

SECTION 3

DATA MANAGEMENT AND ANALYSIS

3.1 Recruitment of Participants

In order to meet the study's goal of recruiting 1,000 participants, a sample of 11,718 telephone numbers was drawn. The sample was drawn by Genesys Sampling Systems, using their most current list of white page listings. All nationwide exchanges were included. The sample file included area code, telephone number, time zone, name, and address.

Westat excluded 521 telephone numbers identified as non residential and 1,509 telephone numbers identified as non-working from the sample. The sample was divided in ten waves, to be released as needed.

Training for the telephone portion of the study took place on October 27, 1997. The training was conducted by a Westat telephone operations manager and project staff. Ten interviewers were trained at this session. All of the interviewers had experience working on other Westat studies and were well-versed in general interviewing techniques. Therefore, the focus of this training was project-specific -- interviewers were trained on the screening instrument as well as how to answer questions relevant to the study.

Prior to the start of telephone recruitment, Westat sent the sample file to Telematch, who provided names and addresses corresponding to the telephone numbers. Telematch was able to find complete information on 4,091 (34.9%) of the telephone numbers. Westat then sent households for whom a name and address were available a letter which introduced the study and informed the household that an interviewer would be calling them soon to determine their eligibility for participation in the survey. The letter stressed the importance of cooperation and stated that a monetary incentive would be offered to participants. The introductory letter is presented in Appendix A, Document # 1. Westat mailed these letters on a "flow" basis throughout the data collection period. Household telephone numbers were released for calling approximately five days after the letters were sent, thus ensuring that the household had an opportunity to read the letter before speaking with an interviewer.

A telephone screening questionnaire, or "screener", was developed. This paper instrument is presented in Appendix A, Document # 2. The main purposes of this instrument were to screen the sample for eligible households, select a respondent for participation in the study, and verify or update the name and address of the respondent. Telephone data collection occurred from October 28, 1997 through February 28, 1998.

During telephone data collection, each telephone number was treated as an individual case to be carefully managed and controlled throughout the various steps of the telephone

data collection process. In addition to the screener questionnaire, telephone interviewers used a call record form to note the results of all calls and to manage the flow of work.

A total of 7,382 telephone numbers, out of the 11,718 drawn, were released for calling during data collection. The final outcomes of these calls can be categorized into eight groups and are summarized in Table 3.1.

- **Complete** - The screener was completed either by the original person listed on the sample or by another member of the household who was at least 18 years old. Names and addresses of the cases with this status were faxed to EnerTech who then sent the respondents a letter explaining the study and a Consent Form to sign and return to them so that they could send a personal exposure measuring device.
- **Ineligible** - An ineligible status was assigned if there was no one 18 years or older living in the household; the telephone number belonged to a second/vacation home; or the household was planning to move in the next two months.
- **Refusal** - The respondent refused the screener or refused to participate in the study. Common reasons for refusals to either answer the screener or to participate in the study were that the respondent did not have time or simply did not want to participate.
- **No contact** - After making ten calls, spaced out over different times of the day and days of the week, it was not possible to make contact with anyone at the number. Therefore, it could not be determined whether the number was for an eligible household.
- **Maximum Attempts** - After making at least eight calls, spaced out over different times of the day and days of the week, and having made contact with someone at the number, it was not possible to complete the screener with the household. The response of this group was treated as a refusal.
- **Non-Working** - The telephone number on the sample list was no longer a working number. No tracing was done for these households.
- **Business Number** - The telephone number on the sample was not for a residence.
- **Language Problem** - The screener could not be completed because no one in the household spoke English.
- **Other** - This code was used when no other final code applied.

Table 3-1 Telephone Screener Results

Screener Outcome	Number of Cases	Percent of Released Telephone Numbers
Complete	1,796	24.3
Ineligible	146	2.0
Refusal	1,729	23.4
No Contact	608	8.2
Maximum Attempts	183	2.5
Non-Working	1,871	25.4
Business Number	890	12.1
Language Problem	150	2.0
Other	9	0.1
Total	7,382	100

The data of Table 3.1 indicate a response rate of $\frac{1796}{1796 + 1729 + 183 + 150 + 9} = 46.4\%$

3.2 Consent Form

Westat supplied Enertech with the names, addresses, and phone numbers in batches of approximately 100 candidate participants per week. Each candidate was mailed an information packet containing:

- a letter from the one of the principal investigators explaining the purpose and methods of the study and photographs demonstrating the use of the meter. Different versions of the letter and photographs were available for adult men, adult women, parents or guardians of school-age boys, school-age girls, toddlers, or infants (see Appendix A, Documents 3 to 8).
- a Consent Form to be signed and returned to Enertech. A photocopy of the Consent Form was provided to the participants for their records (see Appendix A, Document 9).
- a self-addressed, stamped envelope to return the Consent Form to Enertech.

After four business days, Enertech contacted each candidate by phone to answer questions and encourage the individual to sign and return the Consent Form. The Enertech representative would briefly explain the purpose of the study and the measurement protocol. Personal phone contacts were attempted a few times during the course of two weeks. The Enertech caller would leave a message on voice mail or answering machines, when available, only after two or three attempts at a direct contact were made.

The total number of names and addresses provided by Westat to Enertech was 1,796. Enertech sent Consent Forms to the first 1,718 addresses received from Westat. Two addresses were not sent forms for eligibility reasons. It was not necessary to send Consent Forms to the remaining batches received from Westat containing 76 names and addresses because a sufficient number of participants was already available to complete the survey.

Of the 1,718 Consent Forms mailed (816 males and 902 females):

- 1,120 forms were returned (544 men and 576 women). This represents a Consent Form return rate of 65.2% (66.7% for men and 63.9% for women).
- Most of the people who did not return the Consent Forms did not offer any explanation.

Signed Consent Forms were received in the mail from 3 to 80 days after they were mailed. The average turnaround time for the forms was 14 days, the median turnaround time was 10 days..

3.3 Meter Delivery and Return

The magnetic field exposure meter was sent to 1079 out of the 1120 people who returned the signed consent form. It was not necessary to send the meter to the remaining 41 people because the project goal of a sample of at least 1000 people was already achieved. The meter was included in a kit containing:

- a set of instructions on the use and return of the equipment (see Appendix A, Documents 10 to 12);
- an EMDEX PAL™ magnetic field exposure meter;
- a custom pouch for carrying the meter:
 - adults and children over 5 years received a nylon pouch with a pocket for the activity diary;
 - children under 5 received a padded cloth holder in the shape of a teddy bear;
- a small diary for recording times of specific activities (see Appendix A, Document 13);
- a pen imprinted with a toll-free help line;
- a short questionnaire on the subject's occupational and residential environments (see Appendix A, Document 14);
- prepaid shipping materials and documents to return the equipment; and
- a check made out to the participant for \$50.

Two to three business days after the kit was shipped, Enertech called each participant to briefly explain the use of the meter and diary and answer any questions the subject might have as well as to encourage the participants to start the recordings as soon as possible.

The participant merely had to turn a single switch “on” to activate the meter and begin data collection, place the meter in the pouch or holder, and record the start time in the diary. The meter automatically stopped collecting data after 29 hours. The participants were instructed to record the time of day when noting entries in the diary. The participants were instructed to note when they were *home, in bed, at work, at school, or traveling*. The participants were instructed to place the meter on a bed stand while they slept but to keep it as far away from an appliance (such as an electric clock-radio) as their head was. A toll-free support number was provided to all participants. Several calls were received during the survey. The majority of the calls concerned questions regarding the protocol.

Of the 1079 meters shipped, 1,050 meters were returned in time for inclusion of the data in the final report. Of these, 1012 had valid data, corresponding to a valid data rate of 96.4%. The overall usable data (valid data returned on time) rate was 93.8%. There were 38 non valid data, that occurred when participants failed to switch on the meter to start recording, or switched off the meter after only a short period of recording, or when the meter was damaged, or (in five case) because of a meter’s malfunction.

Phone contact was attempted with participants with outstanding meters. Participants with meters outstanding for more than two months were sent a letter encouraging them to return the meter (See Appendix A, Document 18). Non-respondents were sent a second letter and a prepaid shipping package to return the outstanding meter (See Appendix A, Document 19). Of the 29 meters not returned in time for inclusion of the data in the final report, 6 meters were returned after the deadline for entering the data in the database. Twenty three meters were never returned and were considered lost (meter loss rate of 2.1%).

Meters were returned to Enertech between 4 and 116 days after shipping them; the average turnaround time was 15.5 days; the median turnaround time was 13 days. The meter data were downloaded to a file, marked with the activity times found in the diary, and archived. Both the Diary and the Respondent Questionnaire were entered in the database. Following each measurement, the accuracy of the meter was checked for operation within specifications and the meter was readied for the next participant. No data were lost due to a meter operating out of specification.

Each participant was mailed a form letter (see Appendix A, Document 15) showing the average field measured during the first 24 hours the meter was operating.

3.4 Participation Rate

The overall participation rate, equal to the product of the telephone interview response rate (0.464, see subsection 3.1), the Consent Form return rate (0.652, see sub-section 3.2), and the usable data rate (0.938, see sub-section 3.2), was 0.284 (28.4 %).

3.5 Analysis of Meter, Diary, and Questionnaire Data

The personal exposure meter was programmed to sample the magnetic field every 0.5 seconds along its x, y, and z axis coils. The meter performs a number of calculations. First, the field resultant is calculated. If the magnetic fields measured by the x, y, and z axis coils are B_x , B_y , and B_z , the magnetic field resultant B is: $B = \sqrt{B_x^2 + B_y^2 + B_z^2}$. The individual components values are not otherwise used because there are few indications that the direction of the field in space is important and because it is practically impossible to keep track of the orientation of the personal exposure meter relative to the body.

The magnetic field measurements are not stored as a time series of data. This would require storing 1200 field values data every 10 minutes, and a total of 172,800 values in a 24 hour period. Rather, the following quantities contained in memory are updated after every sample: total number of samples, number of samples in each of eight bins, running sum of field values, running sum of the squares of field values, previous field value, number of sudden field changes in each of three bins, time since the last significant field change, total time during which the field is constant, and running sum of the absolute values of field changes. In this way, only 18 values are kept in memory. After each ten-minute period, 16 of the above quantities are stored. The memory of the meter is filled up after 29 hours (174 ten minute periods), when a total of $16 \times 174 = 1,444$ quantities are stored. The meter did not have an absolute time stamp. Time is counted from the moment in which the meter is activated, which is entered into the diary.

Measurement data were transferred from the meter to a binary computer file. The PAL software (Figure 3-1), a Windows™ program, was used to analyze the data.

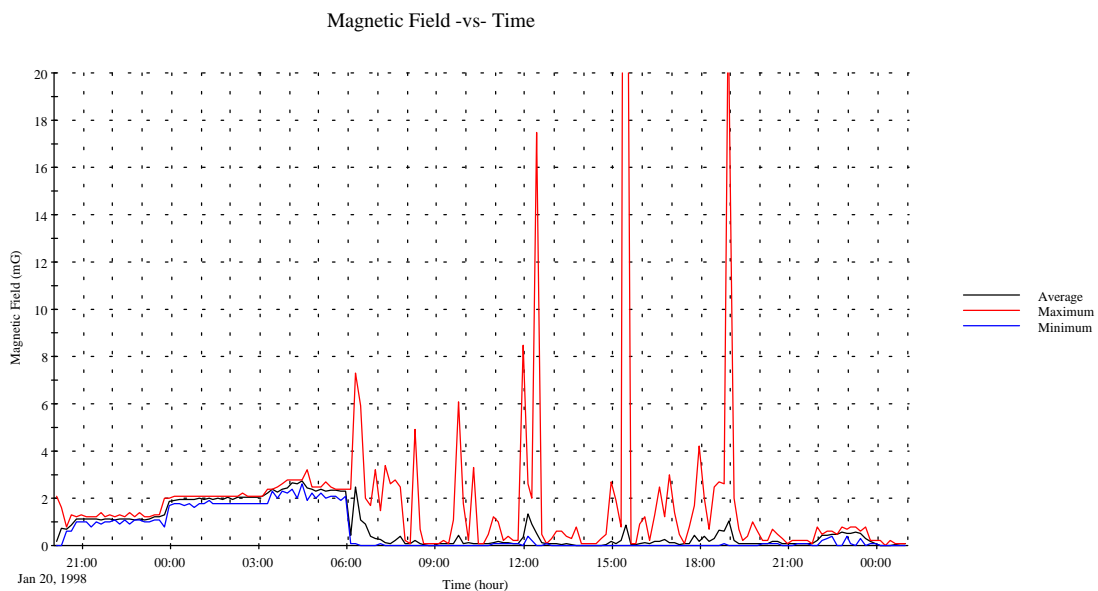


Figure 3-1 Example of a Chart Produced by the PAL Windows Software

The activity diary entries were transcribed in a computer file. This file was used in connection with the PAL software to display a chart (Figure 3-2) of the activities of the participants during the 24 hour measurement period. The software allowed editing the activity diary entries and correct obvious errors made by the user or errors in data transcription from the diary to the computer file.

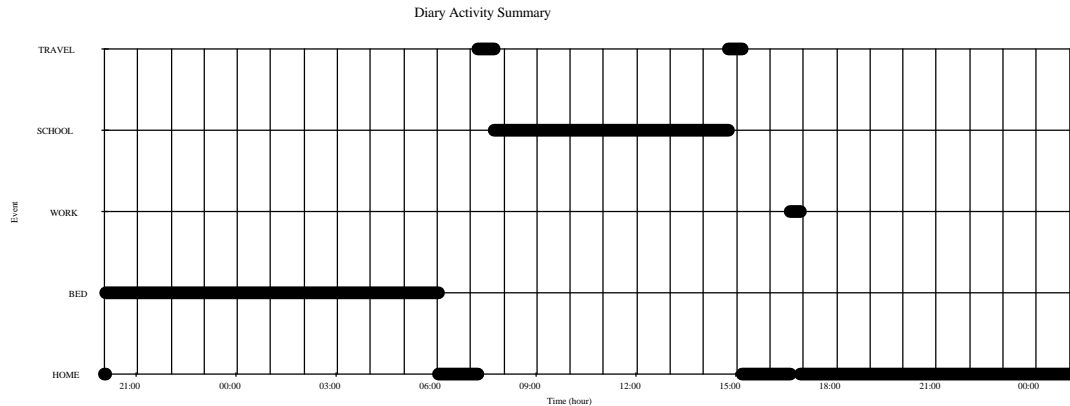


Figure 3-2 Example of the PAL Windows Software Activity Chart

The PAL software was used to merge the activity diary with the meter data and obtain for each participant the following exposure quantities for the first 24 hours from the moment in which the meter was first activated by the participant and for each sub-period (at home not in bed, at home in bed, at work, in school, during travel, or other):

1. Day of the Week (during which most of the 24 hour measurements fell)
2. Activity Type (entire period, in bed, at home not in bed, work, school, travel, other)
3. Total period duration (minutes)
4. Total analyzed period duration (minutes)
5. Average magnetic field (mG)
6. Standard deviation (mG)
7. Geometric mean (mG)
8. Geometric standard deviation
9. Minimum (mG)
10. 1st percentile (mG)
11. 5th percentile (mG)
12. 10th percentile (mG)
13. 25th percentile (mG)
14. 50th percentile (mG)
15. 75th percentile (mG)
16. 90th percentile (mG)
17. 95th percentile (mG)
18. 99th percentile (mG)
19. Maximum (mG)

20. Time above 0.5 mG (minute)
21. Time above 1 mG (minute)
22. Time above 2 mG (minute)
23. Time above 4 mG (minute)
24. Time above 8 mG (minute)
25. Time above 16 mG (minute)
26. Time above 32 mG (minute)
27. Time above 64 mG (minute)
28. Number of sudden field changes between 2.5 and 5 mG
29. Number of sudden field changes between 5 and 10 mG
30. Number of sudden field changes more than 10 mG
31. Length of Time with Constant Field (minute)
32. Intermittence index (%/sample)

The meter data were actually divided into ten-minute period data. The ten-minute data were attributed to the sub-period of activity that was in progress during that time. If two different activities took place during the ten-minute period, the data for this “mixed activity” period were not attributed to either of the two activities. For instance, if the meter were activated at 6:40 a.m. and the participant noted on the diary that he or she was at home until 7:35 a.m. and that he or she was traveling from 7:35 to 7:55, the data for the first five ten-minute periods, from 6:40 to 7:30, would be attributed to the sub-period “at home, not in bed”, the data for the ten minute periods from 7:30 to 7:40 and then again from 7:50 to 8:00 would not be attributed to any sub-period, and the data from 7:40 to 7:50 would be attributed to “travel”. If no activity was attributed to a particular ten-minute time interval, then the interval would be attributed to the sub-period “other”. An example of PAL software output is shown in Table 3-2.

The output of the PAL Windows Software, containing all the variables previously listed, was entered in the database. The personal data from the interviewer telephone log and from the respondent questionnaire were transcribed into computer files, and these files were placed in the database. The following personal data were entered in the database:

1. Subject ID number: a six digit number starting from 100001
2. Sex: male or female
3. Birth date: month, day, year
4. Number of persons in the same household
5. City
6. State
7. Zip code
8. Occupation
9. Facility other than work place visited during the 24 hour measurements
10. Residence type (single family dwelling, duplex, apartment, mobile home)

11. Bedroom floor. Number of the floor where the bedroom is located.
12. Home size (< 1000 ft², between 1000 and 2000 ft², and > 2000 ft²)
13. Type of water line (metallic or plastic)
14. Is a power line visible within 150 feet ? (Yes or no)
15. Distance between residence and power line (within 4 distance ranges)
16. Power line type (to be selected among 8 different types)

Table 3-2 Example of PAL Software Output

Activity Type		All Day	Bed	Home	Work	School	Travel	Other
Total Period	(min)	1440	455	115	500	0	209	161
Analyzed Period	(min)	1440	450	90	480	0	110	120
Average	(mG)	3.86	1.04	0.72	9.27	0	0.99	1.15
St. Dev.	(mG)	5.51	0.28	0.14	6.81	0	0.89	0.72
Geo. Mean	(mG)	1.98	1.01	0.71	8.41	0	0.81	1
Geo. St. Dev.		3.14	1.3	1.19	1.41	0	1.99	1.8
Minimum	(mG)	0	0.5	0.5	3.9	0	0	0
1st Percentile	(mG)	0.22	0.58	0.51	5.01	0	0.2	0.32
5th Percentile	(mG)	0.5	0.66	0.54	6.1	0	0.28	0.44
10th Percentile	(mG)	0.6	0.72	0.58	6.24	0	0.37	0.5
25th Percentile	(mG)	0.81	0.83	0.64	6.81	0	0.52	0.55
50th Percentile	(mG)	1.27	1.02	0.7	7.5	0	0.73	1.14
75th Percentile	(mG)	6.87	1.18	0.78	9.99	0	1.17	1.56
90th Percentile	(mG)	9.35	1.43	0.98	12.77	0	2.36	2.02
95th Percentile	(mG)	11.68	1.61	1.04	14.36	0	2.95	2.36
99th Percentile	(mG)	15.3	1.86	1.1	35.05	0	3.98	3.62
Maximum	(mG)	168	2	3.8	168	0	11.1	9
Time > 0.5 mG	(min)	1366	449.5	89.92	479.6	0	87.02	109.6
Time > 1 mG	(min)	924	253.3	8.56	479.6	0	31.69	64.76
Time > 2 mG	(min)	561	0.94	0.01	479.6	0	15.81	12.52
Time > 4 mG	(min)	504	0	0	479.58	0	1.04	0.62
Time > 8 mG	(min)	205	0	0	204.1	0	0.13	0.03
Time > 16 mG	(min)	7.12	0	0	7.01	0	0	0
Time > 32 mG	(min)	5.44	0	0	5.44	0	0	0
Time > 64 mG	(min)	2.44	0	0	2.44	0	0	0
Sudden Changes 2.5 - 5	(#)	58	0	2	5	0	10	4
Sudden Changes 5 - 10	(#)	34	0	0	9	0	6	0
Sudden Changes > 10	(#)	54	0	0	48	0	0	0
Length of Time with Constant Field	(min)	298	0.9	0	272.7	0	0	2.9
Average change between consecutive readings	% per sample	0.025	0.008	0.013	0.023	0	0.093	0.039

3.6 Database Description

3.6.1 Introduction

This section describes the data set generated as a result of the 1000-person sample personal exposure magnetic field survey. Data management is described in Section 3.5.

The data set produced by this project is intended to be included in the *EMF Measurement Database* developed by EMF RAPID Engineering Project 5. DOE's EMF Measurement Database consists of a *database index* and a *database repository*. For each data set, the index contains the *metadata* (i.e. data about data), describing the nature and organization of the data set. The repository contains the *data products* of the data set.

3.6.2 Metadata

The metadata of the data set of the project: "Survey of Personal Magnetic Field Exposure" consists of four parts: data set reference, data set description, data model, and data product description. A metadata file using the Standardized Generalized Markup Language (SGML) was prepared. This file is listed in Appendix C. The data model used is described by the entity-relationship diagram of Figure 3.3.

3.6.3 Data Products

The following data products were generated by this project:

(ONE) Subject Questionnaire File - File containing questionnaire data filled in by each subject. The questionnaire contains information about work, residence, and power line.

(ONE) Subject Measurement Exposure Data File - File containing data of magnetic field levels and exposure bins of each subject based upon certain activity code criteria.

(ONE) Subject Information File - File containing general information such as gender, birth date, and geographic location of each subject.

(ONE) Subject Diary File - File containing information regarding the types of travel used during the measurement period. In addition, this file lists time periods of data that have been excluded from analysis due to invalid data.

(ONE) Subject Diary Detail File - File containing diary information detailing what times during the measurement period the subject spent in various activities such as home, bed, work, school, and travel. In addition, the starting time of each subject's measurement data is also included in this file. The information in this file is used to compute the exposure levels for each of the various activity types.

(ONE) Subject Weight File - File containing weights used to generate representative sample and variance estimators of the general population. (See Section 5.1)

3.6.4 Other Data

A Microsoft Access™ Database was created containing the same information as the Data Products listed above in Section 3.6.3.

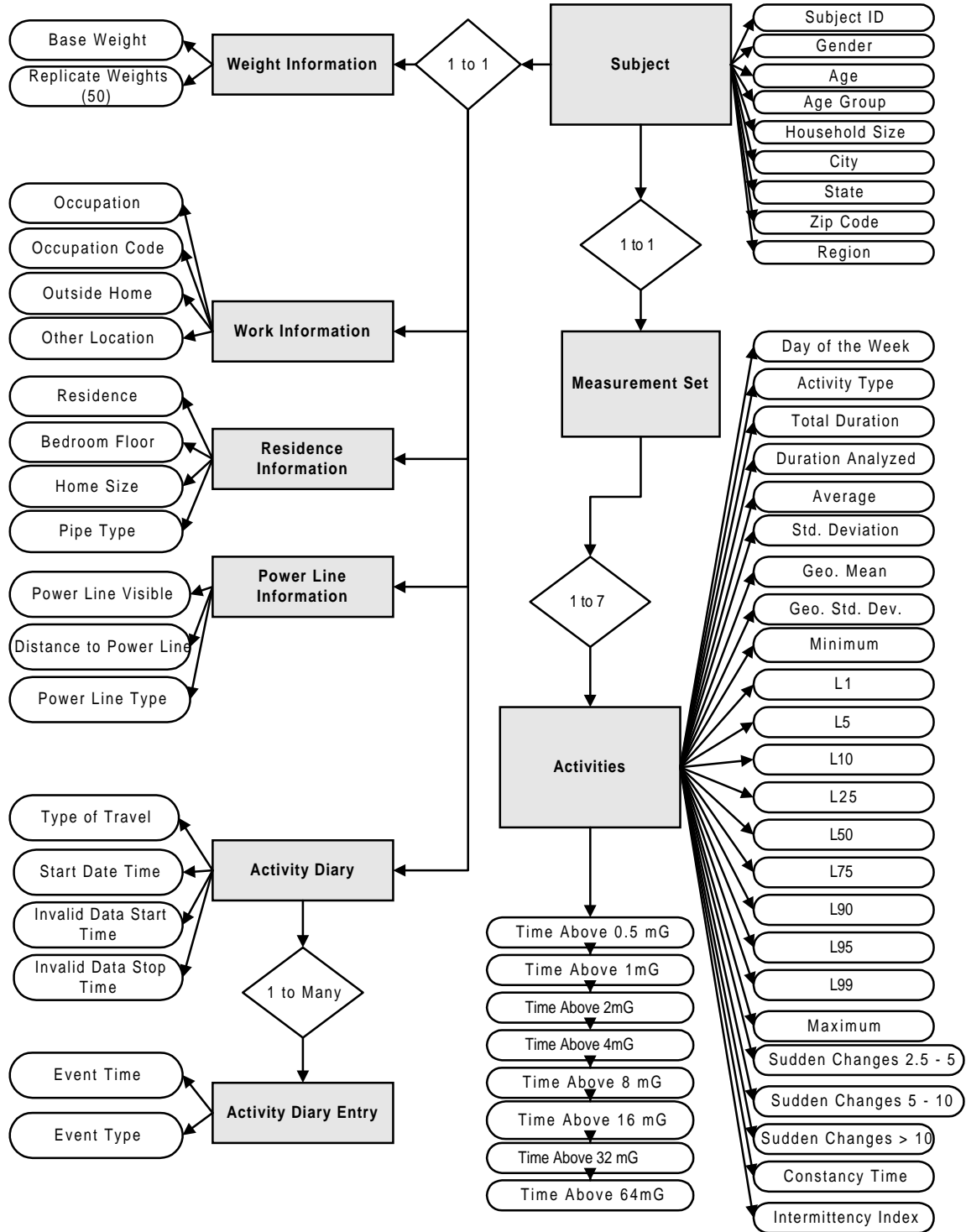


Figure 3.3 Entity - Relationship Diagram