the day before yesterday?

	YES	NO
YESTERDAY.	1	2
DAY BEFORE YESTERDAY . .	1	2

(iii) Where did you go?

	YESTERDAY	DAY BEFORE YESTERDAY
Doctor's Office . . .	1	1
Emergency	1	1
Hospital	2	2
Called Doctor	3	3

(iv) How much time did it take to get this medical attention? Please include time spent waiting to see the doctor and time spent driving to his/her office.

_____ MINUTES

(v) What is your out-of-pocket expense for this medical attention?

$_____

B. Did you take any more medication than usual

YESTERDAY	YES	1
	NO	2
DAY BEFORE	YES	1
	NO	2

IF ASTHMA-BRONCHITIS-EMPHYSEMA - LOW FEV - "ATHLETE" NOTED . . . ASK APPROPRIATE QUESTIONS IN Q3

IF NONE NOTED . . . . . SKIP TO Q4

3. At the time of the first interview you mentioned that you (have/are) (asthma/bronchitis/emphysema/lung condition/athletic). I would like you to think about the last two days and tell me if:

A. Your asthma was:

Much better than usual, ...	1
Better than usual, ...	2
The same as usual, ...	3
Not good as usual, or . . .	4
Much worse than usual?	5

a. Did you take:

More medication than usual, . . .	1
Less medication than usual, or .	2
About the same amount of medication?	3
NO MEDICATION TAKEN	4

b. Did you get in touch with the doctor or doctor's office about your asthma?

YES . . . . ASK aa	1
NO . . SKIP TO BOX BELOW aa .	2

aa. Did you:

Talk on the phone, ...	1
Visit your doctor's office, ...	2
Visit the emergency room, or	3
Go to the hospital?	4

IF OTHER CONDITIONS . . . CONTINUE WITH APPROPRIATE QUESTIONS

IF NO OTHERS . . . . . SKIP TO Q4

B. Thinking about the last two days was your chronic bronchitis:

Much better than usual, ... 1
Better than usual, ... 2
The same as usual, ... 3
Not as good as usual, or . . . 4
Much worse than usual? 5

a. Did you cough or bring up:

More phlegm than usual, or . . 1
Less phlegm than usual? . . . 2
SAME AS USUAL 3

b. Was you sputum (phlegm):

More discolored than usual, . . 1
Less discolored than usual, or 2
The same as usual? 3

C. Did you get in touch with your doctor or doctor's office about your bronchitis?

YES . . . . ASK aa 1
NO . . SKIP TO BOX BELOW aa . 2

aa. Did you:
Talk on the phone, ... 1
Visit your doctor's office, ... 2
Visit the emergency room, or 3
Go to the hospital? 4

IF OTHER CONDITIONS . . . CONTINUE WITH APPROPRIATE QUESTIONS
IF NO OTHERS . . . . . SKIP TO Q4

C. Thinking about the last two days was your emphysema:

Much better than usual, ... 1
Better than usual, ... 2
The same as usual, ... 3
Not as good as usual, or . . . 4
Much worse than usual? 5

a. During the last three days, when exerting yourself did you feel:

More short of breath, or . . . 1
Less short of breath? 2
NEITHER 3

b. Did you get in touch with your doctor or doctor's office about your emphysema?

YES . . . . ASK aa 1
NO . . SKIP TO BOX BELOW aa . 2

aa. Did you: Talk on the phone, ... 1
Visit your doctor's office, ... 2
Visit the emergency room, or 3
Go to the hospital? 4

IF OTHER CONDITIONS . . . CONTINUE WITH APPROPRIATE QUESTIONS IF NO OTHERS . . . . . SKIP TO Q4

C. Thinking of the last two days were your lungs:

More congested than usual, or . . . 1
Less congested? 2

a. Did you get:

Out of breath more easily than usual, or . . . 1
Less than usual? 2

Now, I would like to ask you about the things you do regularly in your leisure time.

4. A. What were your regular leisure or non-work related activities in the past month? LIST - PROBE

1. _____
2. _____
3. _____
4. _____
5. _____

(IF MORE THAN 5 USE THE FIVE THAT THE RESPONDENT DOES MOST OFTEN)

Activity #1

B. About how many hours per week (including transportation) did you _____?

C. How many times a week did you _____?

D. Where do you usually (area or community) _____?

FOR "AT HOME" CODE "1"
FOR "GLENDORA" OR EAST SAN GABRIEL VALLEY CODE "2"
ALL OTHERS LEAVE BLANK _____

E. What is the usual time of day when you did this activity?

Morning . . . . . 1 YES - 2 NO
Afternoon . . . . . 1 YES - 2 NO
Night . . . . . 1 YES - 2 NO
no particular time . . 1 YES - 2 NO

F. What days of the week did you usually do this activity?

Monday . . . 1 YES - 2 NO
Tuesday . . 1 YES - 2 NO
Wednesday. . 1 YES - 2 NO
Thursday . . 1 YES - 2 NO
Friday . . . . . 1 YES - 2 NO
Saturday . . . . . 1 YES - 2 NO,
Sunday . . . . . 1 YES - 2 NO
No particular day . . 1 YES - 2 NO

G. What does it usually cost to do this activity (including transportation) per month? Each time?

_____ PER MONTH
$_____ EACH TIME

H. How much of the time did you _____ outdoors?

Always 1
Most of the time 2
Half of the time 3
Some of the time 4
Never 5

(INTERVIEWER - FOR QUESTIONS I THROUGH J RECORD THE RESPONSE FOR "YESTERDAY" IN THE APPROPRIATE COLUMN THEN REPEAT THE QUESTIONS FOR "DAY BEFORE YESTERDAY.")

	Yesterday	Day Before Yesterday
I. How many hours did you _____ yesterday/day before yesterday?	_____	_____

(INTERVIEWER - IF ZERO GO TO J)

1.	What did it cost you to _____ yesterday/day before yesterday?	_____	_____
ii.	Did you put significantly less effort than planned or usual into _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO
iii.	Did you change the planned or usual time of day of _____ yesterday/day before yesterday?	1 YES-Z NO	1 YES-2 NO
iv.	Did you change the planned or usual location of _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO

		Yesterday	Day Before Yesterday
J.	How many hours had you planned to _____yesterday/day before yesterday?	_____	_____

Activity #2

B. About how many hours per week (including transportation) did you _____?

C. How many times a week did you _____?

D. Where do you usually (area or community)_____?

FOR "AT HOME" CODE "1"
FOR "GLENDORA" OR EAST SAN GABRIEL VALLEY CODE "2"
ALL OTHERS LEAVE BLANK

E. What is the usual time of day when you did this activity?

Morning . . . . . 1 YES - 2 NO
Afternoon . . . . . 1 YES - 2 NO
Night . . . . . 1 YES - 2 NO
no particular time . . 1 YES - 2 NO

F. What days of the week did you usually do this activity?

Monday . . . 1 YES - 2 NO
Tuesday . . 1 YES - 2 NO
Wednesday. . 1 YES - 2 NO
Thursday . . 1 YES - 2 NO
Friday . . . . . 1 YES - 2 NO
Saturday . . . . . 1 YES - 2 NO
Sunday . . . . . 1 YES - 2 NO
No particular day . . 1 YES - 2 NO

G. What does it usually cost to do this activity (including transportation) per month? Each time?

$_____PER MONTH
$_____EACH TIME

H. How much of the time did you_____outdoors?

Always 1
Most of the time 2
Half of the time 3
Some of the time 4
Never 5

(INTERVIEWER - FOR QUESTIONS I THROUGH J RECORD THE RESPONSE FOR "YESTERDAY" IN THE APPROPRIATE COLUMN THEN REPEAT THE QUESTIONS FOR "DAY BEFORE YESTERDAY.")

	Yesterday	Day Before Yesterday
I. How many hours did you _____ yesterday/dav before vesterdav?	_____	_____

(INTERVIEWER - IF ZERO GO TO J)

i.	What did it cost you to _____ yesterday/day before yesterday?	_____	_____
ii.	Did you put significantly less effort than planned or usual into _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO
iii.	Did you change the planned or usual time of day of _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO
iv.	Did you change the planned or usual location of _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO

	Yesterday	Day Before Yesterday
J. How many hours had you planned to _____ yesterday/day before yesterday?	_____	_____

Activity #3

B. About how many hours per week (including transportation) did you _____?

C. How many times a week did you _____?

D. Where do you usually (area or community) _____?

FOR "AT HOME" CODE "1"
FOR "GLENDORA" OR EAST SAN GABRIEL VALLEY CODE "2"
ALL OTHERS LEAVE BLANK _____

E. What is the usual time of day when you did this activity?

Morning . . . . . 1 YES - 2 NO
Afternoon . . . . . 1 YES - 2 NO
Night . . . . . 1 YES - 2 NO
no particular time . . 1 YES - 2 NO

F. What days of the week did you usually do this activity?

Monday . . . 1 YES - 2 NO	Friday . . . . . 1 YES - 2 NO
Tuesday . . 1 YES - 2 NO	Saturday . . . . . 1 YES - 2 NO
Wednesday. . 1 YES - 2 NO	Sunday . . . . . 1 YES - 2 NO
Thursday . . 1 YES - 2 NO	No particular day . . 1 YES - 2 NO

G. What does it usually cost to do this activity (including transportation) per month? Each time?

_____ PER MONTH
$_____ EACH TIME

H. How much of the time did you _____ outdoors?

Always 1
Most of the time 2
Half of the time 3
Some of the time 4
Never 5

(INTERVIEWER - FOR QUESTIONS I THROUGH J RECORD THE RESPONSE FOR "YESTERDAY" IN THE APPROPRIATE COLUMN THEN REPEAT THE QUESTIONS FOR "DAY BEFORE YESTERDAY.")

	Yesterday	Day Before Yesterday
I. How many hours did you _____ yesterday/day before yesterday?	_____	_____

(INTERVIEWER - IF ZERO GO TO J)

i. What did it cost you to _____ yesterday/day before yesterday?	_____	_____
ii. Did you put significantly less effort than planned or usual into _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO
iii. Did you change the planned or usual time of day of _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO
iv. Did you change the planned or usual location of _____ yesterday/day before yesterday?	1 YES-2 NO	1 YES-2 NO

	Yesterday	Day Before Yesterday
J. How many hours had you planned to _____ yesterday/day before yesterday?	_____	_____

5. Regarding yesterday and the day before were there any other major changes in the activities you have planned?

YES 1
NO 2

(IF YES) What were they? _____

_____

6. A. How many hours did you spend outdoors

YESTERDAY _____ hours
DAY BEFORE _____ hours

B. Did you stay in bed any more or less than usual yesterday?

	YESTERDAY	DAY BEFORE YESTERDAY
MORE . . .	1	1
LESS . . .	2	2
NO . . .	3	3

a. How much more (or less)? Yesterday _____
Day Before _____

b. Why did you spend more (less) time in bed yesterday or the day before _____

C. How many hours did you spend at work

YESTERDAY _____ hours
DAY BEFORE _____ hours

FOR EACH DAY NOT WORKED, ASK D

D. Did you make a recreational trip outside the area, such as to the mountains or to the beach or some other recreational area?

YES . . . . ASK i and ii 1
NO . . . . SKIP TO Q7 2

i. Where did you go? Please name the community or area.

_____

ii. How many nights were you away from home? _____ NIGHTS

IF R WAS NOT AT WORK OR ON A RECREATIONAL TRIP YESTERDAY, ASK Q7

7. Were you at home yesterday? 1 YES 2 NO
(More than 4 hours between 10-4)
Now, using a scale of l-10, 10 being the very best and 1 the very worst, how would you rate the air quality outside your home yesterday?

RECORD #_____

8. As you know, we are interested in how people change their activities when pollution is bad. When the air is smoggy, do you or other member of your household change their activities in any way? For example, do you or other members of your household:

(i) Stay indoors more

(ii) Use air conditioning more

(iii) Travel to less polluted areas like the beach

(iv) Buy or use any products

(v) Do anything at all to avoid air pollution

What exactly do you do?

PROBE: _____

_____

_____

_____

9. Now I'd like to read you a list of symptoms other people sometimes have. As I read each one, please tell me if it bothered you yesterday or the day before yesterday. READ a-z. CODE IN APPROPRIATE COLUMN

	YESTERDAY		DAY BEFORE YESTERDAY	
	YES	NO	YES	NO
a. Did your eyes feel irritated?	1	2	1	2
b. Did you feel that you could not see as well as usual?	1	2	1	2
c. Were your eyes unusually sensitive to to bright light?	1	2	1	2
d. Was your throat irritated?	1	2	1	2

		11 YESTERDAY		DAY BEFORE YESTERDAY	
		YES	NO	YES	NO
e.	Was your voice husky or did you lose your voice?	1	2	1	2
f.	Did you have sinus pain or discomfort?	1	2	1	2
g.	Did you have a nosebleed?	1	2	1	2
h.	Was your nose dry and painful?	1	2	1	2
i.	Was your nose runny?	1	2	1	2
j.	Did you have pain when you took a deep breath?	1	2	1	2
k.	Did you feel that you could not take a deep breath?	1	2	1	2
1.	Did you get out of breath easily?	1	2	1	2
m.	Did you have a cough?	1	2	1	2
n.	Did you bring up sputum (phlegm) from your chest?	1	2	1	2
o.	Did you have a headache?	1	2	1	2
p.	Did you get tired easily?	1	2	1	2
q.	Did you feel faint or dizzy?	1	2	1	2
r.	Did you feel spaced-out or disoriented?	1	2	1	2
s.	Did you feel nauseated (sick to your stomach)?	1	2	1	2
t.	Did you have chills or fever? Which one? _____	1	2	1	2
u.	Did you have pain in your ears?	1	2	1	2
v.	Did you have ringing in your ears?	1	2	1	2
w.	Did breathing sound wheezing or whistling	1	2	1	2
x.	Did your chest feel tight?	1	2	1	2

		YESTERDAY		DAY BEFORE YESTERDAY	
		YES	NO	YES	NO
y.	Did you feel that your heart was beating very fast at times when you were resting?	1	2	1	2
z.	Did you have swollen glands?	1	2	1	2

IF "YES" TO ANY SYMPTOM IN Q9 . . . . . ASK Q10
IF "NO" TO ALL SYMPTOMS IN Q9 . . . SKIP TO Q10

10. A. How much of the day did _____ bother you?
(CODE ALL MENTIONS)

LETTER OF SYMPTOM													
Morning	YES	1	1	1	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2	2	2	2
Afternoon	YES	1	1	1	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2	2	2	2
Evening	YES	1	1	1	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2	2	2	2
Night	YES	1	1	1	1	1	1	1	1	1	1	1	1	1
	NO	2	2	2	2	2	2	2	2	2	2	2	2	2

B. During the time you had _____ would you say it was constant or off-and-on?

LETTER OF SYMPTOM													
Constant	1	1	1	1	1	1	1	1	1	1	1	1	1
Off-and-On	2	2	2	2	2	2	2	2	2	2	2	2	2

C. In general how heavily were you exerting yourself when you first noticed _____?

LETTER OF SYMPTOM													
At rest	1	1	1	1	1	1	1	1	1	1	1	1	1
Lightly exerting yourself	2	2	2	2	2	2	2	2	2	2	2	2	2
Moderately exerting yourself	3	3	3	3	3	3	3	3	3	3	3	3	3
Heavily exerting yourself, or	4	4	4	4	4	4	4	4	4	4	4	4	4
Other . . . . . Specify _____	5	5	5	5	5	5	5	5	5	5	5	5	5
Don't know	9	9	9	9	9	9	9	9	9	9	9	9	9

CARD QlOD

A.	$O.OO	K.	$ 5.00	V.	$16.00	FF.	$ 45.00	PP.	$ 200.00
B.	$0.50	L.	$ 6.00	W.	$18.00	GG.	$ 50.00	QQ.	$ 250.00
C.	$1.00	M.	$ 7.00	X.	$20.00	HH.	$ 60.00	RR.	$ 300.00
D.	$1.50	N.	$ 8.00	Y.	$22.00	II.	$ 70.00	SS.	$ 350.00
E.	$2.00	P.	$ 9.00	Z.	$24.00	JJ.	$ 80.00	TT.	$ 400.00
F.	$2.50	Q.	$10.00	AA.	$26.00	KK.	$ 90.00	UU.	$ 450.00
G.	$3.00	R.	$11.00	BB.	$28.00	LL.	$100.00	VV.	$ 500.00
H.	$3.50	S.	$12.00	CC.	$30.00	MM.	$125.00	XX.	$1000.00
I.	$4.00	T.	$13.00	DD.	$35.00	NN.	$150.00	YY.	More than $1000.00
J.	$4.50	U.	$14.00	EE.	$40.00	00.	$175.00		

D. One way to find out how valuable better health is to you is to ask you how much you are willing to pay for it. Suppose you could have avoided the symptom(s) you have experienced by the payment of a sum of money. Please look at this card (HAND CARD QlOD). Which sum of money most closely represents the maximum amount you would have been willing to pay to have avoided (...) yesterday/day before yesterday? INSERT EACH SYMPTOM IN TURN FOR (...). When you have decided, give me the letter next to the amount.

a. Did you answer $0.00 because you feel avoiding the symptom has no value to you?

YES 1
NO 2

LETTER OF SYMPTOM												
RECORD LETTER OF AMOUNT												

E. What do you think caused it?

LETTER OF SYMPTOM													
Weather	1	1	1	1	1	1	1	1	1	1	1	1	1
Smog.	2	2	2	2	2	2	2	2	2	2	2	2	2
Both	3	3	3	3	3	3	3	3	3	3	3	3	3
Other	4	4	4	4	4	4	4	4	4	4	4	4	4

11. Did the air quality yesterday affect what you did?

	YESTERDAY?			DAY BEFORE YESTERDAY?		
	A LOT	A LITTLE	NO	A LOT	A LITTLE	NO
	1	2	3	1	2	3
PROBE						

12. Since we last talked to you (in the last month) have you changed your main job in any way such as:

A. Different company or organization
YES 1
NO 2

B. Different job in the same company
YES 1
NO 2

C. Different work in location
YES 1
NO 2

IF YES TO EITHER B OR C, GO TO D. OTHERWISE, GO TO Q13

D. What kind of business or industry do you now work in?

RECORD RESPONSE _____

CIRCLE CORRECT CATEGORY

Agriculture or Forestry 1
Mining 2
Construction 3
Manufacturing 4
Wholesale or Retail Trade 5
Transportation, Communications, or Public Utilities 6
Finance, Insurance, or Real Estate 7
Services 8
Government 9
Other 10
→ Specify _____

E. What type of work do you now do in your main job?

RECORD RESPONSE _____

CIRCLE CORRECT CATEGORY

SERVICE WORKER	(Food service workers, Cleaning service workers, Dental assistants, Policemen) 1
LABORER	(Longshoremen, Construction workers, Loggers, Garbage collectors) 2
TRANSPORTATION OPERATOR	(Bus drivers, Taxicab drivers, Truck drivers, Railroad switch operators) 3
EQUIPMENT OPERATOR	(Textile workers, Driller, Photographic processors, Smelters) . . . 4
CRAFT WORKER	(Carpenters, Machinists, Bakers, Tailors, Repairmen, Mechanics) . . . 5
CLERICAL WORKER	(Cashiers, Tellers, Secretaries, Receptionists, Telephone operators, Dispatchers) 6
SALES WORKER	(Advertising agents, Real estate agents, Sales clerks, Sales representatives, Vendors) 7
MANAGER OR ADMINISTRATION	(Bank officers, Purchasing agents, Restaurant managers, School administrators) 8
PROFESSIONAL OR TECHNICAL	(Accountants, Engineers, Physicians, Teachers, Entertainers) 9
FARMWORKER	(Farmers, Farm laborers, Farm Supervisors) 10

F. Please name the community where your place of work is located.

_____

FOR "AT HOME" CODE "1"
FOR "GLENDORA" OR EAST SAN GABRIEL VALLEY CODE "2"
ALL OTHERS LEAVE BLANK _____

G. How many weeks per year do you actually work on your main job? (Or if this is a new job, how many weeks of work per year does your main job require?)

_____ WEEKS

H. How many hours do you work each day of the week?

Monday _____
Tuesday _____
Wednesday _____
Thursday _____
Friday _____
Saturday _____
Sunday _____

I. How do you usually go to and from work? Do you:

	YES	NO
Drive?	1	2
Carpool?	1	2
Vanpool?	1	2
Motorcycle or Moped?	1	2
Public Transportation? . . .	1	2
Walk?	1	2
Bicycle?	1	2
Some other way?	1	--
→ SPECIFY _____		

J. How long do you spend commuting each day? Would you say:

Less than 15 minutes 1
16 to 30 minutes, 2
31 to 60 minutes, or 3
over 60 minutes? 4

K. How many hours, on the average, do you spend outdoors during your working day?

RECORD HOURS: _____

L. Do you travel during the day as part of your work?

YES . . . . ASK a 1
NO . . . SKIP TO M . . 2

a. When you travel, do you use:

A car, ... 1
Public transportation, or 2
Walk? 3
Other 4
→SPECIFY _____

b. How long do you usually spend traveling during a working day?

RECORD _____

M. Is your place of work air conditioned?

YES 1
NO 2

N. Are you exposed to anything at work which affects your breathing?

YES . . . . ASK a 1
NO . . . SKIP TO 0 . . . 2

a. What are you exposed to?

_____

_____

0. How are you paid?

1 HOURLY WAGE
2 SALARY
3 OTHER (i.e., Piece work, Commissions, Tips, etc.)

→ (IF SALARY OR OTHER) Please look at this card (HAND CARD Ql2SAL) and tell me the letter of the income category that includes your annual gross (i.e., before deductions and taxes) income from your main job.

RECORD LETTER _____

If you work more hours than average during some week, do you get paid anything at all for those hours?

1 YES
2 NO

→ (IF YES) Which of the following best describes how you get paid for those overtime hours?

1 EQUIVALENT TO STRAIGHT TIME HOURLY WAGE
2 EQUIVALENT TO TIME AND A HALF
3 EQUIVALENT TO DOUBLE TIME
4 EQUIVALENT TO TRIPLE TIME

Approximately, how many hours of overtime do you work in an average week? HOURS

_____

SKIP TO Q13

→ (IF HOURLY) Please look at this card (HAND CARD Q12WAGE) and tell me the letter of the *wage* category that includes your hourly wage for regular or "straight" time work.

RECORD LETTER _____

Do you ever have the opportunity to work overtime on your main job?

1 YES
2 NO

→ (IF YES) Which of the following most closely describes your hourly wage rate for those overtime hours?

1 STRAIGHT TIME
2 TIME AND A HALF
3 DOUBLE TIME
4 TRIPLE TIME

Approximately, how many hours of overtime do you work in an average week _____ HOURS

CARD Q12SAL

A. Less than $6,000
B. $ 6,000 - 6,999
C. $ 7,000 - 7,999
D. $ 8,000 - 8,999
E. $ 9,000 - 9,999
F. $10,000 - 10,999
G. $11,000 - 11,999
H. $12,000 - 12,999
I. $13,000 - 13,999
J. $14,000 - 14,999
K. $15,000 - 17,499
L. $17,500 - 19,999
M. $20,000 - 22,499
N. $22,500 - 24,999
0. $25,000 - 27,499
P. $27,500 - 29,999
Q. $29,999 - 34,999
R. $35,000 - 39,999
S. $40,000 - 44,999
T. $45,000 - 49,999
U. $50,000 - 54,999
V. $55,000 - 59,999
W. $60,000 - 69,999
X. $70,000 - 79,999
Y. $80,000 - 89,999
Z. $90,000 - 99,999+

CARD Ql2WAGE

A.	Less than $3.00
B.	$ 3.00 - 3.49
C.	$ 3.50 - 3.99
D.	$ 4.00 - 4.49
E.	$ 4.50 - 4.99
F.	$ 5.00 - 5.49
G.	$ 5.50 - 5.99
H.	$ 6.00 - 6.49
I.	$ 6.50 - 6.99
J.	$ 7.00 - 7.49
K.	$ 7.50 - 7.99
L.	$ 8.00 - 8.49
M.	$ 8.50 - 8.99
N.	$ 9.00 - 9.49
0.	$ 9.50 - 9.99
	$10.00 - 10.49
Q.	$10.50 - 10.99
R.	$11.00 - 11.49
S.	$11.50 - 11.99
T.	$12.00 - 12.99
U.	$13.00 - 13.99
V.	$14.00 - 14.99
W.	$15.00 - 15.99
X.	$16.00 - 16.99
Y.	$17.00 - 17.99
Z.	$18.00 - 18.99
AA.	$19.00 - 19.99
BB.	$20.00 - 20.99
CC.	$21.00 - 21.99
DD.	$22.00 or more

13. Have there been any other major changes in your life that you would like to tell us about?