

**Geospatial Analysis of Cancer Rates in Residents Living Over Contaminated  
Shallow Ground Water Plumes in Davis And Weber Counties  
1973-2001**

Davis and Weber Counties, Utah

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## **Geospatial Analysis of Cancer Rates in Residents Living over Contaminated Shallow Ground Water Plumes in Davis and Weber Counties 1973-2001**

### SUMMARY

In 2003, the Environmental Epidemiology Program (EEP), within the Utah Department of Health (UDOH) concluded an investigation of cancer incidence rates at the request of Davis County Health Department (DCHD) regarding a perceived elevated incidence of cancer in Sunset and Clinton communities within Davis County. Sunset and Clinton are on the west side of HAFB. The residents of Sunset and Clinton were concerned that cancers in these communities may be caused by contaminated groundwater. The purpose of that investigation was to determine if cancer rates were elevated in the communities of Sunset and Clinton (census tracts 1253.01 and 1253.02) compared to the cancer rates for the State of Utah. The results of that investigation indicated that kidney and renal pelvis cancer were elevated during the first (1973 to 1978) and last (1998-1999) periods evaluated. Cancer of the gallbladder was significantly ( $p < 0.05$ ) elevated in two periods, 1988-1992 and cumulatively from 1973-1999, respectively. Testicular cancer was significantly elevated during the period of 1988 to 1992. The cause of the elevated cancer rates during these specific periods could not be determined. That investigation did not find any association or link with the cancers (gallbladder, testicular, and kidney and renal pelvis) that were significantly elevated to the contaminants of interest (trichloroethylene, tetrachloroethylene, carbon tetrachloride and perchlorate). In addition, that investigation found no evidence suggesting that cancer (of any type) were significantly increasing in the communities of Sunset and Clinton during the periods evaluated.

This study was conducted as a follow-up to the previous study of Sunset and Clinton to determine if cancer rates in residents living over the contaminated plumes are higher than residents in a comparison population not living over the plume. This study investigated the spatial relationship between possible exposure to the contaminated groundwater plumes and cancer incidence rates. Additional data is available to help understand limitations presented in the previous study, including additional information about cases' residential addresses, residential history in the study area, and familial history for cancer. The cancer incidence rates for the potentially exposed population was adjusted for age, sex, residential history in the study area and familial history for cancer. The adjusted cancer rates for the potentially exposed population were compared to the adjusted cancer rates in the population in a study area surrounding HAFB and not potentially exposed to the groundwater plumes.

No evidence of excess cancer incidence risk associated to exposure to the contaminated ground water plumes were found for the study period (1973-2001) within the study population surrounding HAFB.

## **BACKGROUND AND STATEMENT OF ISSUES**

### *Background*

Hill Air Force Base (HAFB) is in an urbanized area in Davis and Weber counties. A map of the location of HAFB is presented in Figure A. Groundwater contamination discovered as early as 1975 includes trichloroethylene, tetrachloroethylene, carbon tetrachloride and perchlorate. The contaminants have been determined to be contained within the shallow aquifer which ranges between 6-8 feet below ground surface to approximately 100 feet below ground surface (MWH 2002, ATSDR 2003a). HAFB also conducted a study of TCE in plant samples collected outside of HAFB. In that study, TCE was found in plant tissue samples at concentrations ranging from 0.001 parts per millions (ppm) to 0.018 ppm (Doucette et. al. 2002, Doucette et. al. 2003, MWH 2003a). A map of the contaminated groundwater plumes emanating from HAFB is presented in Figure 2, Appendix A.

In 2003, the Environmental Epidemiology Program (EEP), within the Utah Department of Health (UDOH) concluded an investigation of cancer incidence rates at the request of Davis County Health Department (DCHD) regarding a perceived elevated incidence of cancer in Sunset and Clinton communities within Davis County (Williams et. al. 2003). Sunset and Clinton are on the west side of HAFB (see Figure 1). The residents of Sunset and Clinton were concerned that cancers in these communities may be caused by contaminated groundwater. Since the contaminated ground water is not used for drinking water, the potential exposure comes from vapor intrusion into basements and consumption of locally grown edible plants. The purpose of that investigation was to determine if cancer rates were elevated in the communities of Sunset and Clinton (census tracts 1253.01 and 1253.02) compared to the cancer rates for the State of Utah. The rate for each type of cancer were evaluated in consecutive five year intervals (1973-1977, 1978-1982, 1983-1987, 1988-1992, 1993-1997 and 1998-1999), as well as cumulatively for the time period of 1973-1999.

The results of that investigation indicated that kidney and renal pelvis cancer were elevated during the first (1973 to 1978) and last (1998-1999) periods evaluated. Cancer of the gallbladder was significantly ( $p < 0.05$ ) elevated in two periods, 1988-1992 and cumulatively from 1973-1999, respectively. Testicular cancer was significantly elevated during the period of 1988 to 1992. The cause of the elevated cancer rates during these specific periods could not be determined (Williams et. al. 2003).

That investigation did not find any association or link with the cancers (gallbladder, testicular, and kidney and renal pelvis) that were significantly elevated to the contaminants of interest (trichloroethylene, tetrachloroethylene, carbon tetrachloride and perchlorate). In addition, that investigation found no evidence suggesting that cancer (of any type) were significantly increasing

in the communities of Sunset and Clinton during the periods evaluated. The report for that investigation is included with this report as Appendix C.

Factors that must be considered in the development of etiology of most cancers, but could not be evaluated in that investigation, include latency period, population migration, personal habits, diet and familial history. The latency or induction period for most adult cancers range from 10 to 30 years after initial exposure to a carcinogen (Frumkin 1997, Hansen et. al. 1998). Therefore, ascertaining the place and time of exposure to a carcinogen is difficult. Migration of people into and out of Sunset and Clinton presents a problematic issue relative to exposure and latency. Humans live and work in many environments and are exposed to complex mixtures of toxic pollutants at home and at work. Information was not available for individual occupational exposures. Lifestyle factors such as smoking and alcohol consumption could not be examined.

### *Study Objectives*

This study was conducted as a follow-up to the previous study of Sunset and Clinton to determine if cancer rates in residents living over the contaminated plumes are higher than residents in a comparison population not living over the plume. This study investigated the spatial relationship between possible exposure to the contaminated groundwater plumes and cancer incidence rates in populations living over the contaminated groundwater plumes. Since the contaminated groundwater is not used for drinking water, the potential exposure comes from vapor intrusions into basements and consumption of locally grown edible plants (fruits and garden vegetables). Additional data is available to help understand limitations presented in the previous study (Williams et. al. 2003), including additional information about cases' residential addresses, residential history in the study area, and familial history for cancer. Exposure was assessed by residential assignment to census block group areas that are over the contaminated ground water plumes. The cancer incidence rates for the potentially exposed population was adjusted for age, sex, residential history in the study area and familial history for cancer. The adjusted cancer rates of cancer for the potentially exposed population were compared to the adjusted cancer rates in the population in a study area surrounding HAFB and not potentially exposed to the groundwater plumes. Because the historical concentration gradient boundaries for the contaminated groundwater plumes are not known, the populations in the census block groups that are within 400 meters of the available graphical boundaries were considered potentially exposed. The distance of 400 meters is the average width of the ground water plume.

## **METHODS**

### *Study Design*

Geographic information systems (GIS) studies are exploratory in nature. As such, this study is a retrospective surveillance study design. The incidence of cancer among residents (the potentially

exposed population) living in a cluster of census block group areas that are over or in close proximity to the contaminated ground water plumes will be compared to the incidence of cancers among the remainder of the residents (the unexposed population) living in census block group areas that are not over or in close proximity to the contaminated ground water plumes. The study (null) hypothesis is that the incidence of cancers are not significantly different between the potentially exposed and the unexposed populations. Assessment of the difference in cancer incidence among the two populations will be made by the standardized incidence ratio (SIR). The criteria for a specific cancer to demonstrate statistical significance are that the SIR is equal to or greater than one (1.0), and that the confidence interval (CI) of the SIR does not include one (1.0) within its confidence limits. For statistical validity, SIRs and corresponding 95% confidence intervals were only calculated for time periods with five or more cases (Caldwell 1990, Elliott and Wartenberg 2004).

A SIR may be mathematically statistically significant but may be a mathematical artifact and not biologically meaningful or relevant. To determine biological relevance, the SIR will need to be greater than two, the cancer cluster is geographically associated with the potentially exposed population, the cancer type is associated to the contaminates of concern and cancer rates are increasing over time.

### *Data Management*

Case data on persons diagnosed with cancer between 1973 and 2001 were obtained from the Utah Cancer Registry (UCR). This data included case street addresses, age, sex and diagnostic information. Individual records for cancers were identified by a cancer tracking reference (CTR) number and sequence number. A sequence number of zero was for a primary diagnosis and all other numbers were for secondary diagnosis in sequence. The CTR is used as a reference number by the Utah Population Database (UPDB). Data requested from the UPDB was done by a list of CTR numbers, and the returned data was linked to cancer cases by the CTR. This study protocol was reviewed by the review board for the Utah Resource for Genetic and Epidemiologic Research (RGE 2004a).

Geographic data for the study area was projected using the North American Datum (NAD) 1983 Universal Transmercator (UTM) Zone 12N projection schema. U.S. 2000 Census Block Group areal units were selected as the subdivision unit for the study area. Geographic information files for the Utah U.S. 2000 Census Block Group areas (GIS feature layer) was obtained from the Utah Automated Geographic Reference Center (AGRC) which is part of the Utah Department of Administrative Services (AGRC 2005). This data was indexed by a feature key which consisted of the state and county Federal Information Processing Standards (FIPS) codes and the U.S. 2000 census tract and census block enumeration codes (ITL 1990, USCB 2004). This composite key, known as the Standard Federal Identifier (STFID), is a unique standardized identification of census areas and was used to geographically link spatial data, population data and case data.

### *Data and Data Preparation*

Study Area: The U.S. 2000 Census Block Group geographic information and graphics file (known as a GIS feature layer) for the State of Utah was obtained from AGRC. From this data, a set of geographic reference file for the study area were developed. Census block group areas within eleven zip code areas (84015, 84040, 84041, 84056, 84067, 84075, 84315, 84401, 84403, and the southern part of 84405) surrounding the base were selected for the study area. Census block group areas in the northern part of zip codes 84405 (Ogden). The study area consisted of 143 census block group areas within those zip codes. A map of the study area is presented in Figure 2, Appendix A. Those census block groups contained approximately 247,500 Utah residents based on the 2000 census population data. A copy of this data set was modified to include only those census block groups in the study area.

Environmental Data: The Environmental Management Directorate, Restoration Division (EMR) at HAFB provided environmental and exposure information collected as part of the HAFB Environmental Restoration Management Action Plan. The extent of groundwater contamination was characterized by monitoring wells from for each plume area. Limited exposure assessment for Sunset and Clinton was characterized by limited based air sampling for off gassing volatile organic compounds (VOC) and plant tissue sampling (MWH 2001, Douchette, et. al. 2002, MWH 2002, Douchette et. al. 2003, MWH 2003a, MWH 2003b). From these data, EMR modeled a graphical presentation of each of the plumes (EMR 2001). An ArcView shape file of the graphic boundaries (for the concentration contour of 5-10  $\mu\text{g/l}$  TCE concentration in groundwater during the 2001-2002 sampling period) was overlaid on the census block group map for the study area.

Exposure Assessment: No personal exposure data was available for this study. Proximity to the plume was used as a surrogate for exposure. Graphic boundaries for the contaminated ground water plumes for a boundary concentration of 5-10  $\mu\text{g}$  of TCE contamination per liter of ground water were available for 2001-2002 sampling period (MWH 2002). Information about the changes in concentration over time or the meander of the ground water plumes were not available. The width of the ground water plume graphics ranged from approximately 100 meters to over 1,000 meters with an average width of approximately 400 meters. For this study, a 400 meter buffer around each contaminated ground water plume was used to identify the potentially exposed population. The population of any census block group that had any portion of its area contained within any of the 400 meter buffer zones were considered potentially exposed for this study. The population residing in 32 (22 % of 143) census block groups met the criteria as potentially exposed. The remainder of the population in the study area were considered unexposed. The potentially exposed population is approximately 53,500 (22% of 247,500) persons based on the 2000 census population data. Data variables were added to the study area census block group GIS data to identify census block groups that included the potentially

exposed population and the unexposed population. This data variable allowed consolidation of the census block group population and case data into potentially exposed and unexposed groups.

Cancer Data: All cancers (24,760 records for Davis (10,969 records) and Weber (13,791 records) counties for the period 1973 to 2001 were obtained from the Utah Cancer Registry (UCR 2005). Those data included the UCR reference number, a sequence number indicating primary and secondary cancer reports, the cases age at diagnosis, sex, and address at diagnosis, as well as site, histology and behavior information. All of the records were geocoded using the ArcMap Version 9.0 geocoding utility and the Dynamap/2000 version 14.3 Street File Network for the State of Utah was obtained from Geographic Data Technology, Inc. (GDT 2004) for the address reference data.

Geocode-able addresses were obtained for 24,433 (98.7%) records. For this study, only those records of primary cancers were included. Of the original 24,760 records, 20,127 (81.3%) were coded as primary cancer records. The remaining 4,633 (8.7%) are records for secondary cancers. Of the primary cancer records, 19,854 (98.6%) were successfully geocoded. From the geocoded records, 11,113 cases of primary cancers were in the study area.

Residential Tenure and Familial History Data: The Utah Population Database (UPDB) utilizes computerized genealogies of the founders of Utah and their Utah descendants to link people residing in Utah in familial structures. The UPDB further links those individuals to other data sets, including cancer records, birth and death certificates, census records, driver's license and Medicaid data. The UPDB is developed and maintained by the Resource for Genetic and Epidemiologic Research (RGE), Huntsman Cancer Institute, University of Utah. Information was requested from the RGE for 11,130 cancer cases that were known or thought to have resided in the study area at the time of their diagnosis. This request was made before geocoding was complete. The RGE compiled a table of address information for those cancer cases within the study area. The addresses were abstracted from birth records (both the case's and the case's children), driver's license records and other vital records. The RGE also compiled a table of relatives of cancer cases found in the UPDB and what, if any, cancer of those relatives. These tables were linkable back to the cancer data with the UCR registry index number (RGE 2004b).

Address information was found for 10,939 (98.3%) of the requested cases. For those cases, 53,066 address records were found. The number of address records found for any one case ranged from 1 to 17. For most of the records (2,843 records or 53.2%), just one address record was found. The case's birth record address was found for 290 cases. The time range for cases with two or more address records ranged from 1 to 88 years. The address record date was compared to the cancer diagnosis date and only those addresses that were pre-diagnosis were considered. Pre-diagnosis addresses were available for 4,556 (41.0%) cancer cases in the study area. The temporal distance between the earliest address date and the cancer diagnosis date was calculated. Cases with a residential history in the study area greater than five years were

considered to have a residential tenure. Information about the availability and tenure code of pre-diagnosis address information were added to the cancer case records. For the 11,113 cancer cases in the study area 6,557 (59.0%) had an unknown residential tenure status. Of the 4,556 (41.0%) cases with pre-diagnosis addresses, 2,891 (26.0%) cases had address that were more than five years earlier than their cancer diagnosis date and those cases were considered to have residential tenure (RGE 2004b).

Familial information was available for 5,854 (52.7%) of the cases. First degree (parents, siblings and children) relatives were found for 2,249 (20.2%) of the cases. Three hundred and eighty-seven (3.5%) of the cases had at least one relative with cancer. Those cases were considered to have a familial history for cancer. Information about the availability and presence of familial history for cancer were added to the cancer case records (RGE 2004b).

Population Data: The 2000 U.S. Census divides Utah into 496 census tracts and 1,481 census block groups within those census tracts (UCSB 2004). Commercially available U.S. Census population data for the U.S. 1970, 1980, 1990 and 2000 censuses were obtained on computer optical data disks (CDs) from Geolytic, Inc. (Geolytic 2002 a-f).

*Age and sex specific population:* The population data for each census period (1970, 1980, 1990 and 2000) were organized into sex specific five year age group (0 to 4 year olds, 5 to 9 year olds, 10 to 14 year olds, ... 75 to 79 year olds, 80 to 84 year olds and 85 years and older) population counts for each census block groups in the study area. The population data was not stratified for race or ethnicity due to limitations in the data. The same index key described for the geographic reference data was used to reference the sex and age stratified census data. This index allowed direct linkage of the census data to the spatial representation of the census block groups. Intercensal population for each one-year period between two consecutive census years was calculated by linear regression for each age and sex population strata.

*Residential tenure in the population:* Census data includes a variable for the percentage of the population who lived at the same residence five years before the census year. Continuous residential tenure is assumed. The percentage of persons in each census population for 1970, 1980, 1990 and 2000 were obtained from the census data (Geolytic 2002 a, b, c, d, f and g).

The residential tenure was known for only 41% of the cancer cases. The percentage of cancer cases with a known residential history was calculated for each census tract. The intercensal year percentage of the population with a residential history longer than five years was calculated using linear regression. Each age and sex specific population, except for the 0 to 5 age group, for each census tract were further stratified into three residential history strata: residential history is unknown, residential history is shorter than five years and residential history is longer than five years. The 0 to 5 year age groups were stratified into two residential history strata: residential history is unknown and residential history is shorter than five years.

*Familial history for cancer in the population:* Familial history for cancer was defined as the percentage of the total population for each census block group that has at least one first order relative (parents, siblings and children) who also had a cancer of any type. No population-based statistic for the familial history for cancer exists for this study area. The percentage of the study area population for which the familial history status was known was assumed to be the same as the over-all percentage of cases for which the familial history status was known, and the rate of having relatives with cancer among the study population was assumed to be the same as the over-all rate or familial history for cancer among the cancer cases within the study area. These rates were assumed to be constant through the study period. No intercensal year percentage of the population with a familial history of cancer were calculated. Each age and sex specific population, for each census tract, were further stratified into three familial history strata: familial history for cancer is unknown, have familial history for cancer and do not have a familial history for cancer.

#### *Analytical Tools and Data Analysis*

Cancer incidence in the study area were analyzed by cancer type by two analytical methods. Both methods use the standardized incidence ratio (SIR) to compare the incidence of disease between two populations. The first method calculated the SIR for each type of cancer for each five-year period from 1973 to 2001 (i.e. 1973-1977, 1974-1978, 1975-1979 ... 1996-2000, 1997-2001) and for the study period (i.e., 1973-2001 inclusive). The calculated SIR values compared the incidence of cancer among the potentially exposed to the unexposed population. This method identifies cancers with an increased incidence among the potentially exposed population. The increase in incidence may be associated to exposure to the contaminated ground water plumes or may be the result of another risk factor highly correlated to the exposure schema used by this study.

The second method used was the Scan test developed by Dr. Martin Kulldorff (Kulldorff 1997). This method conducts iterative spatio-temporal cluster analyses throughout the study area and study period for each cancer type. All possible combinations of adjacent census block groups and consecutive year periods up to 50% the study area in size and 50% of the study period in duration are evaluated. This method identifies clusters of adjacent census block groups and periods of time with statistically significant increases of cancer incidence. This method does not incorporate exposure information.

Geographic Information Systems: ArcView (version 9.0) software developed by Environmental Systems Research Institute (ESRI) was used to geocode cases. Geocoding of the cancer data was conducted using the ArcView geocoding functionality.

ArcView supports Visual Basic for Applications (VBA) macro development and implementation. The age and sex stratified population counts for each census year were linked to

the data table for the census block group layer. A VBA macro was developed to compute the age (a), sex (s), residential tenure status (r) and familial history for cancer status (f) population strata for each intercensal year from 1973 to 2001, and write that information to a flat text population file in a format useable by the SaTScan software and MS Access software. A VBA macro was also developed to compute the census block group centroid latitude and longitude and write that information to a flat text geographic location file in a format useable by the SaTScan software.

The Standardized Incidence Ratio: ArcView was used to tabulate the number of cases and population size of the unexposed population and the standardized incidence count for the unexposed population for each five-year period for each cancer. The incidence count of the unexposed population was standardized for the age, sex, residential history and familial history distribution of the potentially exposed population. The unexposed population's standardized incidence count became the expected incidence count for the potentially exposed population. The actual case counts and population counts for the potentially exposed and unexposed populations were stored to a data table. This table was imported into Microsoft Excel (version 2002) software. The SIR, upper and lower 95% confidence limits and  $\chi^2$  (where  $\chi^2 = [\text{observed case count} - \text{expected case count}]^2 / \text{expected case count}$ ) p-values for each comparison were computed for all cases with five or more observed cases after adjustment. The SIR was calculated from the observed count and the expected incidence count for the exposed population (Greenland and Rothman 1998). The 95% confidence limits were calculated using Byar's method (Berslow and Day 1987, Regidor et. al. 1993). The standardized incidence of cancer in the potentially exposed population for a given time period were statistically elevated when:

- The number of cases after adjustment were 5 or greater;
- The SIR and the lower 95% confidence limit of the SIR were greater than 1.0;
- The  $\chi^2$  p-value was less than 0.05.

Cases with less than 5 cases after adjustment were not evaluated. Only cancer types associated in peer-reviewed journals to the chemical exposures of concern, and with more than five actual cases in the cluster and with a SIR greater than 2 (Caldwell 1990, Elliott and Wartenberg 2004) were considered biologically meaningful.

SaTScan: The SaTScan (version 5.1) was developed by Dr. Martin Kulldorff of the Harvard Medical School and Information Management Systems, Inc. to perform spatio-temporal cluster analysis of diseases events, using the scan test (Kulldorff 2004). This software uses a direct standardization method. The scan statistic compares incidence of cancers within a growing space-time windows centered incrementally on each census block group's area centroid (Kulldorff 1997, Kulldorff et. al. 2004) and each year in the study period. All possible combinations of centroid location and time are considered. The space-time windows are then incrementally enlarged to include adjacent census block groups and consecutive years up to a maximum of 50% of the study area and 50% of the study period. The Poisson probability model was used. Each clustered combination of census block groups and study period years are evaluated for significantly increased incidence of cancer events. Significance was determined by

evaluating the distribution of 9,999 Monte Carlo permutations of the data. This test can find none to many clusters of adjacent census block groups and study period years with increased risk. The test was constrained to not allow overlapping clusters. The standardized incidence of cancer cases identified in space and time by the Scan statistic was statistically significant when:

- The number of cases after adjustment were 5 or greater;
- The SIR is greater than 1.0;
- The log-likelihood p-value was less than 0.01.

The cluster of cancer cases in space and time were considered biologically meaningful (Caldwell 1990, Elliott and Wartenberg 2004) when:

- The cluster of cases was statistically significant;
- The SIR was equal to or greater than 2.0;
- The type of cancer has been associated to one or more of the chemicals of concern in a peer-reviewed publication.
- Fifty-one percent (the majority) of the population included within the spatial boundary of the cluster were from the potentially exposed population.

## RESULTS AND FINDINGS

Standardized Incidence Ratio: The SIR was calculated for the age, sex, residential history and familial history adjusted incidence counts and expected incidence counts for 25 five-year time periods (i.e., 1973-1977, 1974-1978 ... 1997-2001) and the inclusive study period (1973-2001) for each of the 42 cancer types. Standardized incidence ratios were calculated to evaluate the temporal distribution of the 42 cancer types each through the 26 time periods. Table 1 presents the results of the standardized incidence ratio calculations. The standardized incidence of cancer for a given time period were evaluated for significance and biological relevance if the number of cases in the potentially exposed population was 5 or greater. Five hundred and forty five (49.91%) of the time periods evaluated had 5 or more cases and were evaluated for significance and biological relevance. Of those, 8 SIRs (0.73%) were statistically significant at the 95% confidence probability. Those statistically significant SIRs were for lung cancers (1993-1997, 1994-1998, 1995-1999 and 1973-2001), bladder cancers (1987-1991 and 1989-1993), non-Hodgkin's lymphoma (1987-1991), and lymphocytic leukemia (1975-1979). Using the 95% confidence probability, one would expect up to 5% of the standardized incidence ratios to be statistically significant by random chance alone, therefore the criteria for biological relevance are applied. Bladder cancers and lymphocytic leukemia are not associated to the contaminations of concern in peer-reviewed literature and are therefore not relevant. Lung cancers and non-Hodgkin's lymphoma have been associated to the chemicals of concern. However, the increase in incidence for the potentially exposed population is small (less than 2.0) and are not consistently elevated as would be expected. The temporal patterns for both lung cancer and non-Hodgkin's lymphoma show a tendency to increase. The slope of the five-year incidence rate for lung cancer is 0.5 cases per year increment in the potentially exposed population and 0.3 cases per year increment in the unexposed population. The slope of the five-year incidence rate for

non-Hodgkin's lymphoma is 0.3 cases per year increment for the potentially exposed population and 0.2 cases per year increment for the unexposed populations. The differences in the temporal pattern among the potentially exposed population and the unexposed population are not significant ( $p=0.26$  for lung cancer and  $p=0.15$  for non-Hodgkin's lymphoma). Therefore, no elevated standardized incidence ratios were considered to be biologically meaningful.

Spatio-Temporal Cluster Analysis: Spatio-temporal cluster analysis of the standardized incidence of cancers for each of the 42 cancer types was conducted using the SaTScan statistical software. Table 2 presents the results of the most likely cluster periods and location descriptions for the significant clusters. One hundred sixty five possible clusters of excess incidence of cancer cases were identified by the scan statistic. The median number of clusters identified for each cancer type was 3 clusters (range 1 to 10 clusters). The average time period for those clusters was 4.27 years (range = 1 to 19 years, median = 3 years). The average area for those 165 clusters was 9.64 census block groups (range = 1 to 143 census block groups, median = 3 census block groups). The average population included in those clusters was 12,493.21 persons (range = 700 to 103,800 persons, median = 4,864 persons). The average cluster case count was 14.50 cases (range = 2 to 562 cases, median = 4 cases). Only 22 (13.3%) of the 165 clusters were within the potentially exposed population. Seven (4.2%) of the 165 clusters were found to be statistically significant ( $p \leq 0.01$ ). No clusters identified using SaTScan were found to be biologically meaningful.

## DISCUSSION

Cancer Registry: This study presents an analysis of the incidence of cancers occurring in a population that includes persons potentially exposed to groundwater in a shallow aquifer contaminated with trichloroethylene, tetrachloroethylene, carbon tetrachloride and perchlorate. Information about the incidence of cancer in the study area were obtained from the UCR. The UCR is a population-based central cancer registry first started in 1966. Cancer has been reportable in Utah since 1948. All cancers are designated reportable diseases in the Utah Rule R384-100 (Cancer Reporting Rule). In 1973, the UCR became one of the original members of the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program. Cancer surveillance in Utah and maintenance of the registry is conducted in accordance with standards promulgated by the SEER Program and the North American Association of Central Cancer Registries (NAACCR). Information about the sensitivity (completeness) or specificity (accuracy) of data in the registry was not available. The UCR tracks information about the stage of the cancer at diagnosis, however, other than whether the cancer was the primary cancer or not, information about the stage of the cancer was not available for this study. Differences in the proportion of diagnosis that are early stage cancers versus late stage cancers impacts the ability to associate cancer incidence trends to environmental exposures. Areas that are economically depressed are likely to have a higher proportion of cancers that are diagnosed in later stages than

areas with more wealth. For this study, the proportion was assumed to be constant, because no information was available to describe the differences.

Significance: The statistical methods employed in this study assess the probability that the observed distribution of incidence of cancer geographically and in time are random. The probability that the observed distribution of cancers are random is measured by the p-value. A small p-value indicates a small probability that the distribution is random and conversely a large probability that the distribution has some organization or clustering occurring. By convention p-values less than 0.05 (i.e. a 1 in 20 chance) are considered significant (Glantz 1997).

The significance measure, p-value, does not provide information on magnitude or importance of the clustering of cancers. Clusters of cancer incidence which are just slightly higher than would be expected can be significant. The more common the cancer (such as lung cancers, breast cancers or prostate cancers) the more likely that cluster of slightly increased risk can be found. On the other hand, real clusters of rare cancers are more difficult to find unless the magnitude is very large.

Magnitude: In both the SIR test and scan statistic the size of the increase of incidence of cancer is measured by the ratio of the observed number of the cases compared to the expected number of cases. The expected number of cases is the number of cases assumed to be occurring by chance and is determined by the number of cancers found in the comparison or unexposed population. Chance includes all the other causes or risks of cancer not associated with the exposure considered by this study. The process of standardization controls for difference in the chance probability between the different populations. An SIR equaling one indicates that there is no difference between what is observed and what is expected by chance alone. A ratio greater than one indicates more cases are observed than would be expected by chance and suggest an additional risk is present. Conversely, a ratio lower than one indicates that fewer cases are observed than would be expected by chance. The ratio is one kind of measure of risk and indicates the magnitude of risk. For example a ratio of 2 indicates that the risk is twice as large as that expected by chance alone, or that there are twice as many cases as would be expected by chance alone. Biologically meaningful clusters are those in which there were at least 5 observed cases after standardization and the SIR was larger than 2 (Caldwell 1990, Neutra 1990, Rothman 1990, Elliott & Wartenberg 2004).

The SIR as a measure of risk is not exact. The uncertainty is accounted for by confidence limits. The 95% confidence limits are used by convention and is the range where the real risk is likely to occur (Glantz 1997). The interpretation of the SIR should consider whether or not the range between the confidence limits includes one. For example, an SIR of 1.5 with a confidence interval between 1.2 and 1.8 indicates a statistically significant increased risk, some where between 0.2 and 0.8 times higher than would be expected by chance. However, a rate ratio of 1.5 with a confidence interval between 0.9 and 2.1 can not be interpreted as an increased risk,

because the true value could be less than one. The confidence interval is influenced by the frequency of cancers.

Risk Factors: Risk for cancer include environmental and lifestyle or behavioral risk factors for which public health can either provide risk awareness education or implement control measures. Other factors, that public health can not respond to include hereditary, occupational and other lifestyle or behavioral risks (Hemminki et. al. 2004, Chen & Hunter 2005). Klaassen (1996) provides a breakdown of the proportion cancer deaths for various kinds of risk factors of public health importance. This table provides an summary evaluation of the importance of some risk categories in the development of cancer.

<i>Risk Factor</i>	<i>Percentage Attributed to Cancer Mortality</i>
<i>Diet</i>	35%
<i>Tobacco Use</i>	30%
<i>Infectious Agents</i>	10%
<i>Reproductive and sexual behavior</i>	7%
<i>Occupational</i>	4%
<i>Alcohol</i>	3%
<i>Geophysical</i>	3%
<i>Pollution</i>	2%
<i>Medicine and medical procedures</i>	1%
<i>Industrial products</i>	<1%
<i>Food additives</i>	<1%
<i>Unknown</i>	?%

(Klaassen 1996)

For most cancer clusters, chance is the most plausible explanation. Cancers are more common than most community members realize. About one of every two men and one of every three women will develop cancer over full life expectancy. The average U.S. population can expect to see more than 470 new cases per 100,000 citizens and 200 deaths per 100,000 citizens each year. Given the rate that cancer is occurring naturally, some spatial and temporal clustering are expected. At the community level, the perception of the natural variation of incidence distribution at a larger scale may considered important when in fact it is not (Thun & Sinks 2004).

Contaminants of Concern: Groundwater contamination originating from Hill AFB includes trichloroethylene, tetrachloroethylene, carbon tetrachloride, and perchlorate. The health effects associated with exposure to these chemicals are included in the following paragraphs.

### *Trichloroethylene*

Trichloroethylene is a colorless liquid that is used for cleaning metal parts. It was commonly used as a degreasing solvent at Hill AFB until the mid 1970s. Trichloroethylene is the most common groundwater contaminant at Hill AFB. Trichloroethylene is suspected of causing cancer in animals, but its effect on humans is not clear. Several studies with mice and rats have suggested that high levels of trichloroethylene may cause liver or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. However, these results are inconclusive because the cancer could have been caused by other chemicals (ATSDR, 1997). An occupational study found no excess of any cancer among workers exposed to trichloroethylene (Blair et al, 1998).

The International Agency for Research on Cancer (IARC) has concluded that there is limited evidence for the carcinogenicity of Trichloroethylene in humans. IARC has also concluded that there is sufficient evidence that trichloroethylene is carcinogenic in experimental animals. Three well designed studies of people with occupational exposure to trichloroethylene showed higher levels of liver and biliary tracts cancers and non-Hodgkin's lymphoma. Many other studies were either negative or had significant limitations, including small sample size, limited exposure data and exposure to other chemicals (CCOHS, 1998a).

### *Tetrachloroethylene*

Tetrachloroethylene (also known as perchloroethylene) is a chemical used for dry cleaning and metal degreasing. Tetrachloroethylene was used at Hill AFB in very limited quantities. It is suspected of causing cancer in humans. Several human population studies have shown more esophageal cancer, non-Hodgkin's lymphoma and cervical cancer in people occupationally exposed to tetrachloroethylene. The International Agency for Research on Cancer has concluded that there is limited evidence for the carcinogenicity of tetrachloroethylene in humans. There is sufficient evidence for carcinogenicity in animals (CCOHS, 1998b).

The Department of Health and Human Services had determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in rats (ATSDR, 1997).

### *Carbon Tetrachloride*

Carbon tetrachloride is a chemical used in aerosols and refrigerants. It was also used as a degreasing solvent in industrial and dry cleaning operations. Direct exposure to high levels of this chemical may cause cancer and can damage the liver, kidneys, and nervous system. The effects of long-term exposure to low levels of the chemical are unknown.

The Department of Health and Human Services has determined that carbon tetrachloride may reasonably be anticipated to be a carcinogen. Animals that ingested carbon tetrachloride over a long time developed liver cancer. It is not known whether breathing carbon tetrachloride causes cancer in animals or if breathing or ingesting it will cause cancer in people (ATSDR, 1995).

### *Perchlorate*

Perchlorate is an oxygen-adding component in solid fuel propellant for rockets. The currently available database on the health effects and toxicology of perchlorate or its salts is very limited. The majority of human data are clinical reports of patients treated with potassium perchlorate for hyperthyroidism resulting from an autoimmune condition known as Grave's disease. The concerns surrounding perchlorate contamination involves its ability to affect the thyroid gland, which can affect metabolism, growth, and development (EPA, 2001).

Methods and Findings: A cancer cluster is generally understood to be the occurrence of a more cancers than would be expected in a small geographic area or during a short time period (Elliott & Wartenberg 2004). Cancer diseases typically involve a long induction period between the probable event causing exposure and disease manifestation. The investigation of cancer clusters is complicated by the need to distinguish cancers that occurred as a result of environmental influences on the area where or during the period that the cluster is located from cancers that started elsewhere and moved into the study area. In this study, the UPDB was used to attempt to include understanding about residential tenure characteristics in the study population. The UPDB data provided was useful in understanding the relationship of the incidence of cancer among the move-in population versus the incidence of cancer among long time (> 5 years) residents. The UPBD did not provide information about incidence of cancer among persons that moved out of the area. Information was also obtained from the UPDB on familial history for cancer.

The incidence of cancer by type were standardized for age, sex, residential tenure and familial history. Different standardization strategies can lead to different but equally valid understandings about the incidence of cancers in the study area. Often, using a more narrowly defined underlying population will result in an increased number of significant findings and more profound significance (Elliott & Wartenberg 2004). Including the additional covariates of residential tenure and familial history increases the need to include consideration of the magnitude of risk in determining the biological relevance of the clusters that were found.

This study used a standardized incidence ratio and the scan statistic methods to identify areas and time periods when cancer clustering occurred within the study area between 1973 and 2001. The standardized incidence ratio for this study compared the temporal trend of the incidence of cancers within a potentially exposed population residing within census block groups that were within 400 meters of a graphical contaminated ground water plume boundary.

The SIR method assumes the incidence of cancers in space and time follow a Poisson distribution. Those SIRs are calculated for each cancer type grouping, grouped by anatomical cancer type. Because the number of cases in any given year are small, cases are aggregated into multi- year intervals. This method is sensitive to over-dispersions of cancer event counts with respect to the Poisson model and spatial patterns, indicating some dependency between the events of any given area and the events in neighboring areas. The method is also sensitive to outlier data of a few cases and a small population resulting in unstable statistics. On the other hand, this method is insensitive to incidence activity in neighboring areas (da Silva et. al. 2004, Richardson et. al. 2004).

Census block group boundaries within the study area were derived from US 2000 Census. Generally, the population within any one census block group area are similar in their demographic and socio-economic characteristics. Because census block groups are designed to include a specific population size range, the geographic areas of census block groups and the number of neighboring areas that a census block group can have can vary greatly. A limitation of using census block group boundaries is the modifiable areal unit problem (Waller & Gotway 2004). For example, the exposed population included census block groups where only a small fraction of the population were within the 400 meters of any plume graphic boundary, but the whole population was considered exposed. This is an example of a misclassification bias. Similarly, the unexposed population contained fractions of the study area population that were likely exposed.

A preferred alternative to the SIR method is the scan statistic (Kulldorff et. al. 1998). This method compares all possible aggregations of neighboring populations to the rest of the study area and ordering those aggregation on the significance that a cluster of cancer incidence exists with in the aggregate area and time. The scan statistic is used for exploratory analysis and surveillance to identify areas of increased risk. The scan statistic does not consider exposure and therefore does not directly measure or support association of any clustering to exposure. An easy and intuitive software program has been made available that implements this method (Kulldorff 2004). The scan statistic has been widely used in other cancer cluster investigations (SaTScan Bibliography 2005). Seven statistically significant clusters of several cancer types were found by the scan method but no clusters were found to be biologically meaningful.

Cancers: Seven 5-year incidence counts for four cancers (lung cancers for 1993-1997, 1994-1998, 1995-1999; bladder cancers for 1987-1991 and 1989-1993; non-Hodgkin's lymphoma for 1987-1991, and lymphocytic leukemia for 1975-1979), and one study period (1973-2001) cumulative incidence count (for lung cancers) were found to be statistically significant. The increase in incidence among those cancers for those periods in the potentially exposed population was small (SIR less than 2.0) and not consistent through out the study period. While no information was available about the biological exposure (i.e., through biomonitoring or personnel exposure assessment), groundwater contamination has existed throughout the study period. This

study assumes that the potential for exposure also existed throughout the study period. The incidence of any cancer associated to the exposure potential would be expected to be consistent throughout the study period as well. This correlating trend did not occur in any of the cancer types with a significant 5-year incidence count. Other factors and risks may account for the pattern observed.

### *Cancers of the Lung*

Lung cancer is associated with the chemicals of concern in the contaminated ground water (ATSDR 1997b). However, by far the most prominent risk factor for lung cancer is tobacco smoking and use. More than 87% of lung cancers are thought to result from smoking (ALA 2005, HACS 2005). Exposure to radon gas is the second leading cause of lung cancer accounting for 12% of lung cancer cases. Six to 7% of homes have radon levels above a safe level (ALA 2005). Other risk factors include exposure to asbestos, recurring inflammation (e.g., tuberculosis or pneumonia), talcum powder and other minerals or particulate matter, vitamin A deficiency or excess, exposures to carcinogenic substances at the work place and exposure to carcinogenic substances from the environment (HACS 2005). Nationally, the trends for lung cancer increased from 1973 to 1992 and then stabilized during 1992 to 2001 (ALA 2005).

### *Cancers of the Bladder*

Bladder cancer is not associated with the chemicals of concern in the contaminated ground water (ATSDR 1997a, 1997b, 2003a, 2003b, OSU 2001, USEPA 2002). Half of all bladder cancers are attributed to tobacco smoking. The risk for bladder cancer will continue for up to 10 years after smoking cessation. Other risk factors include industrial exposure to polycyclic hycarbons or polychlorinated biphenyls (PCBs); exposure to secondary smoke; working in leather, metal, rubber, textile or painting industries; consumption of fried foods or foods high in saturated fat ; chronic bladder infections and bladder stones (Rosenbaum 2004, OC 2005a, Sloan-Kettering 2005).

### *Non-Hodgkin's Lymphoma*

Non-Hodgkin's lymphoma can be slow-growing (low-grade) or rapidly growing (high-grade) with differing risk factors (OC 2005b). Non-Hodgkin's lymphoma is associated with the chemicals of concern in the contaminated ground water (ATSDR 1997a). Risk factors for non-Hodgkin's lymphoma are not well documented. The strongest risk factor is chronic infections with certain disease causing agents such as Helicobacter pylori bacterium or the Epstein Barr, Hepatitis C, HIV, HTLV-1 or SV-40 viruses. Non-Hodgkin's lymphoma also is associated with familial history and inherited genetic predisposition. Other risk factors include depressed immunity and exposure to chemicals such as pesticides, herbicides, fertilizers, PCBs, and solvents including tetrachloroethylene (Wood & Foss 2003).

### *Lymphocytic Leukemia*

Lymphocytic leukemia is not associated with the chemicals of concern in the contaminated ground water (ATSDR 1997a, 1997b, 2003a, 2003b, OSU 2001, USEPA 2002). Risk factors for lymphocytic leukemia include tobacco smoking or use; excessive unprotected exposure to strong sunlight; exposure to radiation; infectious diseases; exposure to chemicals that damage the blood producing mechanisms in the body; and genetic syndromes (e.g., Down's syndrome) (ACS 2004). Electromagnetic fields may also be a risk factor for lymphocytic leukemia (ACS 2004).

Comparison to Previous Studies: Williams et. al. (2003) conducted a study that involved a portion of this study area. That study found that cancers of the kidney and renal pelvis, gallbladder and testicular cancers were elevated within the communities of Clinton and Sunset (two census tracts). This study differs from the study by Williams. Williams' study assessed the incidence of cancer in the population of the communities of Clinton and Sunset (two census tracts) compared to the cancer incidence rates for the state of Utah using discrete five-year time intervals. This study included portions of those communities (Clinton and Sunset) and other communities surrounding HAFB in the potentially exposed population and compared the incidence of the potentially exposed population to the cancer incidence rate among the unexposed population in the study area and used incrementing five-year study periods (in one year increments).

Findings: The findings of this study suggests that the contaminated ground water plumes have not resulted in an increased risk for cancer within the potentially exposed population living in communities surrounding HAFB.

### **CONCLUSION**

No evidence of excess cancer incidence risk associated to exposure to the contaminated ground water plumes were found for the study period (1973-2001) within the study population surrounding HAFB.

### **RECOMMENDATIONS**

Cancer incidence rates in the study area should be evaluated after an additional five years of cancer data has been collected to ensure cancer rates are not increasing in residents living near the contaminated ground water plumes. Additional air monitoring in houses with basements located over the contaminated ground water plumes should be conducted to evaluate exposure levels. Background levels should be determined by air monitoring in houses with basements that are in the study area but not over the contaminated ground water plumes.

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## **APPENDICES**

## **Appendix A**

### Figures and Tables

Figure 1. Hill Air Force Base, Utah and Surrounding Communities and Other Potential Sources of Exposures to Hazardous Environmental Pollution.

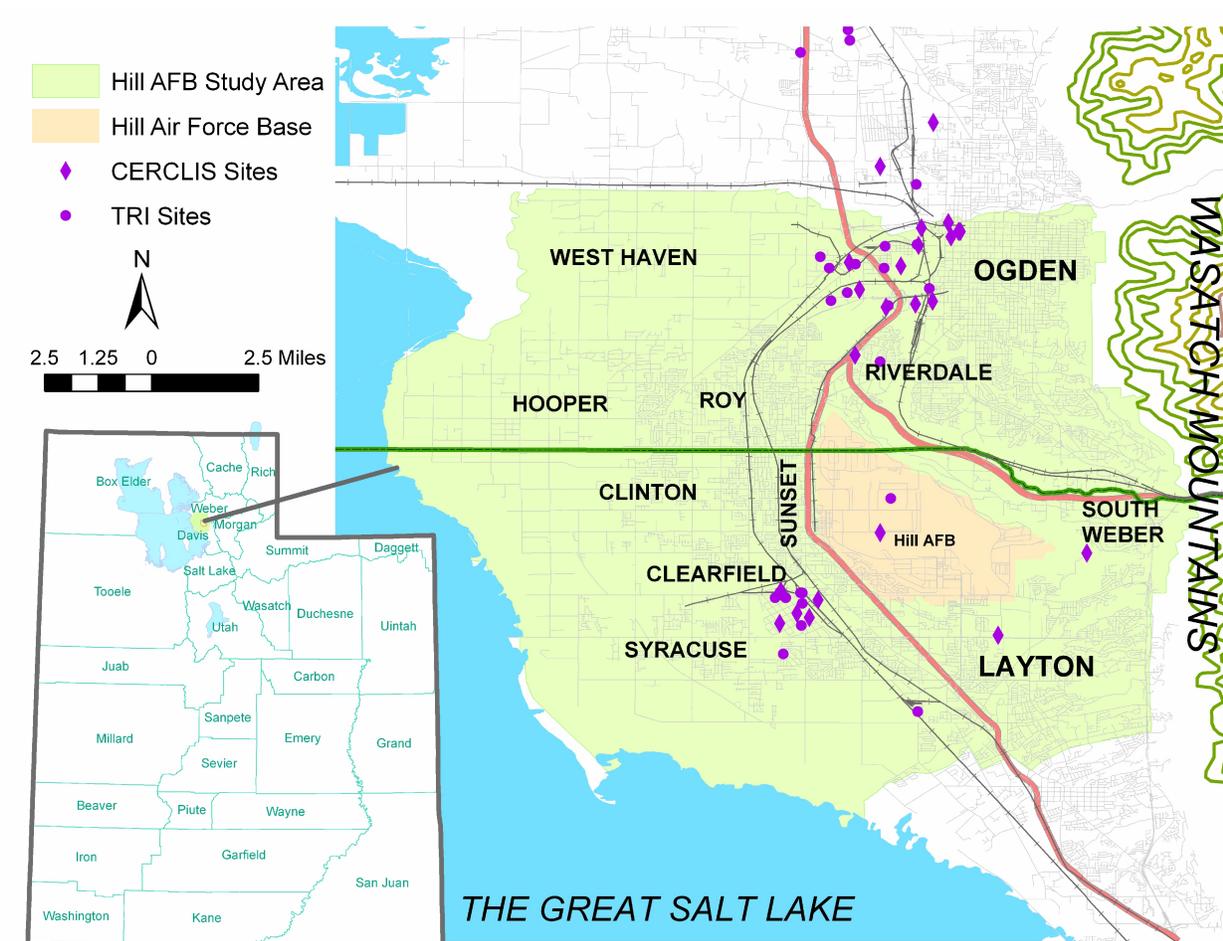


Figure 2. Hill Air Force Base, Utah Cancer Study Area. Study area consists of 143 census block group areas from the 2000 census. Populations of a census block group with any portion of the block group area within 400 meters of a plume were considered exposed.

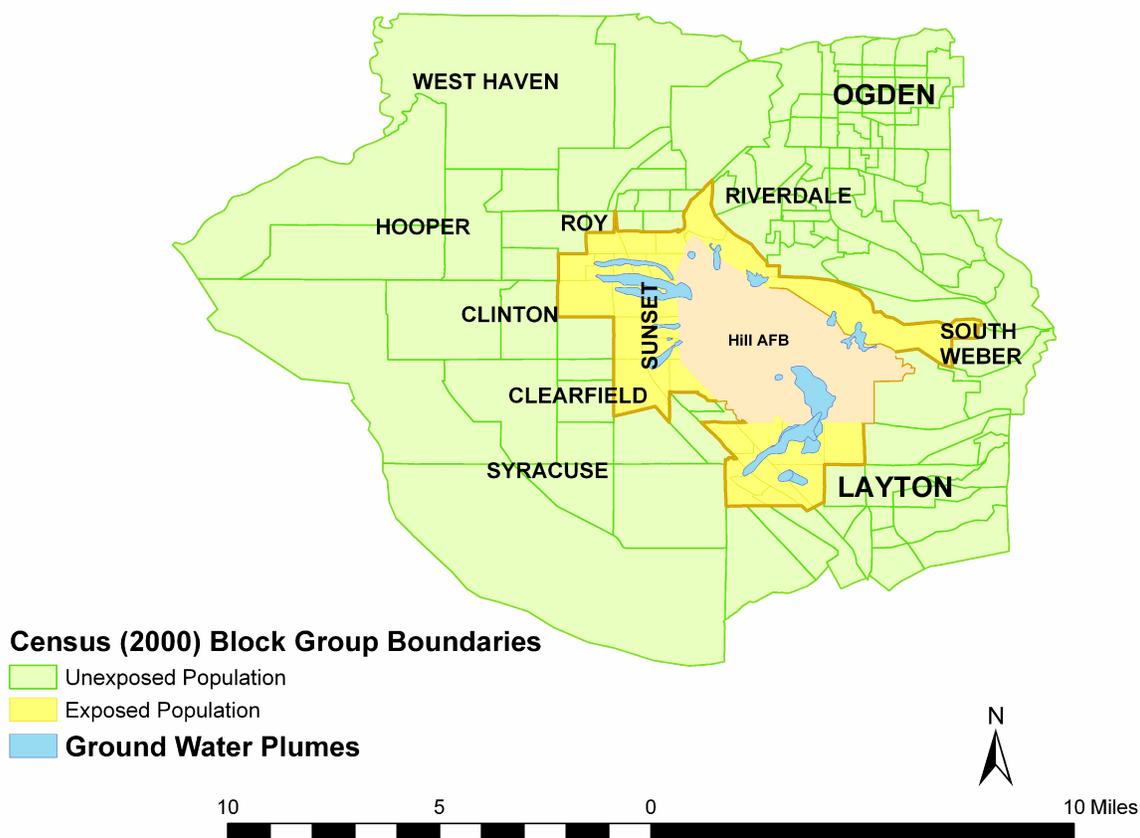


Table 1.1. Standardized Incidence Ratio (SIR) of Cancers of the Oral Cavity and Pharynx Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	4	2.5	8.0	5.0			N/E
1974-1978	6	3.6	8.5	5.1	0.71 ( 0.13 - 1.11 )	0.39	1
1975-1979	8	4.7	9.5	5.5	0.84 ( 0.22 - 1.28 )	0.62	1
1976-1980	8	4.5	9.0	5.1	0.89 ( 0.24 - 1.36 )	0.74	1
1977-1981	9	4.9	9.0	4.9	1.00 ( 0.30 - 1.50 )	0.99	1
1978-1982	9	4.8	8.2	4.3	1.10 ( 0.33 - 1.65 )	0.78	1
1979-1983	9	4.6	7.8	4.0	1.15 ( 0.35 - 1.74 )	0.67	1
1980-1984	5	2.5	8.9	4.5	0.56 ( 0.07 - 0.90 )	0.19	1
1981-1985	8	3.9	9.0	4.4	0.89 ( 0.24 - 1.36 )	0.75	1
1982-1986	8	3.9	7.6	3.7	1.06 ( 0.28 - 1.61 )	0.88	1
1983-1987	12	5.7	8.3	3.9	1.44 ( 0.56 - 2.11 )	0.20	1
1984-1988	11	5.1	9.3	4.3	1.18 ( 0.43 - 1.74 )	0.58	1
1985-1989	12	5.4	7.8	3.5	1.54 ( 0.59 - 2.25 )	0.13	1
1986-1990	11	4.9	7.3	3.2	1.51 ( 0.55 - 2.23 )	0.17	1
1987-1991	11	4.8	6.7	2.9	1.64 ( 0.59 - 2.41 )	0.10	1
1988-1992	9	3.9	7.1	3.0	1.27 ( 0.38 - 1.92 )	0.47	1
1989-1993	10	4.2	6.8	2.9	1.48 ( 0.49 - 2.20 )	0.22	1
1990-1994	11	4.6	7.4	3.1	1.49 ( 0.54 - 2.20 )	0.18	1
1991-1995	12	4.9	9.2	3.8	1.31 ( 0.50 - 1.90 )	0.35	1
1992-1996	16	6.5	10.9	4.4	1.46 ( 0.68 - 2.07 )	0.13	1
1993-1997	17	6.8	11.8	4.7	1.44 ( 0.69 - 2.02 )	0.13	1
1994-1998	16	6.3	11.3	4.4	1.42 ( 0.66 - 2.01 )	0.16	1
1995-1999	15	5.8	12.1	4.7	1.24 ( 0.55 - 1.77 )	0.40	1
1996-2000	19	7.3	10.7	4.1	1.78 ( 0.90 - 2.46 )	0.01	1
1997-2001	14	5.3	12.5	4.7	1.12 ( 0.48 - 1.60 )	0.68	1
1973-2001	62	4.9	53.3	4.2	1.16 ( 0.85 - 1.43 )	0.23	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.2. Standardized Incidence Ratio (SIR) of Cancers of the Esophagus Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.6	0.4			N/E
1974-1978	0	0.0	1.0	0.6			N/E
1975-1979	0	0.0	1.6	0.9			N/E
1976-1980	0	0.0	2.1	1.2			N/E
1977-1981	0	0.0	2.1	1.1			N/E
1978-1982	0	0.0	2.5	1.3			N/E
1979-1983	0	0.0	3.0	1.6			N/E
1980-1984	1	0.5	2.5	1.2			N/E
1981-1985	1	0.5	2.2	1.1			N/E
1982-1986	2	1.0	1.8	0.9			N/E
1983-1987	2	0.9	1.5	0.7			N/E
1984-1988	3	1.4	1.4	0.7			N/E
1985-1989	2	0.9	1.4	0.6			N/E
1986-1990	3	1.3	1.5	0.7			N/E
1987-1991	3	1.3	2.3	1.0			N/E
1988-1992	5	2.1	2.8	1.2	1.78 ( 0.23 - 2.84 )	0.19	1
1989-1993	5	2.1	3.4	1.4	1.49 ( 0.20 - 2.38 )	0.37	1
1990-1994	5	2.1	3.6	1.5	1.40 ( 0.18 - 2.24 )	0.45	1
1991-1995	5	2.1	4.5	1.8	1.12 ( 0.15 - 1.79 )	0.80	1
1992-1996	5	2.0	4.5	1.8	1.12 ( 0.15 - 1.79 )	0.80	1
1993-1997	3	1.2	4.2	1.7			N/E
1994-1998	2	0.8	4.0	1.6			N/E
1995-1999	3	1.2	5.0	2.0			N/E
1996-2000	3	1.2	4.3	1.6			N/E
1997-2001	3	1.1	3.5	1.3			N/E
1973-2001	13	1.0	14.6	1.2	0.89 ( 0.36 - 1.29 )	0.68	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.3. Standardized Incidence Ratio (SIR) of Cancers of the Stomach Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	6	3.8	4.2	2.6	1.43 ( 0.26 - 2.25 )	0.37	1
1974-1978	5	3.0	4.9	2.9	1.03 ( 0.13 - 1.64 )	0.95	1
1975-1979	6	3.5	4.7	2.7	1.28 ( 0.23 - 2.00 )	0.55	1
1976-1980	6	3.4	4.7	2.6	1.28 ( 0.23 - 2.01 )	0.54	1
1977-1981	6	3.3	5.6	3.1	1.07 ( 0.19 - 1.67 )	0.88	1
1978-1982	4	2.1	5.5	2.9			N/E
1979-1983	5	2.6	5.8	3.0	0.87 ( 0.11 - 1.38 )	0.75	1
1980-1984	4	2.0	5.9	3.0			N/E
1981-1985	4	2.0	5.5	2.7			N/E
1982-1986	4	1.9	4.6	2.2			N/E
1983-1987	4	1.9	5.5	2.6			N/E
1984-1988	4	1.9	5.0	2.3			N/E
1985-1989	6	2.7	5.1	2.3	1.17 ( 0.21 - 1.83 )	0.70	1
1986-1990	8	3.6	6.4	2.8	1.25 ( 0.34 - 1.91 )	0.52	1
1987-1991	7	3.1	6.0	2.6	1.17 ( 0.27 - 1.81 )	0.67	1
1988-1992	8	3.4	5.1	2.2	1.57 ( 0.42 - 2.40 )	0.20	1
1989-1993	9	3.8	5.8	2.5	1.55 ( 0.47 - 2.33 )	0.19	1
1990-1994	9	3.8	5.6	2.3	1.60 ( 0.48 - 2.41 )	0.16	1
1991-1995	6	2.5	4.8	2.0	1.26 ( 0.23 - 1.98 )	0.57	1
1992-1996	6	2.4	6.3	2.5	0.96 ( 0.17 - 1.50 )	0.91	1
1993-1997	6	2.4	6.9	2.7	0.88 ( 0.16 - 1.37 )	0.74	1
1994-1998	5	2.0	6.5	2.6	0.77 ( 0.10 - 1.23 )	0.55	1
1995-1999	5	1.9	7.5	2.9	0.66 ( 0.09 - 1.06 )	0.36	1
1996-2000	6	2.3	7.8	3.0	0.77 ( 0.14 - 1.21 )	0.52	1
1997-2001	9	3.4	7.4	2.8	1.21 ( 0.37 - 1.83 )	0.56	1
1973-2001	36	2.9	33.4	2.7	1.08 ( 0.69 - 1.40 )	0.65	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.4. Standardized Incidence Ratio (SIR) of Cancers of the Small Intestine Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	1.1	0.7			N/E
1974-1978	0	0.0	1.1	0.7			N/E
1975-1979	0	0.0	1.0	0.6			N/E
1976-1980	0	0.0	0.9	0.5			N/E
1977-1981	0	0.0	0.9	0.5			N/E
1978-1982	0	0.0	0.9	0.5			N/E
1979-1983	0	0.0	0.9	0.5			N/E
1980-1984	2	1.0	0.5	0.3			N/E
1981-1985	4	2.0	0.4	0.2			N/E
1982-1986	4	1.9	1.0	0.5			N/E
1983-1987	4	1.9	1.0	0.5			N/E
1984-1988	4	1.9	1.0	0.5			N/E
1985-1989	2	0.9	1.6	0.7			N/E
1986-1990	0	0.0	1.5	0.7			N/E
1987-1991	0	0.0	1.6	0.7			N/E
1988-1992	0	0.0	2.1	0.9			N/E
1989-1993	0	0.0	2.2	0.9			N/E
1990-1994	0	0.0	1.8	0.7			N/E
1991-1995	0	0.0	2.0	0.8			N/E
1992-1996	0	0.0	1.3	0.5			N/E
1993-1997	0	0.0	1.3	0.5			N/E
1994-1998	0	0.0	1.2	0.5			N/E
1995-1999	4	1.6	1.8	0.7			N/E
1996-2000	4	1.5	2.1	0.8			N/E
1997-2001	4	1.5	2.6	1.0			N/E
1973-2001	8	0.6	8.4	0.7	0.95 ( 0.25 - 1.45 )	0.89	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.5. Standardized Incidence Ratio (SIR) of Cancers of the Colon Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	13	8.2	13.9	8.8	0.93 ( 0.38 - 1.35 )	0.80	1
1974-1978	16	9.7	13.4	8.1	1.19 ( 0.55 - 1.69 )	0.48	1
1975-1979	24	14.0	14.3	8.3	1.68 ( 0.94 - 2.27 )	0.01	1
1976-1980	23	12.9	13.6	7.7	1.69 ( 0.93 - 2.29 )	0.01	1
1977-1981	25	13.6	16.0	8.7	1.56 ( 0.89 - 2.11 )	0.02	1
1978-1982	24	12.7	18.6	9.8	1.29 ( 0.73 - 1.75 )	0.21	1
1979-1983	23	11.8	19.1	9.9	1.20 ( 0.66 - 1.63 )	0.38	1
1980-1984	25	12.6	22.8	11.4	1.10 ( 0.63 - 1.48 )	0.64	1
1981-1985	24	11.8	24.6	12.1	0.97 ( 0.55 - 1.32 )	0.90	1
1982-1986	26	12.5	23.9	11.5	1.09 ( 0.63 - 1.46 )	0.67	1
1983-1987	29	13.7	24.1	11.4	1.20 ( 0.72 - 1.59 )	0.32	1
1984-1988	29	13.4	26.0	12.0	1.12 ( 0.67 - 1.48 )	0.56	1
1985-1989	26	11.8	26.0	11.8	1.00 ( 0.58 - 1.34 )	1.00	1
1986-1990	29	12.9	27.0	12.0	1.08 ( 0.65 - 1.42 )	0.70	1
1987-1991	31	13.6	27.9	12.2	1.11 ( 0.68 - 1.46 )	0.56	1
1988-1992	35	15.0	27.6	11.9	1.27 ( 0.81 - 1.65 )	0.16	1
1989-1993	33	14.0	26.8	11.4	1.23 ( 0.77 - 1.61 )	0.23	1
1990-1994	31	12.9	26.0	10.8	1.19 ( 0.73 - 1.57 )	0.33	1
1991-1995	28	11.5	26.4	10.9	1.06 ( 0.63 - 1.41 )	0.76	1
1992-1996	26	10.5	27.6	11.2	0.94 ( 0.54 - 1.26 )	0.75	1
1993-1997	27	10.8	29.6	11.8	0.91 ( 0.54 - 1.22 )	0.64	1
1994-1998	31	12.2	34.1	13.4	0.91 ( 0.56 - 1.20 )	0.60	1
1995-1999	30	11.7	35.8	13.9	0.84 ( 0.51 - 1.11 )	0.33	1
1996-2000	32	12.3	37.3	14.3	0.86 ( 0.53 - 1.13 )	0.39	1
1997-2001	39	14.8	36.5	13.8	1.07 ( 0.70 - 1.37 )	0.68	1
1973-2001	156	12.4	143.6	11.4	1.09 ( 0.91 - 1.25 )	0.30	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.6. Standardized Incidence Ratio (SIR) of Cancers of the Rectum and Rectosigmoid Junction Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	4	2.5	5.1	3.2			N/E
1974-1978	5	3.0	5.9	3.6	0.84 ( 0.11 - 1.35 )	0.70	1
1975-1979	6	3.5	5.9	3.4	1.02 ( 0.18 - 1.60 )	0.97	1
1976-1980	7	3.9	6.0	3.3	1.18 ( 0.27 - 1.82 )	0.67	1
1977-1981	8	4.4	6.9	3.7	1.16 ( 0.31 - 1.78 )	0.67	1
1978-1982	10	5.3	7.1	3.8	1.41 ( 0.47 - 2.10 )	0.28	1
1979-1983	8	4.1	7.9	4.1	1.01 ( 0.27 - 1.54 )	0.98	1
1980-1984	8	4.0	8.6	4.3	0.93 ( 0.25 - 1.41 )	0.83	1
1981-1985	8	3.9	10.7	5.3	0.75 ( 0.20 - 1.14 )	0.41	1
1982-1986	7	3.4	11.2	5.4	0.62 ( 0.14 - 0.97 )	0.21	1
1983-1987	8	3.8	12.8	6.1	0.62 ( 0.17 - 0.95 )	0.18	1
1984-1988	9	4.2	11.7	5.4	0.77 ( 0.23 - 1.16 )	0.43	1
1985-1989	12	5.4	12.7	5.8	0.94 ( 0.36 - 1.38 )	0.84	1
1986-1990	12	5.3	12.0	5.3	1.00 ( 0.39 - 1.46 )	0.99	1
1987-1991	14	6.1	11.0	4.8	1.27 ( 0.54 - 1.82 )	0.37	1
1988-1992	12	5.2	11.2	4.8	1.08 ( 0.42 - 1.57 )	0.80	1
1989-1993	15	6.3	14.1	6.0	1.06 ( 0.47 - 1.51 )	0.82	1
1990-1994	13	5.4	13.5	5.6	0.97 ( 0.39 - 1.40 )	0.90	1
1991-1995	15	6.2	14.5	6.0	1.03 ( 0.46 - 1.47 )	0.90	1
1992-1996	14	5.7	13.9	5.6	1.01 ( 0.43 - 1.44 )	0.98	1
1993-1997	14	5.6	12.9	5.1	1.09 ( 0.47 - 1.56 )	0.75	1
1994-1998	10	3.9	10.9	4.3	0.92 ( 0.31 - 1.37 )	0.79	1
1995-1999	13	5.1	11.7	4.6	1.11 ( 0.45 - 1.60 )	0.71	1
1996-2000	14	5.4	12.7	4.9	1.11 ( 0.47 - 1.59 )	0.71	1
1997-2001	16	6.1	14.8	5.6	1.08 ( 0.50 - 1.53 )	0.75	1
1973-2001	62	4.9	62.1	4.9	1.00 ( 0.73 - 1.23 )	0.99	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.7. Standardized Incidence Ratio (SIR) of Cancers of the Anus, Anal Canal and Anorectum Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.3	0.2			N/E
1974-1978	0	0.0	0.3	0.2			N/E
1975-1979	0	0.0	0.5	0.3			N/E
1976-1980	0	0.0	0.6	0.4			N/E
1977-1981	0	0.0	0.5	0.2			N/E
1978-1982	1	0.5	0.4	0.2			N/E
1979-1983	1	0.5	0.4	0.2			N/E
1980-1984	2	1.0	0.2	0.1			N/E
1981-1985	2	1.0	0.1	0.0			N/E
1982-1986	2	1.0	0.2	0.1			N/E
1983-1987	2	0.9	0.1	0.1			N/E
1984-1988	2	0.9	0.6	0.3			N/E
1985-1989	2	0.9	0.8	0.4			N/E
1986-1990	3	1.3	1.6	0.7			N/E
1987-1991	5	2.2	2.0	0.9	2.45 ( 0.32 - 3.92 )	0.04	1
1988-1992	5	2.1	2.5	1.1	2.00 ( 0.26 - 3.20 )	0.11	1
1989-1993	6	2.5	2.7	1.1	2.25 ( 0.41 - 3.53 )	0.04	1
1990-1994	6	2.5	2.5	1.0	2.43 ( 0.44 - 3.81 )	0.02	1
1991-1995	5	2.1	1.9	0.8	2.60 ( 0.34 - 4.15 )	0.03	1
1992-1996	4	1.6	1.4	0.6	2.92 ( 0.22 - 4.75 )	0.02	1
1993-1997	3	1.2	1.7	0.7			N/E
1994-1998	2	0.8	2.1	0.8			N/E
1995-1999	2	0.8	2.6	1.0			N/E
1996-2000	2	0.8	3.6	1.4			N/E
1997-2001	1	0.4	3.8	1.4			N/E
1973-2001	12	1.0	8.1	0.6	1.49 ( 0.57 - 2.17 )	0.17	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.8. Standardized Incidence Ratio (SIR) of Cancers of the Liver and Interhepatic Bile Duct Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	1	0.6	1.7	1.1			N/E
1974-1978	2	1.2	1.3	0.8			N/E
1975-1979	2	1.2	1.7	1.0			N/E
1976-1980	1	0.6	2.4	1.3			N/E
1977-1981	1	0.5	2.1	1.1			N/E
1978-1982	1	0.5	2.9	1.5			N/E
1979-1983	1	0.5	2.9	1.5			N/E
1980-1984	2	1.0	3.2	1.6			N/E
1981-1985	2	1.0	2.7	1.3			N/E
1982-1986	2	1.0	2.8	1.3			N/E
1983-1987	3	1.4	1.9	0.9			N/E
1984-1988	3	1.4	2.1	1.0			N/E
1985-1989	3	1.4	2.2	1.0			N/E
1986-1990	4	1.8	1.9	0.8			N/E
1987-1991	4	1.7	2.2	1.0			N/E
1988-1992	4	1.7	2.5	1.1			N/E
1989-1993	3	1.3	3.5	1.5			N/E
1990-1994	2	0.8	3.4	1.4			N/E
1991-1995	1	0.4	4.5	1.9			N/E
1992-1996	2	0.8	4.5	1.8			N/E
1993-1997	2	0.8	4.8	1.9			N/E
1994-1998	5	2.0	4.6	1.8	1.08 ( 0.14 - 1.73 )	0.86	1
1995-1999	5	1.9	4.9	1.9	1.03 ( 0.13 - 1.64 )	0.95	1
1996-2000	6	2.3	4.8	1.9	1.24 ( 0.23 - 1.94 )	0.60	1
1997-2001	5	1.9	5.0	1.9	1.00 ( 0.13 - 1.59 )	0.99	1
1973-2001	15	1.2	17.9	1.4	0.84 ( 0.38 - 1.20 )	0.50	1

Rates are per 100,000 population.

Statistical Significance:

N/E - Not Evaluated, less than 5 cases.

1 - Not Statistically Significant.

2 - Statistically Significant.

Table 1.9. Standardized Incidence Ratio (SIR) of Cancers of the Gallbladder and Biliary Ducts Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	3	1.9	1.1	0.7			N/E
1974-1978	3	1.8	1.5	0.9			N/E
1975-1979	4	2.3	1.5	0.9			N/E
1976-1980	4	2.2	1.8	1.0			N/E
1977-1981	3	1.6	1.8	1.0			N/E
1978-1982	2	1.1	1.5	0.8			N/E
1979-1983	2	1.0	1.2	0.6			N/E
1980-1984	0	0.0	1.6	0.8			N/E
1981-1985	0	0.0	1.7	0.8			N/E
1982-1986	0	0.0	2.2	1.1			N/E
1983-1987	1	0.5	2.7	1.3			N/E
1984-1988	1	0.5	3.4	1.6			N/E
1985-1989	1	0.5	3.4	1.6			N/E
1986-1990	1	0.4	2.6	1.2			N/E
1987-1991	3	1.3	2.1	0.9			N/E
1988-1992	3	1.3	2.3	1.0			N/E
1989-1993	3	1.3	2.7	1.1			N/E
1990-1994	3	1.3	2.8	1.2			N/E
1991-1995	3	1.2	3.5	1.5			N/E
1992-1996	1	0.4	4.0	1.6			N/E
1993-1997	1	0.4	3.8	1.5			N/E
1994-1998	1	0.4	3.3	1.3			N/E
1995-1999	1	0.4	3.2	1.3			N/E
1996-2000	2	0.8	3.0	1.2			N/E
1997-2001	2	0.8	4.1	1.5			N/E
1973-2001	11	0.9	14.8	1.2	0.74 ( 0.27 - 1.09 )	0.32	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.10. Standardized Incidence Ratio (SIR) of Cancers of the Pancreas Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	7	4.4	4.1	2.6	1.72 ( 0.39 - 2.66 )	0.15	1
1974-1978	6	3.6	5.3	3.2	1.14 ( 0.21 - 1.79 )	0.75	1
1975-1979	6	3.5	6.3	3.7	0.95 ( 0.17 - 1.49 )	0.90	1
1976-1980	5	2.8	6.8	3.8	0.73 ( 0.10 - 1.17 )	0.48	1
1977-1981	4	2.2	7.5	4.1			N/E
1978-1982	3	1.6	8.1	4.3			N/E
1979-1983	3	1.5	8.7	4.5			N/E
1980-1984	3	1.5	10.5	5.3			N/E
1981-1985	3	1.5	11.1	5.5			N/E
1982-1986	5	2.4	11.6	5.6	0.43 ( 0.06 - 0.69 )	0.05	1
1983-1987	5	2.4	11.8	5.6	0.42 ( 0.06 - 0.68 )	0.05	1
1984-1988	5	2.3	10.6	4.9	0.47 ( 0.06 - 0.75 )	0.09	1
1985-1989	4	1.8	8.4	3.8			N/E
1986-1990	7	3.1	7.4	3.3	0.94 ( 0.21 - 1.45 )	0.87	1
1987-1991	5	2.2	6.6	2.9	0.76 ( 0.10 - 1.22 )	0.54	1
1988-1992	5	2.1	6.7	2.9	0.75 ( 0.10 - 1.19 )	0.51	1
1989-1993	7	3.0	8.5	3.6	0.82 ( 0.19 - 1.27 )	0.60	1
1990-1994	8	3.3	9.6	4.0	0.84 ( 0.22 - 1.28 )	0.61	1
1991-1995	8	3.3	10.0	4.1	0.80 ( 0.21 - 1.22 )	0.53	1
1992-1996	8	3.2	11.1	4.5	0.72 ( 0.19 - 1.10 )	0.35	1
1993-1997	9	3.6	12.3	4.9	0.73 ( 0.22 - 1.10 )	0.35	1
1994-1998	8	3.2	11.0	4.3	0.73 ( 0.19 - 1.11 )	0.37	1
1995-1999	10	3.9	12.8	5.0	0.78 ( 0.26 - 1.17 )	0.44	1
1996-2000	7	2.7	13.7	5.2	0.51 ( 0.12 - 0.79 )	0.07	1
1997-2001	7	2.6	14.0	5.3	0.50 ( 0.11 - 0.77 )	0.06	1
1973-2001	35	2.8	53.8	4.3	0.65 ( 0.42 - 0.85 )	0.01	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.11. Standardized Incidence Ratio (SIR) of Other Digestive System Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.5	0.3			N/E
1974-1978	0	0.0	0.7	0.4			N/E
1975-1979	0	0.0	0.2	0.1			N/E
1976-1980	0	0.0	0.5	0.3			N/E
1977-1981	0	0.0	0.5	0.3			N/E
1978-1982	0	0.0	0.5	0.2			N/E
1979-1983	0	0.0	0.3	0.1			N/E
1980-1984	0	0.0	0.3	0.1			N/E
1981-1985	0	0.0	0.1	0.1			N/E
1982-1986	0	0.0	0.1	0.1			N/E
1983-1987	0	0.0	0.1	0.1			N/E
1984-1988	0	0.0	0.1	0.1			N/E
1985-1989	0	0.0	0.4	0.2			N/E
1986-1990	0	0.0	0.3	0.1			N/E
1987-1991	0	0.0	0.8	0.3			N/E
1988-1992	0	0.0	1.1	0.5			N/E
1989-1993	0	0.0	1.6	0.7			N/E
1990-1994	1	0.4	1.3	0.6			N/E
1991-1995	1	0.4	1.3	0.5			N/E
1992-1996	1	0.4	1.9	0.8			N/E
1993-1997	2	0.8	2.3	0.9			N/E
1994-1998	4	1.6	2.1	0.8			N/E
1995-1999	3	1.2	2.9	1.1			N/E
1996-2000	3	1.2	3.2	1.2			N/E
1997-2001	4	1.5	2.4	0.9			N/E
1973-2001	5	0.4	6.1	0.5	0.81 ( 0.11 - 1.30 )	0.64	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.12. Standardized Incidence Ratio (SIR) of Cancers of the Larynx Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	2	1.3	1.5	1.0			N/E
1974-1978	2	1.2	1.5	0.9			N/E
1975-1979	2	1.2	1.5	0.9			N/E
1976-1980	1	0.6	1.0	0.6			N/E
1977-1981	2	1.1	1.5	0.8			N/E
1978-1982	3	1.6	1.6	0.8			N/E
1979-1983	4	2.1	1.5	0.8			N/E
1980-1984	4	2.0	1.4	0.7			N/E
1981-1985	5	2.5	1.7	0.8	3.02 ( 0.40 - 4.83 )	0.01	1
1982-1986	3	1.4	1.4	0.7			N/E
1983-1987	2	0.9	2.3	1.1			N/E
1984-1988	1	0.5	2.9	1.4			N/E
1985-1989	1	0.5	3.2	1.5			N/E
1986-1990	0	0.0	3.1	1.4			N/E
1987-1991	0	0.0	2.6	1.1			N/E
1988-1992	0	0.0	2.0	0.9			N/E
1989-1993	1	0.4	2.3	1.0			N/E
1990-1994	1	0.4	2.9	1.2			N/E
1991-1995	1	0.4	2.9	1.2			N/E
1992-1996	1	0.4	2.9	1.2			N/E
1993-1997	2	0.8	2.2	0.9			N/E
1994-1998	2	0.8	1.3	0.5			N/E
1995-1999	2	0.8	1.0	0.4			N/E
1996-2000	2	0.8	1.0	0.4			N/E
1997-2001	2	0.8	2.0	0.8			N/E
1973-2001	10	0.8	11.7	0.9	0.85 ( 0.28 - 1.27 )	0.61	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.13. Standardized Incidence Ratio (SIR) of Cancers of the Lung and Bronchus Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	20	12.6	17.8	11.2	1.12 ( 0.58 - 1.55 )	0.60	1
1974-1978	18	10.9	16.7	10.1	1.08 ( 0.53 - 1.50 )	0.76	1
1975-1979	16	9.3	18.2	10.6	0.88 ( 0.41 - 1.24 )	0.60	1
1976-1980	18	10.1	18.0	10.1	1.00 ( 0.49 - 1.39 )	0.99	1
1977-1981	20	10.9	19.9	10.8	1.01 ( 0.52 - 1.39 )	0.98	1
1978-1982	26	13.8	21.2	11.2	1.23 ( 0.71 - 1.65 )	0.29	1
1979-1983	32	16.5	24.9	12.8	1.28 ( 0.80 - 1.68 )	0.16	1
1980-1984	39	19.6	27.5	13.8	1.42 ( 0.93 - 1.82 )	0.03	1
1981-1985	41	20.2	30.3	14.9	1.35 ( 0.90 - 1.73 )	0.05	1
1982-1986	45	21.7	30.9	14.9	1.45 ( 0.99 - 1.84 )	0.01	1
1983-1987	45	21.3	31.9	15.1	1.41 ( 0.96 - 1.79 )	0.02	1
1984-1988	41	19.0	33.4	15.5	1.23 ( 0.82 - 1.57 )	0.19	1
1985-1989	39	17.7	33.0	15.0	1.18 ( 0.78 - 1.52 )	0.29	1
1986-1990	41	18.3	32.4	14.4	1.27 ( 0.84 - 1.62 )	0.13	1
1987-1991	37	16.2	34.9	15.3	1.06 ( 0.69 - 1.37 )	0.73	1
1988-1992	33	14.2	38.5	16.5	0.86 ( 0.54 - 1.12 )	0.38	1
1989-1993	39	16.5	40.2	17.0	0.97 ( 0.64 - 1.25 )	0.85	1
1990-1994	41	17.1	42.7	17.8	0.96 ( 0.64 - 1.23 )	0.79	1
1991-1995	46	18.9	41.5	17.0	1.11 ( 0.76 - 1.40 )	0.49	1
1992-1996	53	21.5	39.1	15.8	1.36 ( 0.96 - 1.69 )	0.03	1
1993-1997	57	22.8	40.9	16.3	1.40 ( 1.00 - 1.73 )	0.01	2
1994-1998	60	23.6	39.3	15.5	1.53 ( 1.11 - 1.89 )	0.00	2
1995-1999	57	22.2	40.8	15.8	1.40 ( 1.01 - 1.74 )	0.01	2
1996-2000	56	21.5	44.6	17.1	1.25 ( 0.90 - 1.56 )	0.09	1
1997-2001	59	22.3	47.5	18.0	1.24 ( 0.90 - 1.54 )	0.09	1
1973-2001	228	18.2	186.6	14.9	1.22 ( 1.06 - 1.38 )	0.00	2

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.14. Standardized Incidence Ratio (SIR) of Other Respiratory System Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	2	1.3	0.3	0.2			N/E
1974-1978	2	1.2	0.3	0.2			N/E
1975-1979	1	0.6	0.8	0.5			N/E
1976-1980	2	1.1	0.6	0.3			N/E
1977-1981	1	0.5	1.2	0.7			N/E
1978-1982	1	0.5	1.2	0.6			N/E
1979-1983	1	0.5	1.9	1.0			N/E
1980-1984	1	0.5	1.8	0.9			N/E
1981-1985	0	0.0	1.6	0.8			N/E
1982-1986	0	0.0	1.0	0.5			N/E
1983-1987	2	0.9	2.0	1.0			N/E
1984-1988	3	1.4	1.6	0.7			N/E
1985-1989	5	2.3	1.6	0.7	3.07 ( 0.40 - 4.90 )	0.01	1
1986-1990	7	3.1	2.0	0.9	3.57 ( 0.81 - 5.51 )	0.00	1
1987-1991	7	3.1	2.2	0.9	3.23 ( 0.73 - 4.99 )	0.00	1
1988-1992	5	2.1	1.3	0.6	3.73 ( 0.49 - 5.97 )	0.00	1
1989-1993	4	1.7	1.8	0.8			N/E
1990-1994	2	0.8	1.5	0.6			N/E
1991-1995	0	0.0	1.4	0.6			N/E
1992-1996	1	0.4	1.5	0.6			N/E
1993-1997	1	0.4	1.8	0.7			N/E
1994-1998	1	0.4	1.5	0.6			N/E
1995-1999	2	0.8	1.8	0.7			N/E
1996-2000	2	0.8	1.9	0.7			N/E
1997-2001	2	0.8	2.1	0.8			N/E
1973-2001	13	1.0	8.3	0.7	1.57 ( 0.64 - 2.26 )	0.10	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.15. Standardized Incidence Ratio (SIR) of Cancers of the Bones Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.7	0.4			N/E
1974-1978	0	0.0	1.1	0.7			N/E
1975-1979	0	0.0	1.1	0.6			N/E
1976-1980	0	0.0	0.6	0.3			N/E
1977-1981	1	0.5	0.5	0.3			N/E
1978-1982	1	0.5	0.4	0.2			N/E
1979-1983	1	0.5	0.0	0.0			N/E
1980-1984	2	1.0	0.4	0.2			N/E
1981-1985	2	1.0	0.7	0.3			N/E
1982-1986	2	1.0	1.2	0.6			N/E
1983-1987	3	1.4	1.2	0.5			N/E
1984-1988	4	1.9	1.8	0.8			N/E
1985-1989	3	1.4	1.9	0.9			N/E
1986-1990	3	1.3	1.5	0.7			N/E
1987-1991	2	0.9	1.4	0.6			N/E
1988-1992	1	0.4	2.5	1.1			N/E
1989-1993	0	0.0	2.4	1.0			N/E
1990-1994	1	0.4	2.5	1.0			N/E
1991-1995	2	0.8	3.2	1.3			N/E
1992-1996	2	0.8	3.6	1.5			N/E
1993-1997	3	1.2	3.1	1.2			N/E
1994-1998	4	1.6	3.0	1.2			N/E
1995-1999	4	1.6	2.7	1.1			N/E
1996-2000	3	1.2	3.4	1.3			N/E
1997-2001	3	1.1	2.9	1.1			N/E
1973-2001	10	0.8	10.2	0.8	0.98 ( 0.33 - 1.46 )	0.95	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.16. Standardized Incidence Ratio (SIR) of Cancers of the Soft Tissues (including Heart) Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	1.4	0.9			N/E
1974-1978	1	0.6	1.5	0.9			N/E
1975-1979	1	0.6	1.1	0.7			N/E
1976-1980	1	0.6	1.9	1.1			N/E
1977-1981	2	1.1	2.6	1.4			N/E
1978-1982	2	1.1	2.6	1.4			N/E
1979-1983	1	0.5	2.9	1.5			N/E
1980-1984	1	0.5	3.6	1.8			N/E
1981-1985	2	1.0	4.4	2.2			N/E
1982-1986	1	0.5	3.8	1.8			N/E
1983-1987	1	0.5	3.6	1.7			N/E
1984-1988	1	0.5	3.2	1.5			N/E
1985-1989	1	0.5	4.1	1.9			N/E
1986-1990	0	0.0	2.6	1.2			N/E
1987-1991	0	0.0	2.8	1.2			N/E
1988-1992	2	0.9	3.5	1.5			N/E
1989-1993	2	0.8	3.8	1.6			N/E
1990-1994	2	0.8	3.4	1.4			N/E
1991-1995	2	0.8	4.5	1.8			N/E
1992-1996	5	2.0	6.0	2.4	0.83 ( 0.11 - 1.33 )	0.68	1
1993-1997	4	1.6	5.9	2.4			N/E
1994-1998	6	2.4	6.6	2.6	0.90 ( 0.16 - 1.42 )	0.80	1
1995-1999	10	3.9	6.5	2.5	1.54 ( 0.51 - 2.29 )	0.17	1
1996-2000	10	3.8	6.8	2.6	1.48 ( 0.49 - 2.20 )	0.22	1
1997-2001	8	3.0	6.1	2.3	1.31 ( 0.35 - 2.00 )	0.44	1
1973-2001	16	1.3	22.3	1.8	0.72 ( 0.33 - 1.01 )	0.18	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.17. Standardized Incidence Ratio (SIR) of Cutaneous Melanoma Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	4	2.5	6.0	3.8			N/E
1974-1978	6	3.6	7.3	4.4	0.82 ( 0.15 - 1.29 )	0.63	1
1975-1979	6	3.5	6.9	4.0	0.87 ( 0.16 - 1.36 )	0.73	1
1976-1980	6	3.4	7.1	4.0	0.85 ( 0.15 - 1.33 )	0.68	1
1977-1981	10	5.4	8.7	4.7	1.15 ( 0.38 - 1.71 )	0.66	1
1978-1982	14	7.4	10.9	5.8	1.28 ( 0.55 - 1.84 )	0.35	1
1979-1983	13	6.7	11.6	6.0	1.12 ( 0.46 - 1.61 )	0.69	1
1980-1984	16	8.0	13.3	6.7	1.20 ( 0.56 - 1.70 )	0.46	1
1981-1985	14	6.9	16.2	8.0	0.87 ( 0.37 - 1.24 )	0.59	1
1982-1986	16	7.7	14.2	6.9	1.12 ( 0.52 - 1.59 )	0.64	1
1983-1987	15	7.1	15.7	7.4	0.96 ( 0.43 - 1.36 )	0.86	1
1984-1988	18	8.3	17.2	8.0	1.05 ( 0.52 - 1.46 )	0.85	1
1985-1989	18	8.2	19.4	8.8	0.93 ( 0.46 - 1.29 )	0.75	1
1986-1990	24	10.7	18.3	8.2	1.31 ( 0.74 - 1.77 )	0.18	1
1987-1991	24	10.5	20.4	8.9	1.18 ( 0.66 - 1.59 )	0.42	1
1988-1992	23	9.9	21.3	9.2	1.08 ( 0.60 - 1.47 )	0.71	1
1989-1993	19	8.0	22.3	9.4	0.85 ( 0.43 - 1.18 )	0.48	1
1990-1994	17	7.1	21.5	9.0	0.79 ( 0.38 - 1.11 )	0.33	1
1991-1995	13	5.3	20.9	8.6	0.62 ( 0.25 - 0.90 )	0.08	1
1992-1996	11	4.5	23.2	9.4	0.47 ( 0.17 - 0.70 )	0.01	1
1993-1997	17	6.8	21.6	8.6	0.79 ( 0.38 - 1.10 )	0.32	1
1994-1998	22	8.7	21.6	8.5	1.02 ( 0.55 - 1.39 )	0.94	1
1995-1999	31	12.0	23.9	9.3	1.30 ( 0.80 - 1.71 )	0.15	1
1996-2000	30	11.5	25.6	9.8	1.17 ( 0.71 - 1.55 )	0.38	1
1997-2001	32	12.1	25.2	9.5	1.27 ( 0.79 - 1.67 )	0.18	1
1973-2001	97	7.7	96.8	7.7	1.00 ( 0.79 - 1.19 )	0.99	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.18. Standardized Incidence Ratio (SIR) of Other Skin Cancers (excluding basal and squamous cell carcinomas) Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	2	1.3	1.1	0.7			N/E
1974-1978	3	1.8	0.8	0.5			N/E
1975-1979	3	1.7	0.5	0.3			N/E
1976-1980	2	1.1	1.3	0.7			N/E
1977-1981	2	1.1	1.4	0.7			N/E
1978-1982	3	1.6	1.4	0.8			N/E
1979-1983	3	1.5	1.4	0.7			N/E
1980-1984	2	1.0	1.4	0.7			N/E
1981-1985	2	1.0	1.0	0.5			N/E
1982-1986	2	1.0	0.8	0.4			N/E
1983-1987	1	0.5	0.9	0.4			N/E
1984-1988	0	0.0	1.3	0.6			N/E
1985-1989	0	0.0	2.0	0.9			N/E
1986-1990	0	0.0	2.0	0.9			N/E
1987-1991	0	0.0	2.5	1.1			N/E
1988-1992	2	0.9	3.5	1.5			N/E
1989-1993	2	0.8	3.2	1.3			N/E
1990-1994	2	0.8	2.5	1.0			N/E
1991-1995	2	0.8	2.1	0.9			N/E
1992-1996	2	0.8	1.5	0.6			N/E
1993-1997	0	0.0	0.3	0.1			N/E
1994-1998	1	0.4	0.5	0.2			N/E
1995-1999	1	0.4	1.6	0.6			N/E
1996-2000	1	0.4	2.4	0.9			N/E
1997-2001	2	0.8	2.4	0.9			N/E
1973-2001	10	0.8	9.5	0.8	1.06 ( 0.35 - 1.57 )	0.86	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.19. Standardized Incidence Ratio (SIR) of Cancers of the Breast Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	24	15.1	26.9	16.9	0.89 ( 0.50 - 1.20 )	0.57	1
1974-1978	25	15.1	28.7	17.4	0.87 ( 0.50 - 1.17 )	0.49	1
1975-1979	29	16.9	25.1	14.6	1.16 ( 0.70 - 1.53 )	0.43	1
1976-1980	31	17.4	27.1	15.2	1.15 ( 0.70 - 1.51 )	0.45	1
1977-1981	35	19.1	29.0	15.8	1.21 ( 0.77 - 1.57 )	0.27	1
1978-1982	35	18.5	31.8	16.8	1.10 ( 0.70 - 1.43 )	0.57	1
1979-1983	37	19.1	34.4	17.7	1.07 ( 0.70 - 1.39 )	0.66	1
1980-1984	36	18.1	38.5	19.3	0.94 ( 0.60 - 1.21 )	0.69	1
1981-1985	39	19.2	40.3	19.8	0.97 ( 0.64 - 1.24 )	0.84	1
1982-1986	39	18.8	43.0	20.7	0.91 ( 0.60 - 1.17 )	0.54	1
1983-1987	46	21.7	48.0	22.7	0.96 ( 0.66 - 1.21 )	0.78	1
1984-1988	49	22.7	51.1	23.7	0.96 ( 0.67 - 1.21 )	0.77	1
1985-1989	47	21.3	54.2	24.6	0.87 ( 0.60 - 1.10 )	0.33	1
1986-1990	51	22.7	56.4	25.1	0.90 ( 0.64 - 1.13 )	0.47	1
1987-1991	55	24.1	60.2	26.3	0.91 ( 0.65 - 1.14 )	0.50	1
1988-1992	49	21.1	61.3	26.4	0.80 ( 0.56 - 1.01 )	0.12	1
1989-1993	51	21.6	63.5	26.9	0.80 ( 0.56 - 1.01 )	0.12	1
1990-1994	56	23.3	65.4	27.2	0.86 ( 0.61 - 1.06 )	0.25	1
1991-1995	57	23.4	70.6	29.0	0.81 ( 0.58 - 1.00 )	0.11	1
1992-1996	63	25.5	70.9	28.7	0.89 ( 0.65 - 1.09 )	0.35	1
1993-1997	70	28.0	73.3	29.3	0.96 ( 0.71 - 1.17 )	0.70	1
1994-1998	72	28.4	77.2	30.4	0.93 ( 0.70 - 1.14 )	0.55	1
1995-1999	81	31.5	80.5	31.3	1.01 ( 0.77 - 1.21 )	0.95	1
1996-2000	81	31.1	83.6	32.1	0.97 ( 0.74 - 1.17 )	0.78	1
1997-2001	87	32.9	89.3	33.8	0.97 ( 0.76 - 1.17 )	0.81	1
1973-2001	297	23.7	314.4	25.0	0.94 ( 0.83 - 1.05 )	0.33	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.20. Standardized Incidence Ratio (SIR) of Cancers of the Cervix Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	3	1.9	7.0	4.4			N/E
1974-1978	4	2.4	6.8	4.1			N/E
1975-1979	4	2.3	6.9	4.0			N/E
1976-1980	5	2.8	6.5	3.6	0.77 ( 0.10 - 1.24 )	0.57	1
1977-1981	6	3.3	6.2	3.4	0.96 ( 0.18 - 1.51 )	0.93	1
1978-1982	5	2.6	6.6	3.5	0.76 ( 0.10 - 1.21 )	0.53	1
1979-1983	6	3.1	6.4	3.3	0.94 ( 0.17 - 1.48 )	0.89	1
1980-1984	6	3.0	6.6	3.3	0.91 ( 0.17 - 1.43 )	0.82	1
1981-1985	3	1.5	6.8	3.3			N/E
1982-1986	3	1.4	6.3	3.0			N/E
1983-1987	6	2.8	5.9	2.8	1.01 ( 0.18 - 1.59 )	0.97	1
1984-1988	5	2.3	6.9	3.2	0.72 ( 0.09 - 1.16 )	0.47	1
1985-1989	7	3.2	6.7	3.0	1.05 ( 0.24 - 1.63 )	0.89	1
1986-1990	7	3.1	6.9	3.1	1.01 ( 0.23 - 1.56 )	0.98	1
1987-1991	6	2.6	6.5	2.9	0.92 ( 0.17 - 1.44 )	0.84	1
1988-1992	6	2.6	8.1	3.5	0.74 ( 0.13 - 1.16 )	0.46	1
1989-1993	7	3.0	8.4	3.6	0.83 ( 0.19 - 1.29 )	0.63	1
1990-1994	6	2.5	9.2	3.8	0.65 ( 0.12 - 1.02 )	0.29	1
1991-1995	7	2.9	8.7	3.6	0.80 ( 0.18 - 1.24 )	0.56	1
1992-1996	7	2.8	9.7	3.9	0.72 ( 0.16 - 1.12 )	0.39	1
1993-1997	6	2.4	9.3	3.7	0.65 ( 0.12 - 1.02 )	0.28	1
1994-1998	6	2.4	9.3	3.7	0.64 ( 0.12 - 1.01 )	0.28	1
1995-1999	7	2.7	7.3	2.9	0.95 ( 0.22 - 1.47 )	0.90	1
1996-2000	7	2.7	7.5	2.9	0.93 ( 0.21 - 1.44 )	0.85	1
1997-2001	8	3.0	6.4	2.4	1.25 ( 0.33 - 1.90 )	0.53	1
1973-2001	32	2.5	41.6	3.3	0.77 ( 0.48 - 1.01 )	0.14	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.21. Standardized Incidence Ratio (SIR) of Cancers of the Uterus Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	12	7.5	9.6	6.0	1.25 ( 0.48 - 1.82 )	0.44	1
1974-1978	15	9.1	9.7	5.9	1.54 ( 0.69 - 2.19 )	0.09	1
1975-1979	13	7.6	11.5	6.7	1.13 ( 0.46 - 1.63 )	0.66	1
1976-1980	12	6.7	10.8	6.1	1.11 ( 0.43 - 1.62 )	0.71	1
1977-1981	10	5.4	12.2	6.6	0.82 ( 0.27 - 1.22 )	0.53	1
1978-1982	11	5.8	12.0	6.4	0.92 ( 0.33 - 1.35 )	0.77	1
1979-1983	8	4.1	13.6	7.0	0.59 ( 0.16 - 0.90 )	0.13	1
1980-1984	8	4.0	12.7	6.4	0.63 ( 0.17 - 0.96 )	0.19	1
1981-1985	7	3.4	13.7	6.7	0.51 ( 0.12 - 0.79 )	0.07	1
1982-1986	9	4.3	12.4	6.0	0.73 ( 0.22 - 1.10 )	0.34	1
1983-1987	8	3.8	14.0	6.6	0.57 ( 0.15 - 0.87 )	0.11	1
1984-1988	11	5.1	12.7	5.9	0.87 ( 0.31 - 1.28 )	0.64	1
1985-1989	11	5.0	14.0	6.3	0.79 ( 0.28 - 1.16 )	0.43	1
1986-1990	11	4.9	14.9	6.6	0.74 ( 0.27 - 1.09 )	0.31	1
1987-1991	11	4.8	16.1	7.0	0.68 ( 0.25 - 1.01 )	0.21	1
1988-1992	11	4.7	16.7	7.2	0.66 ( 0.24 - 0.97 )	0.16	1
1989-1993	9	3.8	16.9	7.2	0.53 ( 0.16 - 0.80 )	0.05	1
1990-1994	9	3.8	18.6	7.7	0.48 ( 0.15 - 0.73 )	0.03	1
1991-1995	12	4.9	19.7	8.1	0.61 ( 0.23 - 0.89 )	0.08	1
1992-1996	9	3.6	18.7	7.6	0.48 ( 0.15 - 0.72 )	0.02	1
1993-1997	10	4.0	17.5	7.0	0.57 ( 0.19 - 0.85 )	0.07	1
1994-1998	9	3.5	17.3	6.8	0.52 ( 0.16 - 0.78 )	0.05	1
1995-1999	10	3.9	15.7	6.1	0.64 ( 0.21 - 0.95 )	0.15	1
1996-2000	9	3.5	13.0	5.0	0.69 ( 0.21 - 1.04 )	0.27	1
1997-2001	12	4.5	13.1	5.0	0.92 ( 0.35 - 1.34 )	0.77	1
1973-2001	61	4.9	79.8	6.4	0.76 ( 0.56 - 0.94 )	0.04	1

Rates are per 100,000 population.

Statistical Significance:

N/E - Not Evaluated, less than 5 cases.

1 - Not Statistically Significant.

2 - Statistically Significant.

Table 1.22. Standardized Incidence Ratio (SIR) of Cancers of the Ovary Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	6	3.8	4.9	3.1	1.24 ( 0.22 - 1.94 )	0.60	1
1974-1978	6	3.6	6.1	3.7	0.99 ( 0.18 - 1.56 )	0.98	1
1975-1979	5	2.9	7.1	4.1	0.70 ( 0.09 - 1.12 )	0.43	1
1976-1980	5	2.8	7.4	4.2	0.68 ( 0.09 - 1.08 )	0.38	1
1977-1981	3	1.6	7.5	4.1			N/E
1978-1982	2	1.1	6.5	3.4			N/E
1979-1983	4	2.1	6.6	3.4			N/E
1980-1984	4	2.0	5.7	2.9			N/E
1981-1985	4	2.0	5.9	2.9			N/E
1982-1986	7	3.4	6.6	3.2	1.06 ( 0.24 - 1.64 )	0.87	1
1983-1987	9	4.3	8.4	4.0	1.07 ( 0.32 - 1.61 )	0.84	1
1984-1988	9	4.2	7.0	3.2	1.29 ( 0.39 - 1.95 )	0.44	1
1985-1989	12	5.4	6.7	3.0	1.80 ( 0.69 - 2.62 )	0.04	1
1986-1990	11	4.9	6.5	2.9	1.69 ( 0.61 - 2.48 )	0.08	1
1987-1991	10	4.4	6.6	2.9	1.52 ( 0.51 - 2.27 )	0.18	1
1988-1992	11	4.7	5.3	2.3	2.07 ( 0.75 - 3.05 )	0.01	1
1989-1993	10	4.2	7.3	3.1	1.38 ( 0.46 - 2.05 )	0.31	1
1990-1994	8	3.3	9.7	4.0	0.82 ( 0.22 - 1.26 )	0.58	1
1991-1995	10	4.1	11.1	4.6	0.90 ( 0.30 - 1.34 )	0.73	1
1992-1996	9	3.6	11.0	4.4	0.82 ( 0.25 - 1.23 )	0.55	1
1993-1997	10	4.0	12.5	5.0	0.80 ( 0.27 - 1.19 )	0.47	1
1994-1998	9	3.5	13.6	5.3	0.66 ( 0.20 - 1.00 )	0.22	1
1995-1999	12	4.7	14.0	5.4	0.86 ( 0.33 - 1.25 )	0.60	1
1996-2000	14	5.4	13.3	5.1	1.05 ( 0.45 - 1.51 )	0.86	1
1997-2001	15	5.7	13.1	5.0	1.14 ( 0.51 - 1.62 )	0.61	1
1973-2001	49	3.9	48.6	3.9	1.01 ( 0.70 - 1.27 )	0.96	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.23. Standardized Incidence Ratio (SIR) of Other Female Genital Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	3	1.9	1.0	0.6			N/E
1974-1978	3	1.8	1.0	0.6			N/E
1975-1979	3	1.7	1.0	0.6			N/E
1976-1980	3	1.7	0.9	0.5			N/E
1977-1981	1	0.5	0.1	0.0			N/E
1978-1982	0	0.0	0.1	0.0			N/E
1979-1983	0	0.0	0.3	0.2			N/E
1980-1984	0	0.0	0.4	0.2			N/E
1981-1985	0	0.0	0.4	0.2			N/E
1982-1986	0	0.0	0.7	0.3			N/E
1983-1987	0	0.0	1.2	0.6			N/E
1984-1988	0	0.0	1.1	0.5			N/E
1985-1989	0	0.0	1.2	0.5			N/E
1986-1990	1	0.4	2.2	1.0			N/E
1987-1991	1	0.4	2.3	1.0			N/E
1988-1992	1	0.4	2.5	1.1			N/E
1989-1993	1	0.4	3.2	1.4			N/E
1990-1994	1	0.4	3.3	1.4			N/E
1991-1995	0	0.0	2.5	1.0			N/E
1992-1996	0	0.0	2.7	1.1			N/E
1993-1997	0	0.0	2.2	0.9			N/E
1994-1998	0	0.0	1.6	0.6			N/E
1995-1999	0	0.0	1.3	0.5			N/E
1996-2000	0	0.0	1.3	0.5			N/E
1997-2001	1	0.4	1.4	0.5			N/E
1973-2001	5	0.4	8.1	0.6	0,62 ( 0.08 - 0.99 )	0.28	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.24. Standardized Incidence Ratio (SIR) of Cancers of the Prostate Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	11	6.9	17.0	10.7	0.65 ( 0.23 - 0.95 )	0.14	1
1974-1978	14	8.5	19.8	12.0	0.71 ( 0.30 - 1.01 )	0.19	1
1975-1979	17	9.9	22.1	12.9	0.77 ( 0.37 - 1.08 )	0.28	1
1976-1980	15	8.4	24.6	13.9	0.61 ( 0.27 - 0.87 )	0.05	1
1977-1981	18	9.8	24.1	13.1	0.75 ( 0.37 - 1.04 )	0.21	1
1978-1982	24	12.7	26.9	14.2	0.89 ( 0.50 - 1.21 )	0.58	1
1979-1983	25	12.9	28.3	14.6	0.88 ( 0.50 - 1.19 )	0.53	1
1980-1984	25	12.6	30.6	15.4	0.82 ( 0.47 - 1.10 )	0.31	1
1981-1985	31	15.3	32.6	16.0	0.95 ( 0.59 - 1.25 )	0.78	1
1982-1986	32	15.4	35.6	17.2	0.90 ( 0.56 - 1.18 )	0.54	1
1983-1987	28	13.2	35.0	16.5	0.80 ( 0.48 - 1.06 )	0.24	1
1984-1988	31	14.4	36.2	16.8	0.86 ( 0.53 - 1.13 )	0.38	1
1985-1989	33	15.0	38.5	17.5	0.86 ( 0.54 - 1.12 )	0.38	1
1986-1990	32	14.3	43.2	19.3	0.74 ( 0.46 - 0.97 )	0.09	1
1987-1991	40	17.5	50.8	22.2	0.79 ( 0.52 - 1.01 )	0.13	1
1988-1992	55	23.6	60.6	26.0	0.91 ( 0.65 - 1.13 )	0.47	1
1989-1993	58	24.5	75.7	32.0	0.77 ( 0.55 - 0.95 )	0.04	1
1990-1994	73	30.4	83.7	34.9	0.87 ( 0.66 - 1.06 )	0.24	1
1991-1995	85	34.9	89.4	36.7	0.95 ( 0.73 - 1.14 )	0.65	1
1992-1996	84	34.0	93.4	37.8	0.90 ( 0.69 - 1.08 )	0.33	1
1993-1997	90	35.9	99.9	39.9	0.90 ( 0.70 - 1.08 )	0.32	1
1994-1998	93	36.6	100.0	39.4	0.93 ( 0.73 - 1.11 )	0.48	1
1995-1999	90	35.0	103.5	40.2	0.87 ( 0.68 - 1.04 )	0.18	1
1996-2000	86	33.0	105.4	40.4	0.82 ( 0.63 - 0.98 )	0.06	1
1997-2001	91	34.4	107.7	40.8	0.84 ( 0.66 - 1.01 )	0.11	1
1973-2001	276	22.0	324.0	25.8	0.85 ( 0.75 - 0.95 )	0.01	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.25. Standardized Incidence Ratio (SIR) of Cancers of the Testis Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	1	0.6	4.2	2.6			N/E
1974-1978	1	0.6	4.2	2.6			N/E
1975-1979	1	0.6	3.5	2.0			N/E
1976-1980	0	0.0	3.2	1.8			N/E
1977-1981	1	0.5	4.0	2.2			N/E
1978-1982	1	0.5	5.4	2.9			N/E
1979-1983	1	0.5	5.8	3.0			N/E
1980-1984	1	0.5	7.3	3.7			N/E
1981-1985	1	0.5	6.9	3.4			N/E
1982-1986	0	0.0	7.6	3.6			N/E
1983-1987	0	0.0	5.7	2.7			N/E
1984-1988	1	0.5	7.0	3.2			N/E
1985-1989	3	1.4	6.6	3.0			N/E
1986-1990	5	2.2	8.3	3.7	0.60 ( 0.08 - 0.96 )	0.25	1
1987-1991	9	3.9	7.8	3.4	1.16 ( 0.35 - 1.74 )	0.66	1
1988-1992	11	4.7	8.9	3.8	1.24 ( 0.45 - 1.83 )	0.47	1
1989-1993	11	4.7	9.9	4.2	1.11 ( 0.40 - 1.64 )	0.73	1
1990-1994	11	4.6	10.0	4.2	1.10 ( 0.40 - 1.62 )	0.75	1
1991-1995	10	4.1	9.0	3.7	1.11 ( 0.37 - 1.66 )	0.73	1
1992-1996	6	2.4	9.8	4.0	0.61 ( 0.11 - 0.96 )	0.23	1
1993-1997	4	1.6	8.8	3.5			N/E
1994-1998	6	2.4	8.4	3.3	0.72 ( 0.13 - 1.13 )	0.41	1
1995-1999	5	1.9	8.9	3.4	0.56 ( 0.07 - 0.90 )	0.19	1
1996-2000	4	1.5	9.0	3.5			N/E
1997-2001	5	1.9	9.4	3.5	0.53 ( 0.07 - 0.85 )	0.15	1
1973-2001	22	1.8	41.2	3.3	0.53 ( 0.29 - 0.73 )	0.00	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.26. Standardized Incidence Ratio (SIR) of Other Male Genital Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	1	0.6	0.2	0.1			N/E
1974-1978	0	0.0	0.2	0.1			N/E
1975-1979	0	0.0	0.4	0.3			N/E
1976-1980	0	0.0	0.4	0.2			N/E
1977-1981	0	0.0	0.4	0.2			N/E
1978-1982	0	0.0	0.3	0.1			N/E
1979-1983	0	0.0	0.5	0.3			N/E
1980-1984	0	0.0	0.3	0.1			N/E
1981-1985	0	0.0	0.8	0.4			N/E
1982-1986	0	0.0	0.8	0.4			N/E
1983-1987	0	0.0	0.8	0.4			N/E
1984-1988	0	0.0	0.6	0.3			N/E
1985-1989	0	0.0	0.6	0.3			N/E
1986-1990	0	0.0	0.0	0.0			N/E
1987-1991	0	0.0	0.0	0.0			N/E
1988-1992	0	0.0	0.0	0.0			N/E
1989-1993	0	0.0	0.0	0.0			N/E
1990-1994	0	0.0	0.0	0.0			N/E
1991-1995	0	0.0	0.0	0.0			N/E
1992-1996	0	0.0	0.5	0.2			N/E
1993-1997	0	0.0	0.5	0.2			N/E
1994-1998	0	0.0	0.8	0.3			N/E
1995-1999	1	0.4	1.1	0.4			N/E
1996-2000	2	0.8	1.3	0.5			N/E
1997-2001	2	0.8	0.8	0.3			N/E
1973-2001	3	0.2	2.6	0.2			N/E

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.27. Standardized Incidence Ratio (SIR) of Cancers of the Bladder Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	8	5.0	6.8	4.3	1.18 ( 0.32 - 1.80 )	0.64	1
1974-1978	11	6.7	6.9	4.2	1.59 ( 0.57 - 2.34 )	0.12	1
1975-1979	8	4.7	7.3	4.3	1.09 ( 0.29 - 1.67 )	0.80	1
1976-1980	8	4.5	7.1	4.0	1.13 ( 0.30 - 1.72 )	0.73	1
1977-1981	8	4.4	7.6	4.1	1.06 ( 0.28 - 1.61 )	0.88	1
1978-1982	8	4.2	9.5	5.0	0.84 ( 0.22 - 1.28 )	0.62	1
1979-1983	5	2.6	10.0	5.2	0.50 ( 0.07 - 0.80 )	0.11	1
1980-1984	6	3.0	9.7	4.9	0.62 ( 0.11 - 0.97 )	0.23	1
1981-1985	7	3.4	12.1	6.0	0.58 ( 0.13 - 0.89 )	0.14	1
1982-1986	5	2.4	12.5	6.0	0.40 ( 0.05 - 0.64 )	0.03	1
1983-1987	5	2.4	11.2	5.3	0.45 ( 0.06 - 0.71 )	0.06	1
1984-1988	7	3.2	11.3	5.2	0.62 ( 0.14 - 0.96 )	0.20	1
1985-1989	12	5.4	10.2	4.6	1.18 ( 0.45 - 1.72 )	0.57	1
1986-1990	17	7.6	9.3	4.1	1.83 ( 0.88 - 2.57 )	0.01	1
1987-1991	18	7.9	8.2	3.6	2.19 ( 1.08 - 3.05 )	0.00	2
1988-1992	18	7.7	9.1	3.9	1.98 ( 0.98 - 2.77 )	0.00	1
1989-1993	18	7.6	8.1	3.4	2.21 ( 1.09 - 3.09 )	0.00	2
1990-1994	14	5.8	12.7	5.3	1.10 ( 0.47 - 1.58 )	0.72	1
1991-1995	10	4.1	14.8	6.1	0.68 ( 0.23 - 1.01 )	0.21	1
1992-1996	9	3.6	17.6	7.1	0.51 ( 0.15 - 0.77 )	0.04	1
1993-1997	14	5.6	18.4	7.3	0.76 ( 0.33 - 1.09 )	0.31	1
1994-1998	12	4.7	20.9	8.2	0.58 ( 0.22 - 0.84 )	0.05	1
1995-1999	15	5.8	19.7	7.7	0.76 ( 0.34 - 1.08 )	0.29	1
1996-2000	19	7.3	20.2	7.8	0.94 ( 0.48 - 1.30 )	0.79	1
1997-2001	21	7.9	18.3	6.9	1.15 ( 0.61 - 1.57 )	0.53	1
1973-2001	68	5.4	69.6	5.5	0.98 ( 0.73 - 1.20 )	0.85	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.28. Standardized Incidence Ratio (SIR) of Cancers of the Kidney and Renal Pelvis Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	7	4.4	3.7	2.3	1.87 ( 0.43 - 2.90 )	0.09	1
1974-1978	6	3.6	3.9	2.3	1.55 ( 0.28 - 2.44 )	0.28	1
1975-1979	5	2.9	3.8	2.2	1.33 ( 0.17 - 2.12 )	0.53	1
1976-1980	5	2.8	3.9	2.2	1.29 ( 0.17 - 2.06 )	0.57	1
1977-1981	5	2.7	3.7	2.0	1.36 ( 0.18 - 2.17 )	0.49	1
1978-1982	5	2.6	4.7	2.5	1.07 ( 0.14 - 1.71 )	0.87	1
1979-1983	4	2.1	4.8	2.5			N/E
1980-1984	4	2.0	4.6	2.3			N/E
1981-1985	2	1.0	5.3	2.6			N/E
1982-1986	2	1.0	6.2	3.0			N/E
1983-1987	2	0.9	5.5	2.6			N/E
1984-1988	3	1.4	7.0	3.2			N/E
1985-1989	7	3.2	7.9	3.6	0.89 ( 0.20 - 1.37 )	0.75	1
1986-1990	13	5.8	7.9	3.5	1.64 ( 0.67 - 2.37 )	0.07	1
1987-1991	13	5.7	7.1	3.1	1.84 ( 0.75 - 2.65 )	0.03	1
1988-1992	14	6.0	7.5	3.2	1.87 ( 0.80 - 2.68 )	0.02	1
1989-1993	14	5.9	8.1	3.4	1.72 ( 0.74 - 2.47 )	0.04	1
1990-1994	11	4.6	7.3	3.0	1.51 ( 0.54 - 2.22 )	0.17	1
1991-1995	9	3.7	8.0	3.3	1.13 ( 0.34 - 1.70 )	0.71	1
1992-1996	9	3.6	9.7	3.9	0.93 ( 0.28 - 1.39 )	0.82	1
1993-1997	7	2.8	11.1	4.4	0.63 ( 0.14 - 0.97 )	0.22	1
1994-1998	9	3.5	10.6	4.2	0.85 ( 0.26 - 1.28 )	0.63	1
1995-1999	13	5.1	11.3	4.4	1.15 ( 0.47 - 1.67 )	0.61	1
1996-2000	10	3.8	11.9	4.6	0.84 ( 0.28 - 1.25 )	0.59	1
1997-2001	14	5.3	12.1	4.6	1.15 ( 0.49 - 1.65 )	0.59	1
1973-2001	49	3.9	42.0	3.3	1.17 ( 0.81 - 1.47 )	0.28	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.29. Standardized Incidence Ratio (SIR) of Other Urinary System Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.3	0.2			N/E
1974-1978	0	0.0	0.4	0.2			N/E
1975-1979	0	0.0	0.2	0.1			N/E
1976-1980	1	0.6	0.1	0.1			N/E
1977-1981	2	1.1	0.4	0.2			N/E
1978-1982	2	1.1	0.4	0.2			N/E
1979-1983	2	1.0	0.4	0.2			N/E
1980-1984	2	1.0	0.4	0.2			N/E
1981-1985	1	0.5	0.4	0.2			N/E
1982-1986	0	0.0	0.1	0.1			N/E
1983-1987	0	0.0	0.1	0.1			N/E
1984-1988	0	0.0	0.0	0.0			N/E
1985-1989	0	0.0	0.0	0.0			N/E
1986-1990	0	0.0	0.0	0.0			N/E
1987-1991	0	0.0	0.2	0.1			N/E
1988-1992	0	0.0	0.2	0.1			N/E
1989-1993	0	0.0	0.4	0.1			N/E
1990-1994	1	0.4	0.4	0.1			N/E
1991-1995	1	0.4	0.9	0.4			N/E
1992-1996	1	0.4	1.0	0.4			N/E
1993-1997	1	0.4	1.0	0.4			N/E
1994-1998	1	0.4	0.8	0.3			N/E
1995-1999	0	0.0	1.2	0.5			N/E
1996-2000	0	0.0	0.6	0.2			N/E
1997-2001	0	0.0	0.3	0.1			N/E
1973-2001	3	0.2	2.3	0.2			N/E

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.30. Standardized Incidence Ratio (SIR) of Cancers of the Eye and Orbit Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	2	1.3	0.7	0.4			N/E
1974-1978	2	1.2	0.8	0.5			N/E
1975-1979	1	0.6	0.7	0.4			N/E
1976-1980	2	1.1	0.5	0.3			N/E
1977-1981	1	0.5	0.8	0.4			N/E
1978-1982	1	0.5	0.6	0.3			N/E
1979-1983	1	0.5	0.4	0.2			N/E
1980-1984	2	1.0	0.4	0.2			N/E
1981-1985	2	1.0	0.4	0.2			N/E
1982-1986	2	1.0	0.4	0.2			N/E
1983-1987	3	1.4	0.6	0.3			N/E
1984-1988	4	1.9	1.2	0.6			N/E
1985-1989	3	1.4	1.1	0.5			N/E
1986-1990	2	0.9	1.4	0.6			N/E
1987-1991	2	0.9	1.3	0.6			N/E
1988-1992	1	0.4	1.3	0.6			N/E
1989-1993	0	0.0	1.1	0.4			N/E
1990-1994	2	0.8	1.3	0.6			N/E
1991-1995	3	1.2	1.4	0.6			N/E
1992-1996	3	1.2	1.1	0.4			N/E
1993-1997	3	1.2	0.9	0.4			N/E
1994-1998	4	1.6	1.5	0.6			N/E
1995-1999	3	1.2	1.5	0.6			N/E
1996-2000	2	0.8	1.7	0.6			N/E
1997-2001	3	1.1	2.1	0.8			N/E
1973-2001	13	1.0	6.2	0.5	2.09 ( 0.85 - 3.01 )	0.01	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.31. Standardized Incidence Ratio (SIR) of Cancers of the Brain Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	8	5.0	5.0	3.1	1.61 ( 0.43 - 2.45 )	0.18	1
1974-1978	8	4.8	5.8	3.5	1.39 ( 0.37 - 2.11 )	0.35	1
1975-1979	9	5.2	6.6	3.8	1.37 ( 0.41 - 2.07 )	0.34	1
1976-1980	11	6.2	7.1	4.0	1.55 ( 0.56 - 2.28 )	0.14	1
1977-1981	10	5.4	8.4	4.6	1.20 ( 0.40 - 1.78 )	0.57	1
1978-1982	8	4.2	9.0	4.8	0.88 ( 0.24 - 1.35 )	0.73	1
1979-1983	8	4.1	11.2	5.8	0.71 ( 0.19 - 1.09 )	0.34	1
1980-1984	6	3.0	10.8	5.4	0.56 ( 0.10 - 0.87 )	0.14	1
1981-1985	4	2.0	12.1	5.9			N/E
1982-1986	3	1.4	11.8	5.7			N/E
1983-1987	4	1.9	12.1	5.7			N/E
1984-1988	6	2.8	11.2	5.2	0.53 ( 0.10 - 0.84 )	0.12	1
1985-1989	7	3.2	11.9	5.4	0.59 ( 0.13 - 0.91 )	0.15	1
1986-1990	6	2.7	12.8	5.7	0.47 ( 0.09 - 0.73 )	0.06	1
1987-1991	10	4.4	13.7	6.0	0.73 ( 0.24 - 1.09 )	0.32	1
1988-1992	11	4.7	13.7	5.9	0.81 ( 0.29 - 1.19 )	0.47	1
1989-1993	11	4.7	14.0	5.9	0.79 ( 0.28 - 1.16 )	0.43	1
1990-1994	11	4.6	13.6	5.7	0.81 ( 0.29 - 1.19 )	0.48	1
1991-1995	13	5.3	11.6	4.8	1.12 ( 0.46 - 1.61 )	0.69	1
1992-1996	12	4.9	10.1	4.1	1.19 ( 0.46 - 1.74 )	0.54	1
1993-1997	12	4.8	13.9	5.5	0.87 ( 0.33 - 1.26 )	0.62	1
1994-1998	13	5.1	13.7	5.4	0.95 ( 0.39 - 1.37 )	0.85	1
1995-1999	12	4.7	14.9	5.8	0.81 ( 0.31 - 1.18 )	0.45	1
1996-2000	12	4.6	15.0	5.7	0.80 ( 0.31 - 1.17 )	0.44	1
1997-2001	11	4.2	16.3	6.2	0.68 ( 0.24 - 1.00 )	0.19	1
1973-2001	51	4.1	64.1	5.1	0.80 ( 0.56 - 1.00 )	0.10	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.32. Standardized Incidence Ratio (SIR) of Other Central Nervous System Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.0	0.0			N/E
1974-1978	0	0.0	0.0	0.0			N/E
1975-1979	0	0.0	0.0	0.0			N/E
1976-1980	0	0.0	0.0	0.0			N/E
1977-1981	0	0.0	0.0	0.0			N/E
1978-1982	0	0.0	0.7	0.4			N/E
1979-1983	0	0.0	0.7	0.4			N/E
1980-1984	0	0.0	1.1	0.6			N/E
1981-1985	0	0.0	1.5	0.7			N/E
1982-1986	0	0.0	1.5	0.7			N/E
1983-1987	0	0.0	0.8	0.4			N/E
1984-1988	0	0.0	0.8	0.3			N/E
1985-1989	0	0.0	0.4	0.2			N/E
1986-1990	0	0.0	0.0	0.0			N/E
1987-1991	0	0.0	0.3	0.1			N/E
1988-1992	1	0.4	0.6	0.3			N/E
1989-1993	2	0.8	0.6	0.3			N/E
1990-1994	2	0.8	0.6	0.3			N/E
1991-1995	2	0.8	0.6	0.2			N/E
1992-1996	2	0.8	0.3	0.1			N/E
1993-1997	1	0.4	0.0	0.0			N/E
1994-1998	0	0.0	0.0	0.0			N/E
1995-1999	0	0.0	0.0	0.0			N/E
1996-2000	0	0.0	0.2	0.1			N/E
1997-2001	0	0.0	0.5	0.2			N/E
1973-2001	2	0.2	2.6	0.2			N/E

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.33. Standardized Incidence Ratio (SIR) of Cancers of the Thyroid Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	5	3.1	5.0	3.2	0.99 ( 0.13 - 1.58 )	0.98	1
1974-1978	5	3.0	5.5	3.3	0.91 ( 0.12 - 1.45 )	0.83	1
1975-1979	5	2.9	5.9	3.5	0.84 ( 0.11 - 1.35 )	0.70	1
1976-1980	3	1.7	6.0	3.4			N/E
1977-1981	2	1.1	6.8	3.7			N/E
1978-1982	6	3.2	6.4	3.4	0.94 ( 0.17 - 1.47 )	0.87	1
1979-1983	7	3.6	7.1	3.7	0.98 ( 0.22 - 1.52 )	0.96	1
1980-1984	8	4.0	6.1	3.1	1.31 ( 0.35 - 1.99 )	0.45	1
1981-1985	8	3.9	7.2	3.5	1.12 ( 0.30 - 1.70 )	0.76	1
1982-1986	9	4.3	6.8	3.3	1.32 ( 0.40 - 1.98 )	0.41	1
1983-1987	5	2.4	7.1	3.4	0.70 ( 0.09 - 1.12 )	0.43	1
1984-1988	5	2.3	7.3	3.4	0.68 ( 0.09 - 1.09 )	0.39	1
1985-1989	4	1.8	7.7	3.5			N/E
1986-1990	5	2.2	6.4	2.8	0.78 ( 0.10 - 1.25 )	0.58	1
1987-1991	7	3.1	7.1	3.1	0.98 ( 0.22 - 1.52 )	0.96	1
1988-1992	10	4.3	9.2	3.9	1.09 ( 0.36 - 1.62 )	0.78	1
1989-1993	11	4.7	9.7	4.1	1.14 ( 0.41 - 1.67 )	0.67	1
1990-1994	15	6.3	10.8	4.5	1.39 ( 0.62 - 1.98 )	0.20	1
1991-1995	15	6.2	11.2	4.6	1.34 ( 0.60 - 1.91 )	0.25	1
1992-1996	11	4.5	10.9	4.4	1.01 ( 0.36 - 1.48 )	0.98	1
1993-1997	10	4.0	8.5	3.4	1.18 ( 0.39 - 1.75 )	0.61	1
1994-1998	11	4.3	9.7	3.8	1.13 ( 0.41 - 1.66 )	0.69	1
1995-1999	9	3.5	11.2	4.3	0.81 ( 0.24 - 1.21 )	0.52	1
1996-2000	11	4.2	12.0	4.6	0.91 ( 0.33 - 1.34 )	0.76	1
1997-2001	11	4.2	13.6	5.2	0.81 ( 0.29 - 1.19 )	0.48	1
1973-2001	45	3.6	49.3	3.9	0.91 ( 0.62 - 1.16 )	0.54	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.34. Standardized Incidence Ratio (SIR) of Other Endocrine System Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	1.3	0.8			N/E
1974-1978	0	0.0	1.3	0.8			N/E
1975-1979	0	0.0	1.6	0.9			N/E
1976-1980	0	0.0	1.1	0.6			N/E
1977-1981	0	0.0	0.8	0.4			N/E
1978-1982	0	0.0	1.3	0.7			N/E
1979-1983	0	0.0	1.3	0.7			N/E
1980-1984	1	0.5	1.3	0.7			N/E
1981-1985	1	0.5	1.7	0.8			N/E
1982-1986	1	0.5	1.7	0.8			N/E
1983-1987	1	0.5	1.1	0.5			N/E
1984-1988	1	0.5	0.7	0.3			N/E
1985-1989	0	0.0	0.4	0.2			N/E
1986-1990	0	0.0	0.3	0.1			N/E
1987-1991	1	0.4	0.9	0.4			N/E
1988-1992	1	0.4	1.3	0.6			N/E
1989-1993	1	0.4	1.6	0.7			N/E
1990-1994	1	0.4	1.9	0.8			N/E
1991-1995	1	0.4	1.6	0.6			N/E
1992-1996	0	0.0	0.9	0.4			N/E
1993-1997	0	0.0	0.6	0.2			N/E
1994-1998	0	0.0	0.5	0.2			N/E
1995-1999	0	0.0	0.5	0.2			N/E
1996-2000	0	0.0	1.0	0.4			N/E
1997-2001	0	0.0	1.0	0.4			N/E
1973-2001	2	0.2	6.6	0.5			N/E

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.35. Standardized Incidence Ratio (SIR) of Hodgkin's Lymphoma Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	4	2.5	3.0	1.9			N/E
1974-1978	4	2.4	3.3	2.0			N/E
1975-1979	3	1.7	3.6	2.1			N/E
1976-1980	3	1.7	4.9	2.8			N/E
1977-1981	4	2.2	5.2	2.8			N/E
1978-1982	5	2.6	5.2	2.7	0.97 ( 0.13 - 1.54 )	0.94	1
1979-1983	5	2.6	4.9	2.5	1.03 ( 0.13 - 1.65 )	0.95	1
1980-1984	5	2.5	5.3	2.7	0.94 ( 0.12 - 1.50 )	0.88	1
1981-1985	5	2.5	4.6	2.3	1.08 ( 0.14 - 1.72 )	0.86	1
1982-1986	4	1.9	4.7	2.3			N/E
1983-1987	3	1.4	4.2	2.0			N/E
1984-1988	3	1.4	4.8	2.2			N/E
1985-1989	2	0.9	5.2	2.4			N/E
1986-1990	1	0.4	5.0	2.2			N/E
1987-1991	2	0.9	4.7	2.0			N/E
1988-1992	2	0.9	5.1	2.2			N/E
1989-1993	4	1.7	5.7	2.4			N/E
1990-1994	4	1.7	4.4	1.8			N/E
1991-1995	4	1.6	5.3	2.2			N/E
1992-1996	4	1.6	6.2	2.5			N/E
1993-1997	6	2.4	6.7	2.7	0.89 ( 0.16 - 1.40 )	0.78	1
1994-1998	5	2.0	6.1	2.4	0.82 ( 0.11 - 1.31 )	0.66	1
1995-1999	6	2.3	6.9	2.7	0.87 ( 0.16 - 1.36 )	0.73	1
1996-2000	8	3.1	6.2	2.4	1.29 ( 0.34 - 1.96 )	0.47	1
1997-2001	7	2.6	5.2	2.0	1.35 ( 0.31 - 2.09 )	0.43	1
1973-2001	25	2.0	28.1	2.2	0.89 ( 0.51 - 1.20 )	0.55	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.36. Standardized Incidence Ratio (SIR) of Non-Hodgkin's Lymphoma Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	10	6.3	7.6	4.8	1.32 ( 0.44 - 1.97 )	0.38	1
1974-1978	8	4.8	7.5	4.5	1.07 ( 0.29 - 1.64 )	0.84	1
1975-1979	7	4.1	8.7	5.0	0.81 ( 0.18 - 1.25 )	0.57	1
1976-1980	5	2.8	9.3	5.2	0.54 ( 0.07 - 0.86 )	0.16	1
1977-1981	5	2.7	11.1	6.1	0.45 ( 0.06 - 0.72 )	0.07	1
1978-1982	5	2.6	12.2	6.4	0.41 ( 0.05 - 0.66 )	0.04	1
1979-1983	7	3.6	13.5	6.9	0.52 ( 0.12 - 0.80 )	0.08	1
1980-1984	8	4.0	14.1	7.1	0.57 ( 0.15 - 0.86 )	0.10	1
1981-1985	9	4.4	15.3	7.5	0.59 ( 0.18 - 0.89 )	0.11	1
1982-1986	8	3.9	14.7	7.1	0.54 ( 0.15 - 0.83 )	0.08	1
1983-1987	13	6.1	15.9	7.5	0.82 ( 0.33 - 1.18 )	0.46	1
1984-1988	16	7.4	16.7	7.7	0.96 ( 0.45 - 1.36 )	0.87	1
1985-1989	19	8.6	16.1	7.3	1.18 ( 0.60 - 1.63 )	0.47	1
1986-1990	20	8.9	16.7	7.4	1.20 ( 0.62 - 1.65 )	0.42	1
1987-1991	26	11.4	15.0	6.6	1.73 ( 1.00 - 2.32 )	0.00	2
1988-1992	23	9.9	16.5	7.1	1.39 ( 0.77 - 1.89 )	0.11	1
1989-1993	21	8.9	18.8	7.9	1.12 ( 0.59 - 1.53 )	0.61	1
1990-1994	20	8.3	19.7	8.2	1.01 ( 0.53 - 1.40 )	0.95	1
1991-1995	25	10.3	19.8	8.1	1.26 ( 0.72 - 1.70 )	0.24	1
1992-1996	20	8.1	21.4	8.7	0.93 ( 0.49 - 1.29 )	0.76	1
1993-1997	23	9.2	19.6	7.8	1.17 ( 0.65 - 1.59 )	0.44	1
1994-1998	23	9.1	19.8	7.8	1.16 ( 0.64 - 1.58 )	0.47	1
1995-1999	27	10.5	21.9	8.5	1.23 ( 0.72 - 1.65 )	0.27	1
1996-2000	24	9.2	23.2	8.9	1.03 ( 0.58 - 1.40 )	0.87	1
1997-2001	26	9.8	26.0	9.8	1.00 ( 0.58 - 1.34 )	1.00	1
1973-2001	95	7.6	94.1	7.5	1.01 ( 0.79 - 1.20 )	0.93	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.37. Standardized Incidence Ratio (SIR) of Multiple Myeloma Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	1	0.6	2.2	1.4			N/E
1974-1978	1	0.6	2.9	1.7			N/E
1975-1979	1	0.6	2.8	1.6			N/E
1976-1980	1	0.6	2.9	1.6			N/E
1977-1981	1	0.5	3.3	1.8			N/E
1978-1982	2	1.1	3.2	1.7			N/E
1979-1983	3	1.5	3.0	1.6			N/E
1980-1984	5	2.5	3.2	1.6	1.56 ( 0.20 - 2.50 )	0.31	1
1981-1985	6	3.0	3.3	1.6	1.81 ( 0.33 - 2.85 )	0.14	1
1982-1986	9	4.3	3.0	1.4	3.04 ( 0.92 - 4.58 )	0.00	1
1983-1987	8	3.8	3.2	1.5	2.50 ( 0.67 - 3.80 )	0.01	1
1984-1988	8	3.7	3.8	1.8	2.09 ( 0.56 - 3.19 )	0.03	1
1985-1989	6	2.7	4.5	2.1	1.32 ( 0.24 - 2.07 )	0.49	1
1986-1990	5	2.2	5.1	2.3	0.99 ( 0.13 - 1.57 )	0.97	1
1987-1991	4	1.7	5.5	2.4			N/E
1988-1992	6	2.6	6.0	2.6	0.99 ( 0.18 - 1.56 )	0.99	1
1989-1993	6	2.5	4.8	2.0	1.25 ( 0.23 - 1.97 )	0.58	1
1990-1994	10	4.2	5.0	2.1	2.02 ( 0.67 - 3.01 )	0.02	1
1991-1995	10	4.1	5.0	2.0	2.01 ( 0.67 - 3.00 )	0.02	1
1992-1996	10	4.1	4.9	2.0	2.02 ( 0.67 - 3.01 )	0.02	1
1993-1997	11	4.4	4.8	1.9	2.29 ( 0.83 - 3.37 )	0.00	1
1994-1998	11	4.3	5.6	2.2	1.97 ( 0.71 - 2.90 )	0.02	1
1995-1999	11	4.3	5.0	1.9	2.19 ( 0.79 - 3.23 )	0.01	1
1996-2000	10	3.8	5.1	2.0	1.97 ( 0.66 - 2.93 )	0.03	1
1997-2001	9	3.4	6.2	2.3	1.46 ( 0.44 - 2.20 )	0.25	1
1973-2001	34	2.7	24.2	1.9	1.40 ( 0.89 - 1.83 )	0.05	1

Rates are per 100,000 population.

Statistical Significance:

N/E - Not Evaluated, less than 5 cases.

1 - Not Statistically Significant.

2 - Statistically Significant.

Table 1.38. Standardized Incidence Ratio (SIR) of Lymphocytic Leukemia Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	7	4.4	4.7	2.9	1.49 ( 0.34 - 2.31 )	0.29	1
1974-1978	8	4.8	4.9	3.0	1.64 ( 0.44 - 2.50 )	0.16	1
1975-1979	12	7.0	3.7	2.1	3.28 ( 1.27 - 4.79 )	0.00	2
1976-1980	9	5.1	3.9	2.2	2.32 ( 0.70 - 3.49 )	0.01	1
1977-1981	9	4.9	4.0	2.2	2.27 ( 0.69 - 3.42 )	0.01	1
1978-1982	9	4.8	4.8	2.5	1.88 ( 0.57 - 2.83 )	0.05	1
1979-1983	8	4.1	5.3	2.7	1.50 ( 0.40 - 2.29 )	0.25	1
1980-1984	4	2.0	6.5	3.3			N/E
1981-1985	3	1.5	6.8	3.3			N/E
1982-1986	3	1.4	8.2	4.0			N/E
1983-1987	2	0.9	7.1	3.3			N/E
1984-1988	2	0.9	6.8	3.1			N/E
1985-1989	3	1.4	6.6	3.0			N/E
1986-1990	4	1.8	6.4	2.8			N/E
1987-1991	3	1.3	5.5	2.4			N/E
1988-1992	4	1.7	8.6	3.7			N/E
1989-1993	5	2.1	11.4	4.8	0.44 ( 0.06 - 0.70 )	0.06	1
1990-1994	5	2.1	11.7	4.9	0.43 ( 0.06 - 0.68 )	0.05	1
1991-1995	4	1.6	11.4	4.7			N/E
1992-1996	7	2.8	11.4	4.6	0.61 ( 0.14 - 0.95 )	0.19	1
1993-1997	9	3.6	8.9	3.6	1.01 ( 0.31 - 1.52 )	0.97	1
1994-1998	7	2.8	7.1	2.8	0.98 ( 0.22 - 1.52 )	0.96	1
1995-1999	8	3.1	7.3	2.8	1.09 ( 0.29 - 1.66 )	0.80	1
1996-2000	9	3.5	8.3	3.2	1.08 ( 0.33 - 1.63 )	0.81	1
1997-2001	7	2.6	8.4	3.2	0.83 ( 0.19 - 1.28 )	0.62	1
1973-2001	35	2.8	41.5	3.3	0.84 ( 0.54 - 1.10 )	0.32	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.39. Standardized Incidence Ratio (SIR) of Myeloid Leukemia Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	8	5.0	4.0	2.5	2.02 ( 0.54 - 3.08 )	0.04	1
1974-1978	6	3.6	3.4	2.1	1.75 ( 0.32 - 2.74 )	0.17	1
1975-1979	7	4.1	3.5	2.0	2.01 ( 0.46 - 3.11 )	0.06	1
1976-1980	6	3.4	4.2	2.4	1.43 ( 0.26 - 2.25 )	0.38	1
1977-1981	5	2.7	2.9	1.6	1.74 ( 0.23 - 2.79 )	0.21	1
1978-1982	4	2.1	2.0	1.1			N/E
1979-1983	5	2.6	2.4	1.2	2.10 ( 0.27 - 3.35 )	0.09	1
1980-1984	7	3.5	3.8	1.9	1.86 ( 0.42 - 2.88 )	0.09	1
1981-1985	7	3.4	4.4	2.2	1.59 ( 0.36 - 2.47 )	0.21	1
1982-1986	9	4.3	5.0	2.4	1.80 ( 0.54 - 2.71 )	0.07	1
1983-1987	8	3.8	6.4	3.0	1.25 ( 0.33 - 1.91 )	0.53	1
1984-1988	6	2.8	6.9	3.2	0.87 ( 0.16 - 1.36 )	0.73	1
1985-1989	3	1.4	5.5	2.5			N/E
1986-1990	2	0.9	4.4	2.0			N/E
1987-1991	2	0.9	4.0	1.8			N/E
1988-1992	2	0.9	3.7	1.6			N/E
1989-1993	5	2.1	4.0	1.7	1.25 ( 0.16 - 1.99 )	0.62	1
1990-1994	5	2.1	6.3	2.6	0.79 ( 0.10 - 1.27 )	0.61	1
1991-1995	8	3.3	7.9	3.3	1.01 ( 0.27 - 1.54 )	0.98	1
1992-1996	6	2.4	8.6	3.5	0.70 ( 0.13 - 1.09 )	0.37	1
1993-1997	7	2.8	8.3	3.3	0.84 ( 0.19 - 1.30 )	0.64	1
1994-1998	6	2.4	8.8	3.5	0.68 ( 0.12 - 1.07 )	0.34	1
1995-1999	7	2.7	6.7	2.6	1.05 ( 0.24 - 1.63 )	0.89	1
1996-2000	5	1.9	6.5	2.5	0.77 ( 0.10 - 1.24 )	0.56	1
1997-2001	6	2.3	8.4	3.2	0.72 ( 0.13 - 1.13 )	0.41	1
1973-2001	34	2.7	31.8	2.5	1.07 ( 0.68 - 1.39 )	0.70	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.40. Standardized Incidence Ratio (SIR) of Monocytic Leukemia Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	0.2	0.1			N/E
1974-1978	0	0.0	0.2	0.1			N/E
1975-1979	0	0.0	0.2	0.1			N/E
1976-1980	0	0.0	0.2	0.1			N/E
1977-1981	0	0.0	0.0	0.0			N/E
1978-1982	0	0.0	0.3	0.1			N/E
1979-1983	0	0.0	0.3	0.1			N/E
1980-1984	0	0.0	0.3	0.1			N/E
1981-1985	0	0.0	0.3	0.1			N/E
1982-1986	0	0.0	0.3	0.1			N/E
1983-1987	0	0.0	0.0	0.0			N/E
1984-1988	0	0.0	0.0	0.0			N/E
1985-1989	0	0.0	0.0	0.0			N/E
1986-1990	0	0.0	0.0	0.0			N/E
1987-1991	1	0.4	0.0	0.0			N/E
1988-1992	1	0.4	0.2	0.1			N/E
1989-1993	1	0.4	0.2	0.1			N/E
1990-1994	1	0.4	0.4	0.1			N/E
1991-1995	1	0.4	0.4	0.1			N/E
1992-1996	0	0.0	0.4	0.1			N/E
1993-1997	0	0.0	0.4	0.2			N/E
1994-1998	1	0.4	0.4	0.2			N/E
1995-1999	1	0.4	0.3	0.1			N/E
1996-2000	1	0.4	0.8	0.3			N/E
1997-2001	1	0.4	1.0	0.4			N/E
1973-2001	2	0.2	1.8	0.1			N/E

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.41. Standardized Incidence Ratio (SIR) of Other Leukemia Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	0	0.0	1.0	0.6			N/E
1974-1978	1	0.6	1.0	0.6			N/E
1975-1979	2	1.2	1.0	0.6			N/E
1976-1980	2	1.1	0.8	0.4			N/E
1977-1981	3	1.6	0.5	0.3			N/E
1978-1982	3	1.6	0.7	0.4			N/E
1979-1983	2	1.0	0.4	0.2			N/E
1980-1984	1	0.5	1.0	0.5			N/E
1981-1985	1	0.5	1.6	0.8			N/E
1982-1986	0	0.0	1.8	0.9			N/E
1983-1987	0	0.0	1.8	0.8			N/E
1984-1988	0	0.0	2.1	1.0			N/E
1985-1989	1	0.5	1.7	0.8			N/E
1986-1990	1	0.4	1.8	0.8			N/E
1987-1991	1	0.4	1.8	0.8			N/E
1988-1992	2	0.9	2.0	0.9			N/E
1989-1993	2	0.8	2.1	0.9			N/E
1990-1994	1	0.4	2.1	0.9			N/E
1991-1995	1	0.4	2.0	0.8			N/E
1992-1996	1	0.4	2.0	0.8			N/E
1993-1997	0	0.0	1.8	0.7			N/E
1994-1998	1	0.4	2.0	0.8			N/E
1995-1999	1	0.4	2.2	0.9			N/E
1996-2000	1	0.4	2.4	0.9			N/E
1997-2001	2	0.8	2.3	0.9			N/E
1973-2001	7	0.6	9.5	0.8	0.74 ( 0.17 - 1.14 )	0.42	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 1.42. Standardized Incidence Ratio (SIR) of Other Cancers Between the Potentially Exposed Compared to the Unexposed Populations of Communities Surrounding Hill Air Force Base from 1973 through 2001.

Period	Potentially Exposed Population		Unexposed Population (Standardized)		Standardized Incidence Ratio (95% CL)	p-value	Statistical Significance
	Observed Cases	Rate	Expected Cases	Rate			
1973-1977	4	2.5	4.8	3.0	0.83 ( 0.06 - 1.35 )	0.70	1
1974-1978	7	4.2	5.2	3.1	1.36 ( 0.31 - 2.10 )	0.42	1
1975-1979	8	4.7	6.0	3.5	1.34 ( 0.36 - 2.05 )	0.40	1
1976-1980	8	4.5	5.6	3.2	1.42 ( 0.38 - 2.16 )	0.32	1
1977-1981	7	3.8	5.7	3.1	1.24 ( 0.28 - 1.91 )	0.57	1
1978-1982	9	4.8	5.1	2.7	1.76 ( 0.53 - 2.65 )	0.08	1
1979-1983	7	3.6	5.1	2.6	1.36 ( 0.31 - 2.11 )	0.41	1
1980-1984	9	4.5	6.6	3.3	1.37 ( 0.41 - 2.06 )	0.35	1
1981-1985	11	5.4	7.6	3.7	1.45 ( 0.52 - 2.13 )	0.22	1
1982-1986	11	5.3	7.0	3.4	1.57 ( 0.57 - 2.32 )	0.13	1
1983-1987	11	5.2	9.1	4.3	1.21 ( 0.44 - 1.78 )	0.53	1
1984-1988	14	6.5	9.4	4.4	1.49 ( 0.64 - 2.13 )	0.14	1
1985-1989	12	5.4	9.2	4.2	1.30 ( 0.50 - 1.90 )	0.36	1
1986-1990	9	4.0	8.2	3.7	1.09 ( 0.33 - 1.65 )	0.79	1
1987-1991	10	4.4	9.4	4.1	1.06 ( 0.35 - 1.58 )	0.84	1
1988-1992	14	6.0	9.0	3.9	1.55 ( 0.66 - 2.22 )	0.10	1
1989-1993	15	6.3	10.7	4.5	1.40 ( 0.63 - 2.00 )	0.19	1
1990-1994	16	6.7	10.7	4.5	1.50 ( 0.69 - 2.11 )	0.11	1
1991-1995	16	6.6	11.3	4.6	1.41 ( 0.66 - 2.00 )	0.16	1
1992-1996	13	5.3	10.0	4.1	1.30 ( 0.53 - 1.87 )	0.35	1
1993-1997	9	3.6	11.1	4.5	0.81 ( 0.24 - 1.22 )	0.52	1
1994-1998	7	2.8	9.6	3.8	0.73 ( 0.17 - 1.13 )	0.41	1
1995-1999	5	1.9	11.5	4.5	0.43 ( 0.06 - 0.69 )	0.05	1
1996-2000	9	3.5	12.0	4.6	0.75 ( 0.23 - 1.13 )	0.38	1
1997-2001	14	5.3	14.5	5.5	0.97 ( 0.41 - 1.38 )	0.90	1
1973-2001	59	4.7	50.5	4.0	1.17 ( 0.85 - 1.44 )	0.23	1

Rates are per 100,000 population.

Statistical Significance: N/E - Not Evaluated, less than 5 cases.  
 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2. Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence		Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected	Ratio	p-value	
<b>Oral cavity and pharynx</b>							
1 1975-1988	33,400	0%	59	29.70	1.99	0.02	2
2 1979-1979	2,498	0%	3	0.08	36.77	0.77	1
3 1978-1979	8,177	100%	5	0.53	9.49	0.97	1
4 1987-1988	1,265	100%	3	0.18	17.04	1.00	1
<b>Esophagus</b>							
1 1990-2000	72,396	27%	33	13.60	2.43	0.01	2
<b>Stomach</b>							
1 2001-2001	2,423	0%	3	0.08	36.16	0.76	1
2 1990-1990	1,854	0%	3	0.09	32.78	0.83	1
3 1978-1980	8,437	0%	7	1.35	5.18	1.00	1
4 1974-1978	5,488	0%	5	0.69	7.21	1.00	1
<b>Small Intestine</b>							
1 1974-1983	11,445	0%	8	1.13	7.05	0.26	1
2 1984-1985	3,834	100%	3	0.07	45.35	0.41	1
3 1995-2001	2,329	0%	3	0.11	26.61	0.85	1
4 1985-1987	2,773	0%	2	0.06	33.92	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.

2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Colon</b>							
1 1973-1983	4,174	0%	30	10.38	2.89	0.04	2
2 1992-1999	9,975	0%	30	13.21	2.27	0.81	1
3 1981-1986	5,569	0%	21	7.80	2.69	0.88	1
4 1975-1988	1,323	0%	12	3.24	3.70	0.98	1
5 1978-1984	1,739	100%	9	1.91	4.71	0.98	1
6 1985-1985	3,498	0%	4	0.35	11.31	1.00	1
7 1998-1998	23,615	0%	12	3.83	3.14	1.00	1
<b>Rectum</b>							
1 1993-1993	36,407	26%	13	2.16	6.02	0.03	2
2 1985-1986	3,597	0%	6	0.56	10.70	0.52	1
3 1978-1980	788	0%	4	0.19	20.70	0.98	1
4 1981-1992	30,837	0%	52	30.90	1.68	0.98	1
5 1989-1998	3,923	0%	10	2.50	4.00	0.99	1
6 1983-1995	3,121	0%	6	0.99	6.04	1.00	1
<b>Anus</b>							
1 1990-1992	1,325	100%	3	0.04	70.99	0.17	1
2 1997-2000	72,240	2%	11	3.01	3.65	0.85	1
3 1988-1990	3,258	0%	2	0.07	29.45	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Liver</b>							
1 1993-1993	11,464	0%	4	0.22	17.85	0.71	1
2 1997-1997	2,026	0%	2	0.02	90.93	0.90	1
3 1994-1999	7,248	0%	6	0.89	6.71	0.98	1
4 1978-1990	1,010	0%	3	0.21	14.02	1.00	1
5 1997-1998	1,325	100%	2	0.06	34.71	1.00	1
6 1994-1996	1,587	0%	2	0.06	33.64	1.00	1
<b>Gallbladder</b>							
1 1978-1984	3,936	0%	5	0.41	12.19	0.63	1
2 1989-1989	1,115	0%	2	0.02	95.19	0.87	1
3 1991-1991	2,723	100%	2	0.04	55.85	0.99	1
4 2000-2001	1,307	0%	2	0.04	55.13	0.99	1
<b>Pancreas</b>							
1 1975-1988	19,489	0%	47	18.83	2.50	< 0.01	2
2 1976-1984	1,323	0%	6	0.60	9.95	0.62	1
3 1983-1984	7,275	0%	5	0.49	10.15	0.94	1
<b>Other Digestive System</b>							
1 1996-1999	7,100	0%	4	0.17	23.69	0.28	1
2 1997-1998	19,179	31%	4	0.21	19.36	0.46	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Larynx</b>							
1 1987-1994	19,827	0%	11	2.10	5.24	0.17	1
2 1981-1981	27,073	35%	4	0.31	12.77	0.95	1
3 1997-1998	2,420	100%	2	0.06	35.10	1.00	1
<b>Lung</b>							
1 1989-2001	32,174	0%	166	86.52	1.92	< 0.01	2
2 1997-1999	700	0%	6	0.51	11.75	0.45	1
3 1982-1983	5,286	100%	5	0.31	16.38	0.46	1
4 1991-1991	2,094	0%	4	0.22	18.30	0.86	1
5 1976-1977	1,325	100%	4	0.29	13.86	0.99	1
6 1987-1993	988	100%	8	1.57	5.08	1.00	1
<b>Other Respiratory System</b>							
1 1991-1996	802	0%	4	0.05	73.38	0.01	2
2 1987-1990	3,976	100%	5	0.16	31.49	0.02	2
3 1987-1987	44,605	0%	5	0.40	12.65	0.50	1
<b>Bones</b>							
1 1997-1999	3,936	0%	3	0.09	34.37	0.64	1
2 2000-2000	2,836	0%	2	0.04	56.78	0.97	1
3 1991-1994	18,219	10%	5	0.68	7.37	0.99	1
4 1995-1996	11,464	0%	3	0.21	14.48	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Soft Tissue</b>							
1 1996-1999	92,733	33%	20	7.63	2.62	0.73	1
2 2001-2001	1,249	0%	2	0.03	61.80	0.99	1
3 1995-2000	13,183	0%	8	1.80	4.44	1.00	1
4 1994-1996	3,482	0%	3	0.20	15.17	1.00	1
<b>Cutaneous</b>							
1 1999-1999	103,800	37%	27	10.14	2.66	0.27	1
2 1987-1989	29,336	0%	21	7.65	2.74	0.75	1
3 1992-1994	2,268	0%	6	0.67	8.94	0.81	1
4 2001-2001	2,446	0%	4	0.23	17.49	0.85	1
5 1985-1985	1,789	0%	3	0.13	23.31	0.99	1
6 1975-1976	1,337	0%	3	0.17	17.46	1.00	1
<b>Other Skin</b>							
1 1989-1989	6,867	0%	3	0.06	50.53	0.33	1
2 1980-1982	2,653	0%	3	0.06	47.11	0.38	1
3 1980-1992	840	0%	3	0.09	33.03	0.68	1
4 1991-1992	29,596	0%	5	0.50	9.94	0.80	1
5 1974-1978	7,081	72%	3	0.18	16.41	1.00	1
6 1982-1983	3,699	100%	2	0.05	41.73	1.00	1
<b>Breast</b>							
1 1993-2001	84,637	23%	384	267.68	1.44	< 0.01	2

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Cervix</b>							
1 1991-1997	4,174	0%	7	0.77	9.09	0.34	1
2 1975-1981	2,592	0%	5	0.55	9.13	0.97	1
3 1995-1995	1,230	0%	2	0.50	42.61	1.00	1
4 1981-1985	3,728	0%	4	0.42	9.45	1.00	1
<b>Uterus</b>							
1 1973-1983	16,082	0%	43	18.18	2.37	0.02	1
2 1981-1984	4,659	0%	11	1.85	5.95	0.16	1
3 1987-1988	5,562	0%	7	1.04	6.74	0.90	1
4 1998-1999	2,853	0%	5	0.57	8.77	0.99	1
<b>Ovary</b>							
1 1998-1999	7,571	0%	9	1.08	8.37	0.09	1
2 1978-1979	9,656	9%	7	0.85	8.22	0.53	1
3 1993-1995	17,201	0%	11	2.67	4.13	0.88	1
4 1991-1991	976	100%	2	0.05	40.95	1.00	1
<b>Other Female Genital</b>							
1 1990-1997	16,232	0%	8	1.32	6.05	0.47	1
2 1990-1993	8,236	0%	4	0.24	16.90	0.65	1
3 1992-1993	1,563	0%	2	0.02	102.32	0.76	1
4 1984-1989	1,459	0%	2	0.05	38.71	1.00	1
5 1990-1990	10,137	21%	2	0.07	30.50	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio		p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected				
<b>Prostate</b>								
1	1991-2001	87,748	32%	562	366.09	1.54	< 0.01	2
<b>Testis</b>								
1	1991-1994	36,003	45%	17	3.99	4.27	0.03	2
2	1988-1988	1,248	0%	2	0.03	67.01	0.98	1
3	1987-1991	2,415	0%	4	0.32	12.32	0.98	1
4	1993-1994	2,773	0%	3	0.16	19.13	1.00	1
5	1998-1998	1,232	0%	2	0.04	48.64	1.00	1
<b>Other Male Genital</b>								
1	1996-2000	5,702	40%	3	0.08	38.02	0.37	1
2	1977-1979	4,864	0%	2	0.04	47.93	0.92	1
3	1979-1985	7,863	0%	3	0.18	16.26	0.93	1
<b>Bladder</b>								
1	1994-2000	17,870	0%	34	12.80	2.66	0.03	2
2	2000-2000	61,885	35%	15	4.23	3.55	0.67	1
3	1982-2000	10,167	9%	7	1.33	5.26	1.00	1
<b>Kidney</b>								
1	1988-2001	75,412	26%	75	48.23	1.56	0.57	1
2	1974-1974	4,323	0%	4	0.21	18.74	0.74	1
3	1986-1997	1,232	0%	5	0.65	7.71	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Other Urinary System</b>							
1 1991-1999	7,146	0%	5	0.21	24.36	0.02	2
2 1980-1999	3,672	0%	2	0.02	113.83	0.53	1
3 1994-1996	8,561	49%	2	0.05	37.77	0.97	1
4 1974-1975	6,661	0%	2	0.06	36.22	0.97	1
<b>Eye</b>							
1 1985-1986	988	100%	2	0.03	66.74	0.94	1
2 2000-2001	2,239	0%	2	0.04	50.92	0.99	1
3 1994-1994	6,307	100%	2	0.04	45.75	0.99	1
4 1978-1984	843	0%	2	0.05	42.58	1.00	1
5 1998-1999	2,852	100%	2	0.05	40.87	1.00	1
<b>Brain</b>							
1 1988-1999	7,944	12%	21	5.50	3.82	0.02	1
2 1981-1983	2,853	0%	6	0.44	13.72	0.20	1
3 1997-1997	49,610	0%	10	2.60	3.85	1.00	1
<b>Other Central Nervous System</b>							
1 1991-1993	57,860	30%	4	0.34	11.66	0.64	1
2 1982-1985	5,168	11%	2	0.04	55.89	0.80	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Thyroid</b>							
1 1999-2001	39,405	16%	19	5.29	3.59	0.10	1
2 1979-1986	2,186	0%	5	0.61	8.22	0.99	1
3 1993-1994	1,889	100%	3	0.18	16.80	1.00	1
4 1983-1988	4,134	29%	5	0.73	6.83	1.00	1
<b>Other Endocrine</b>							
1 1973-1985	12,788	7%	5	0.68	7.30	0.94	1
2 1990-1991	6,702	0%	2	0.06	35.21	0.99	1
3 1993-1994	5,389	0%	2	0.06	35.03	0.99	1
<b>Hodgkin's Lymphoma</b>							
1 1978-1980	5,694	0%	4	0.21	19.43	0.63	1
2 1995-1997	7,268	0%	5	0.47	10.66	0.84	1
3 1984-1984	6,129	0%	3	0.11	26.19	0.93	1
<b>Non-Hodgkin's Lymphoma</b>							
1 1990-1990	1,067	0%	4	0.11	35.50	0.19	1
2 1991-1992	3,059	100%	5	0.44	11.30	0.88	1
3 1995-2001	1,739	100%	7	1.06	6.60	0.93	1
4 1983-1984	2,470	0%	5	0.50	10.43	0.96	1
5 1993-1995	23,961	0%	20	7.70	2.60	0.97	1
6 1998-1999	9,847	33%	9	2.05	4.40	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Multiple Myeloma</b>							
1 1988-1989	8,902	0%	7	0.65	10.84	0.15	1
2 1999-2001	6,006	13%	6	0.61	9.80	0.57	1
3 1982-1983	5,177	0%	4	0.28	14.20	0.93	1
4 1993-1995	1,590	100%	3	0.15	20.64	0.99	1
<b>Lymphocytic Leukemia</b>							
1 1992-1993	41,841	0%	20	3.23	6.19	< 0.01	2
<b>Myeloid Leukemia</b>							
1 1992-1992	2,109	0%	3	0.07	44.46	0.56	1
2 1993-1995	82,601	21%	22	8.66	2.54	0.77	1
3 2000-2001	10,718	0%	6	0.82	7.32	0.95	1
<b>Monocytic Leukemia</b>							
1 1997-1997	12,790	0%	2	0.05	42.85	0.89	1
2 1991-1992	13,060	0%	2	0.06	33.58	0.95	1
3 2000-2001	21,847	0%	2	0.06	22.69	0.99	1
<b>Other Leukemia</b>							
1 1982-1990	2,620	0%	5	0.23	21.46	0.08	1
2 1994-1998	5,168	11%	4	0.24	16.33	0.73	1
3 1984-1984	3,543	0%	2	0.02	82.29	0.89	1
4 1979-1981	3,324	100%	2	0.06	34.85	1.00	1
5 1986-1987	3,385	0%	2	0.06	32.07	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

Table 2 (Continued). Clusters of Cancers Identified by the Scan Statistic in the Communities Surrounding Hill Air Force Base, Utah from 1973 through 2001.

Cluster Period	Population		Number of Cases		Standardized Incidence Ratio	p-value	Statistical Significance
	in the Cluster	Potentially Exposed	in cluster	Expected			
<b>Other Cancers</b>							
1 1987-1987	7,335	0%	6	0.47	12.73	0.28	1
2 1975-1979	1,150	0%	6	0.43	11.73	0.80	1
3 1997-2001	21,371	15%	16	5.05	3.17	0.82	1
4 1988-1994	7,667	0%	13	3.54	3.67	0.85	1
5 1985-1985	37,626	23%	8	1.47	5.43	0.94	1
6 1999-1999	5,629	0%	4	0.36	11.20	1.00	1
7 1984-1989	3,069	24%	5	0.64	7.85	1.00	1
8 1978-1984	1,105	0%	5	0.64	7.81	1.00	1
9 2000-2000	4,978	0%	4	0.38	10.63	1.00	1
10 1975-1975	1,154	0%	2	0.04	47.95	1.00	1

Rates are per 100,000 population.

Statistical Significance: 1 - Not Statistically Significant.  
 2 - Statistically Significant.

## **Appendix B**

### **Direct Standardization and Standardized Incidence Ratio Calculations**

### Direct Standardization and Standardized Incidence Ratio Calculations

Let:	$X_{E:c,y,a,s,r,f}$	Denote the count of cancer cases assigned to census block group 'c' in the exposed population (E), year 'y' within the study period (1973-2001), 5-year age group 'a,' sex 's,' residential tenure status 'r,' and familial history for cancer status 'f' for each cancer type.
	$X_{U:c,y,a,s,r,f}$	Denote the count of cancer cases assigned to census block group 'c' in the unexposed population (U), year 'y' within the study period (1973-2001), 5-year age group 'a,' sex 's,' residential tenure status 'r,' and familial history for cancer status 'f' for each cancer type.
	$P_{E:c,y,a,s,r,f}$	Denote the population count for census block group 'c' in the exposed population (E), year 'y' within the study period (1973-2001), 5-year age group 'a,' sex 's,' residential tenure status 'r,' and familial history for cancer status 'f' for each cancer type.
	$P_{U:c,y,a,s,r,f}$	Denote the population count for census block group 'c' in the unexposed population (U), year 'y' within the study period (1973-2001), 5-year age group 'a,' sex 's,' residential tenure status 'r,' and familial history for cancer status 'f' for each cancer type.

Tables of this data were created using ArcView GIS software (version 9.0) and imported into Microsoft Access software (version 2002).

Re-proportion the cancer case and population counts: Only the study period inclusive SIR was calculated. Period stratified case and population counts for the exposed and unexposed population areas were calculated from summation of the yearly census block group counts.

The following calculations were made using the query "group by" functionality in Microsoft Access. The cancers were filtered for a specific cancer type. Each cancer type was in turn evaluated.

$$X_{E:a,s,r,f} = \sum_c \sum_y X_{E:c,y,a,s,r,f}$$

$$X_{U:a,s,r,f} = \sum_c \sum_y X_{U:c,y,a,s,r,f}$$

$$P_{E:a,s,r,f} = \sum_c \sum_y P_{E:c,y,a,s,r,f}$$

$$P_{U:a,s,r,f} = \sum_c \sum_y P_{U:c,y,a,s,r,f}$$

$$P_E = \sum_c \sum_y \sum_r \sum_f \sum_a \sum_s P_{E:c,y,a,s,r,f}$$

$$P_U = \sum_c \sum_y \sum_r \sum_f \sum_a \sum_s P_{U:c,y,a,s,r,f}$$

- Where:  $X_{E:a,s,r,f}$  is the count of cancer cases for the age, sex, residential history and familial history strata in the exposed population for the study period (1973-2001).
- $X_{U:a,s,r,f}$  is the count of cancer cases for the age, sex, residential history status and familial history strata in the unexposed population for the study period (1973-2001).
- $P_{E:a,s,r,f}$  is the population count for the age, sex, residential history and familial history strata in the exposed population for the study period (1973-2001).
- $P_{U:a,s,r,f}$  is the population count for the age, sex, residential history status and familial history strata in the unexposed population for the study period (1973-2001).
- $P_E$  is the total population count (person years) for the exposed population for the study period (1973-2001).  $P_E = 1,251,502$  person years.
- $P_U$  is the total population count (person years) for the unexposed population for the study period (1973-2001).  $P_U = 4,184,131$  person years.

Direct Standardized Cancer Incidence Rate: The incidence of cancer by type in the exposed population (the combined population of all of the exposed census tracts) were standardized to the incidence of cancer in the unexposed population using a direct standardization method.

$$X_S = \left( \sum_{a,s,r,f} \left( X_{E:a,s,r,f} \frac{P_{U:a,s,r,f}}{P_{E:a,s,r,f}} \right) \right) \left( \frac{P_E}{P_U} \right)$$

$$X_E = \left( \sum_{a,s,r,f} \left( X_{U:a,s,r,f} \right) \right) \left( \frac{P_E}{P_U} \right)$$

- Where:  $X_S$  is the standardized cancer incidence count for the exposed population for the study period, standardized to the unexposed population and re-proportioned to the exposed population. This is the standardized observed count of cancer incidence.

$X_E$  is the cancer incidence count for the unexposed population re-proportioned to the exposed population. Since this method is standardizing to the unexposed population, the cancer incidence count does not need to be adjusted. This is the standardized expected count of cancer incidence.

Standardized Incidence Ratio: Standardized incidence ratio (SIR) was calculated for each cancer type for the study period from the standardized incidence count for the exposed population and the proportional incidence count for the unexposed population (the expected incidence count for the exposed population). The lower and upper confidence limits were obtained using Byar's method (Berslow and Day 1987, Regidor et. al. 1993). The calculations were made using Microsoft Excel software (version 2002).

$$SIR = \frac{X_S}{X_E}$$

$$\underline{SIR} = \frac{X_S}{X_E} \left( 1 - \left( \frac{1}{9X_S} \right) - \left( \frac{Z_\alpha}{3\sqrt{X_S}} \right) \right)^3$$

$$\overline{SIR} = \frac{(X_S + 1)}{X_E} \left( 1 - \left( \frac{1}{9(X_S + 1)} \right) + \left( \frac{Z_\alpha}{3\sqrt{X_S + 1}} \right) \right)^3$$

Where:  $Z_\alpha$  for the 95% confidence interval is 1.96.

## **Appendix C**

### **An Investigation of Cancer Incidence in Sunset and Clinton, Utah, 1973-1999**