An Assessment of the Feasibility of a Study of Cancer among Former Employees of the IBM Facility in Endicott, New York

Final Draft Report

by

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Executive Summary

This report addresses the question of whether it is scientifically feasible to conduct a cancer study among former employees of the IBM facility in Endicott, NY. The findings are intended to inform decision-makers outside the National Institute for Occupational Safety and Health (NIOSH) who would determine whether or not such a study should be performed.

Most cancer studies among employees of a company are based on existing records; thus, this feasibility assessment focused on a review of relevant, existing company personnel and industrial hygiene records. NIOSH determined the availability of information needed to assemble a study cohort (group) of former employees and examined whether historical exposures could be estimated from work history and exposure information or whether only surrogates of exposure (e.g., duration of employment, employment in certain departments) could be ascertained.

The records review indicates that personnel data are available in electronic format for employees who worked after 1964. The electronic personnel data includes detailed work history information for employees who worked in 1984 or later. For employees who stopped working prior to 1984, work history information is limited to the job held at the end of each calendar year. Limited industrial hygiene data are available in both hard copy and electronic format. The majority of the industrial hygiene data is from 1980 or later.

Based on the available information, a retrospective cohort study of cancer mortality and cancer incidence is scientifically feasible. The electronic personnel data are sufficient to establish a cohort of former employees who worked for at least one year after 1964. Such a cohort could be matched to national death data and state cancer registry data to determine cancer deaths and cancer occurrences. Then, the rate of cancer among employees could be compared to the rate of cancer in the general population. The rate of cancer among employees who were potentially exposed to chemicals, or who worked in certain department(s), could also be evaluated. For some specific chemicals or groups of chemicals, it may also be possible to develop qualitative exposure categories (e.g., higher versus lower).

A retrospective cohort study of cancer among former employees would be able to evaluate whether or not employees are more likely to develop or die of certain cancers than the general population. This type of cancer study would also be able to evaluate whether or not former employees who had potential exposure to chemicals, or who worked in some departments, are more likely to develop or die of certain cancers than the general population or other workers.

Determining the degree that cancers are work-related may be limited by lack of data on other factors known to contribute to the development of cancer. For example, key data may not be available on employees' medical histories, lifestyle choices (e.g., smoking), and environmental exposures to chemicals outside the job. Despite this limitation, it still may be possible to conclude that a specific type of cancer may be work-related if the extent of cancer observed among employees is greater than what can be explained by other risk factors. If questions remain about the contribution of workplace exposures to cancer, a follow-up nested case-control study that would allow a detailed comparison of former workers with cancer to a group of workers without cancer could be considered. In such a study, it may be possible to collect and analyze additional data on workplace exposures and other risk factors (e.g., smoking) to better distinguish the contribution of workplace exposures from the contribution of non-work-related factors.

In summary, a retrospective cohort study of cancer would have value in addressing the community's concern about the risk of cancer among former IBM employees. Such a study is scientifically feasible. However, the overall feasibility of a study also depends on the cooperation of IBM and the availability of resources. If a study is conducted, the study researchers would need access to relevant records at IBM. A study would also require considerable resources, costing an estimated $3.1 million.

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Introduction

This report describes the feasibility of conducting a cancer study among former employees of the IBM facility in Endicott, NY. The goals of this feasibility study were to 1) determine if there are adequate records for identifying and constructing a study cohort of former employees, 2) evaluate the work history and exposure records from IBM to determine if historical exposures could be estimated either quantitatively or qualitatively or whether only surrogates of exposure (e.g., duration of employment, employment in certain departments) could be ascertained, 3) based on 1 and 2, determine if it is scientifically feasible to perform a cancer study among former employees of the IBM facility in Endicott and 4) if scientifically feasible, provide recommendations on how such a study might be conducted.

Methods

Most cancer studies among employees of a company are conducted based on existing records; thus, this feasibility assessment focused on the question of whether relevant company records exist. Initially, NIOSH representatives met with IBM representatives to learn about the Endicott facility and the available data. NIOSH representatives subsequently requested, received, and evaluated electronic personnel and work history data for former IBM employees at Endicott. NIOSH awarded a contract to Battelle to 1) identify the main exposures of concern at the plant given the primary health outcome of concern is cancer, 2) identify and evaluate the quantity and quality of the data on the potential exposures at the plant, 3) provide an expert opinion on whether or not exposures could be estimated for an epidemiologic cancer study or whether only surrogates of exposures such as duration of employment or area(s) in which employees worked would be available, and 4) provide recommendations for assessing exposures if a cancer study among former employees is conducted.

Selected industrial hygiene data were reviewed at the IBM offices in Somers, NY. Battelle's assessment of the feasibility of evaluating exposures for a cancer study among former employees and recommendations are provided in Battelle's attached final report entitled "Feasibility Assessment for Exposure Assessment for a Study of Cancer in the Electronics Industry". NIOSH did not obtain or review records from Endicott Interconnect Technology (E.I.T.), which bought the Microelectronics Division of the Endicott facility in November 2002, because the latency period for most cancers (i.e., the time from first exposure to a cancer-causing agent and clinical recognition of the disease) is 10 to 20 years, or longer. The key findings, conclusions and recommendations in this report are based on an evaluation of available records by NIOSH and Battelle investigators.

History of the Endicott Facility

The Endicott facility has been operating since 1911 and is the birthplace of IBM. The facility was originally part of IBM's predecessor, the Computing-Tabulating-Recording Company. Over the years, a variety of products were assembled at the Endicott facility including clocks, tabulating machines, typewriters, guns, printers, and automated machines for banks. In the 1960s, the facility began manufacturing printed circuit boards. By the mid-1980s, representatives of IBM estimated that approximately 30%-50% of the manufacturing workforce was involved in the production of circuit boards and chip packaging and the remainder was involved in the assembly of printers and bank machines. The major processes in the production of circuit boards are described in Appendix III. The solvents used in the circuit board manufacturing processes changed over time. Chlorinated solvents were phased out starting in the 1980s.

Computer chips were not produced at the Endicott facility. The circuit boards and chip packaging produced at Endicott where shipped to another location where the chips were mounted.

The Microelectronics Division of IBM's Endicott facility was sold to Endicott Interconnect Technologies, Inc. (EIT) in 2002. EIT retained approximately 1800 former IBM employees who continued to manufacture chip packaging, printed circuit boards, and electro-mechanical equipment.

Findings

Ability to identify former employees

In retrospective cohort studies of the work-relatedness of cancer, the cohort (study population) is usually identified from company personnel records. NIOSH investigators evaluated two primary sources of personnel data: electronic "year end" personnel files which provide a snapshot of IBM employees at the end of each year from 1965 through 2003 and an electronic work history file which provides information on IBM employees in 1984 or later. NIOSH investigators did not identify hard copy personnel records during the feasibility assessment. However, when representatives of IBM reviewed a previous version of this report for trade secret information and technical accuracy, they indicated hard copy personnel records are available for some employees. NIOSH investigators did not attempt to locate or obtain personnel records for contractors who worked at the IBM facility at Endicott since the number of contractors was probably small relative to the number of IBM employees.

Former IBM workers employed in 1965 or later can be identified from the electronic files with one notable exception. Employees who stopped working prior to 1984 and who were not actively employed at the end of a calendar year are not included, excluding some employees who worked for less than one year prior to 1984. The absence of records for some short-term workers is not a serious limitation. Cancer studies among employees of a company commonly exclude short-term workers since including these workers may not significantly improve (and may even reduce) the ability to detect an association between exposure and cancer and also may significantly increase the cost of the study. This is especially true when a large proportion of the workforce consists of short-term employees. Short-term workers may differ from other workers with respect to baseline health and risk factors such as smoking (Kolstad and Olsen, 1999) and are potentially exposed to workplace chemicals for a relatively short period of time. Employees who worked more than one year but had breaks in their employment at the end of each calendar year are not included in the electronic files; however, it is unlikely that there are large numbers of such workers.

We were not able to confirm whether the electronic files included all employees who worked at the end of a year in 1965 or later. We did not explore whether other data on former employees exist that could be used for this purpose because the scientific feasibility of a study does not depend upon the availability of such data. However, we compared the work history file, which provided information on individuals employed in 1984 or later, with the "year end" personnel files to evaluate the completeness of the work history file. We expected the work history file, which provided information on individuals employed in 1984 or later, to include all workers who were actively employed in the "year end" personnel files for 1984 or later at locations in Endicott associated with manufacturing. The work history file included most (~96%), but not all, of these workers.

Ability to identify former employees who had cancer

There are two primary methods for identifying former employees who have had cancer – matching the study population with national death data to identify individuals who died of cancer and matching the study population with cancer registry data to identify individuals who were diagnosed with cancer. The study population is matched with national death data and cancer registry data using name, social security number, and date of birth. We evaluated the quality of these data in the electronic files of former employees to determine if these data could be used to identify cancers through matching with national death data and cancer registry data. The quality of these data appears to be good. Only 0.2% of the records in the electronic personnel files had an invalid social security number. Date of birth was not available for 0.4% of the employees with a valid social security number who worked at least one year after 1964. More than one date of birth was listed for 1.7% of these employees.

Occurrences of cancer also can be identified by contacting former employees and the next-of-kin of deceased employees. There are significant disadvantages to this approach; it is labor-intensive and costly. In addition, this approach is successful only if most employees (or their next-of-kin) are located and choose to participate. Locating former employees and identifying and locating the next-of-kin of deceased employees can be difficult. However, this approach may be preferable for cancers that have a good survival rate (since many of these cancers would be missed by only looking at cancer deaths) if many members of the study population reside in a state without a cancer registry. The cancer registry approach would be preferable in a study of former employees of the IBM facility in Endicott. Most former employees probably reside in New York, Pennsylvania (which is less than 10 miles from Endicott), or Florida (where some former employees may have moved after retiring). Although we did not trace former workers to determine their current address, most employees resided in these states according to the address information in the electronic files obtained from IBM (86% resided in NY, 6% in FL, and 2% in PA). Cancer registry data are available for New York, Florida, and Pennsylvania beginning in 1976, 1981, and 1985, respectively.

Although some company records such as medical records may contain information on employees who have had cancer, it is unlikely these records would capture all such employees. Therefore, we did not explore the possibility of using company records to identify employees who have had cancer.

Determining when (and for how long) employees worked at IBM

Employees who stopped working prior to 1984 are in the "year end" personnel files but not in the work history file. It is not possible to determine from the "year end" personnel files exactly when and how long these employees worked at IBM. The "year end" personnel files indicate whether these individuals were working at the end of each year, but these files do not provide information on whether these individuals were working at IBM at other times during the year. The records also do not provide information on exactly how long these employees worked. This can only be roughly estimated by searching all "year end" personnel files for an employee. For example, if an employee is included in the 1980, 1981, and 1982 "year end" personnel files, we may assume that the employee worked between 2 and 4 years. This will not always be correct since this method assumes that employees did not have any breaks in employment; however, it is not a fatal flaw. This method also misses employment that occurred prior to 1965 when the "year end" personnel files begin.

The data for employees employed in 1984 or later do not have these limitations. Detailed work history information including the jobs an employee held and the dates in which these jobs were held are available for employees in 1984 or later. However, the detailed work history data may not include all jobs held by these workers prior to 1984. On average, most (90%) but not all of the departments in which an employee worked according to the "year end" personnel files prior to 1984 are in the work history file.

We identified 28,000 employees in the electronic files who worked at least one year after 1964 at locations in Endicott associated with manufacturing (see Appendix IV). The majority (~87%) of these 28,000 employees are also in the detailed work history file. Duration of employment was calculated for these employees from the data in the work history file. Duration of employment was estimated for the remaining workers who only worked prior to 1984. The true duration of employment for some of these workers may be less than one year. Duration of employment is commonly used as a crude surrogate of exposure in cancer studies among employees of a company, especially when historical exposures cannot be estimated.

Ability to determine the area or department in which employees worked

We were also interested in learning whether we could determine where employees worked since many employees may have worked in areas where little, if any, exposure to chemicals occurred. The department(s) in which an employee worked can be determined from the electronic personnel data with a few exceptions. First, the electronic personnel data do not include the department(s) in which some employees worked prior to 1965. Second, the "year end" personnel files provide only the department in which an employee worked at the end of the year. Information on other departments in which an employee worked during the year is not provided. We estimate that the "year end" personnel files, on average, miss approximately 21% of the departments in which an employee worked. This estimate is based on a comparison of the "year end" personnel files and the work history file for employees in both files. Although this is a limitation, the duration of employment in these departments missing from the files (and the potential for exposure to chemicals in these departments) would be short. Third, "year end" personnel files prior to 1975 include department codes, but not the corresponding department name. To the extent that the department codes did not change over time, the department names corresponding to almost all (over 99.9%) of these department codes can be determined from the information in the "year end" personnel files for later years and the work history file for workers employed in 1984 or later. Finally, there may be situations where the department does not accurately reflect the physical location at which an employee worked (e.g., a manager or secretary for a department may not always physically work in the same location as the rest of the employees in the department). Another challenge in determining the department(s) in which employees worked is the sheer number of department codes. Over 3,800 department codes appear in the work history data for the 28,000 employees who worked for one or more years after 1964.

Identifying available exposure data and potential exposures

The exposure data were evaluated by Battelle to determine if exposures could be estimated for an epidemiologic study. They did not evaluate the data to determine the quality of IBM's industrial hygiene program. Battelle identified two primary sources of industrial hygiene (i.e., exposure) data – hard copy industrial hygiene records and an electronic database called the CHEMS database. The hard copy industrial hygiene records were organized by department and contained process descriptions and industrial hygiene sampling results. Some limited data from the mid to late 1970s were included in these records, but the majority of the data were for 1980 or later. The CHEMS database included industrial hygiene sampling data from 1980 through 2004. The CHEMS database also included process descriptions but we did not request access to these process descriptions for the purposes of this feasibility assessment.

Battelle and NIOSH investigators reviewed essentially all of the hard copy industrial hygiene records for 1980 and later and approximately two-thirds of the hard copy industrial hygiene records prior to 1980. These data were compared to summary data from the CHEMS database.

The industrial hygiene data in the hard copy industrial hygiene records and CHEMS database were sparse. There was no or minimal industrial hygiene information for the majority of the departments. This is not surprising since there may have been little potential for exposure to chemicals in many departments (e.g., sales). However, even the departments with the largest amount of sampling data did not have consistent yearly sampling data. When sampling data were present, the samples were often taken either due to employee complaints or after modifications to equipment.

Neither the hard copy records nor the CHEMS database contained all of the industrial hygiene sampling data. Of the 196 departments that had industrial hygiene sampling data, 123 had sampling data in both the hard copy records and the CHEMS database, 33 had sampling data in the hard copy records only, and 40 had sampling data in the CHEMS database only. An additional 48 departments had no sampling data, but had process descriptions in the hard copy records that mentioned chemicals.

Table 6A in Battelle's attached report provides information on the chemicals mentioned in the hard copy industrial hygiene records by department. Table 5 of Battelle's attached report provides information on the potential carcinogenicity of these chemicals.

The presence of sampling results for a chemical probably indicates that the chemical was used in the department. As shown in Table 6A of Battelle's attached report, many of the sampling results were non-detectable.

Supplementary data sources that were identified that may be useful in an exposure assessment effort include 1) annual lists of the chemicals that each department was authorized to use for the years 1984 and 1986 through 1999, 2) annual lists of chemicals that departments had requested to purchase beginning in 1999, 3) limited information from IBM on when specific chemicals were last used in the circuit board manufacturing process, and 4) IBM's Environmental, Chemical and Occupational Evaluation System (ECHOES) database. These supplemental data sources were not fully evaluated for the purposes of this feasibility assessment. Battelle investigators evaluated the data in the CHEMS database instead of the ECHOES database because the CHEMS database covered a longer time period and served as the source of the industrial hygiene sampling data in the ECHOES database. In addition, Battelle and NIOSH investigators weren't able to evaluate the ECHOES database due to technical difficulties. Nonetheless, some limitations of these supplemental data sources were identified. For example, IBM indicated that a chemical may be authorized for use by a given department but not be used by that department. In addition, many of the records in the lists of chemicals that departments had requested to purchase were missing department information.

Ability to determine the potential exposures to individual employees

Battelle determined potential exposure to individual employees using two methods. In the first method, an occupational epidemiologist with industrial hygiene experience determined the potential for wet process type exposures and machining type exposures based on the division, department, and position listed for all jobs which employees held. Wet process type exposures represent the numerous chemical solutions used in etching, plating and laminating circuit boards and their substrates. Machining type exposures represent the exposures frequently encountered in fabrication and assembly procedures. These assignments were made using expert judgment without reference to the industrial hygiene data. Using this method, Battelle estimated that 1,881 (6.7%) of 28,000 former employees who worked for at least one year after 1964 had a "high" potential, 4,972 (17.8%) had a "moderate" potential," 3,413 (12.2%) had a "low" potential and 17,734 (63.3%) had "no" potential for exposures associated with wet processes; 2,419 (8.6%) had a "high" potential, 5,082 (18.2%) had a "moderate" potential, 3,040 (10.9%) had a "low" potential and 17,459 (62.4%) had "no" potential for exposures associated with machining.

In the second method, Battelle linked data from the hard copy industrial hygiene records with data from the electronic personnel and work history files to determine potential exposures for individual employees based on the departments(s) in which they worked and the chemicals mentioned in the industrial hygiene records for those departments (regardless of the time period in which the chemical was mentioned in these records and the sampling results). This method did not use data from the CHEMS database because these data were not made available to us until after Battelle completed this work. Using this method, Battelle estimated that 8,631 (30.8%) of the 28,000 former employees who were employed for at least one year after 1964 worked in departments where known carcinogens were used, 1,663 (5.9%) worked in departments where suspected carcinogens were used, 198 (0.7%) worked in departments were possible carcinogens were used, 1,357 (4.8%) worked in departments where other chemicals were used, and 16,151 (57.7%) worked in departments where no chemicals were used. To obtain a more accurate picture of the potential exposures to individual employees using this method, the time period would need to be taken into account since the specific chemicals used in a department changed over time.

Battelle compared the assessment of potential exposure based on these two methods to evaluate the usefulness of the work history information for estimating exposure and to evaluate the potential for missing exposure information based on the hard copy industrial hygiene records. Some differences could be expected in these two methods for rating the potential for exposures since they are based on different information. The first method depended on the division, department, and position associated with each job whereas the second method was based only on department (linked to the industrial hygiene records). We expected jobs with wet process type exposures to involve a larger number of chemicals and a higher probability of potentially carcinogenic exposures. We also expected jobs that did not involve wet process type exposures or machining type exposures to be the least likely to involve chemical exposures. When the two methods were compared (see pages 18-19 and tables 12, 13, and 14 in Battelle's attached report), 74.9% of the jobs categorized as having a "high" potential for wet process type exposures versus 15.6% of all jobs were in departments which had potential exposures to known or suspected human carcinogens; 23.3% of the jobs categorized as having a high potential for wet process type exposures versus 81.0% of all jobs were associated with departments for which there was no industrial hygiene data. These data support our assumption that jobs with wet process type exposures involve a larger number of chemicals and a higher probability of potentially carcinogenic exposures. However, these data also demonstrate the potential for missing information in the hard copy industrial hygiene records. Only 3.7% of the jobs categorized as having no potential for wet process type exposures or machining type exposures were in departments with the potential for exposure to known or suspected human carcinogens; 94.5% of these jobs were in departments with no industrial hygiene data. These data support our assumption that jobs that did not involve wet process type exposures or machining type exposures would be the least likely to involve chemical exposures.

Availability of information, other than employment, that may influence cancer risk

The risk of many cancers varies with age, gender, and race. These data are available in the electronic personnel data obtained from IBM. The electronic personnel files included multiple records containing this information for the same employee. The information on gender and race was conflicting for approximately 4-5% of the 28,000 employees who worked for at least one year after 1964.

The risk of cancer can also vary according to socioeconomic status, smoking status, and family history of cancer. These data are not in the records that we reviewed but may be available in other company records (e.g., smoking data may be in the medical records). We did not evaluate the availability of information on the potential for environmental exposure to chemicals outside the IBM facility.

Determine if the study population is large enough to detect an increased risk of cancer if an increased risk exists

We estimated that 28,000 employees worked at least one year after 1964. Of these 28,000 employees, Battelle estimated that over 10,000 employees worked in departments that used known or suspected carcinogens. However, this estimate is based only on information in the hard copy industrial hygiene records. It does not take into account 31 additional departments with the potential for exposure to chemicals that were identified from the electronic industrial hygiene data (i.e., the CHEMS database). The Battelle estimate also assumes that the chemicals used in each department did not change over time because determining the date that chemicals were first used and last used in each department was beyond the scope of this feasibility study. Yet, we know that the specific chemicals used in a department did indeed change over time.

Finally, we do not know how many of the employees who worked in departments that used known or suspected carcinogens were actually exposed to these chemicals. Many of the exposure levels were non-detectable which may indicate that the potential for inhalation exposure was minimal. The potential for dermal exposure was not evaluated. Thus, the estimate is crude and the actual number of employees who worked for at least one year after 1964 who were potentially exposed to known or suspected carcinogens may be greater or much smaller. Based on the information in both the hard copy industrial hygiene records and the CHEMS database, we estimate that 16,565 (59%) of the 28,000 employees who worked at least one year after 1964 worked in departments that used chemieals.

Because of the data limitations on the number of employees who were potentially exposed to known or suspected carcinogens, we evaluated whether the estimated number of employees who worked in departments that used chemicals was large enough to detect an increased risk of cancer, if an increased risk exists. This was done for several specific cancers including kidney cancer and testicular cancer (because an increased risk of these cancers was observed among Endicott residents living in the area where volatile organic compounds have been found in soil vapor (New York State Department of Health, 2005)) as well as lung cancer, leukemia, and liver cancer.

Based on U.S. general population mortality rates, the expected number of deaths from lung cancer, leukemia, kidney cancer, liver cancer, and testicular cancer among employees who worked in departments that used chemicals is 290, 30, 21, 22, and 1, respectively. We estimate that a study would have a statistical power of 80% or more to detect a 20% increase in deaths from lung cancer, a 50% increase in deaths from leukemia, a 60% increase in deaths from kidney cancer, a 70% increase in deaths from liver cancer, and a 400% increase in deaths from testicular cancer among these workers compared to the general population of the United States.

Based on U.S. general population cancer incidence rates, the expected number of incident lung cancers, leukemias, kidney cancers, liver cancers, and testicular cancers among workers who worked in departments that used chemicals is 313, 46, 54, 27, and 13, respectively. We estimate that a study would have a statistical power of 80% or more to detect a 20% increase in lung cancer incidence, a 50% increase in leukemia incidence, a 40% increase in kidney cancer incidence, a 60% increase in liver cancer incidence, and a 80% increase in testicular cancer incidence among these workers compared to the general population of the United States. More detailed information is provided in Appendix V.

Conclusions

Feasibility of a cancer study

Based on the findings, a retrospective cohort study of cancer mortality and cancer incidence is scientifically feasible. The available records are sufficient to establish a cohort of former employees who worked for at least one year after 1964. Such a cohort could be matched to national death data and state cancer registry data to determine cancer deaths and occurrences of cancer. It does not appear feasible to include workers who worked less than one year unless the cohort is limited to employees who worked in 1984 or later since these employees are not captured in the electronic personnel records prior to 1984.

Feasibility of assessing exposure using surrogates of exposure

It appears scientifically feasible to identify workers potentially exposed to chemicals based on the department(s) in which they worked after 1964. Departments in which chemicals were used can be identified from the industrial hygiene records. These data could be supplemented with ancillary data such as data on requests to purchase chemicals by department and with interviews with former employees and industrial hygienists. At the most general level, the rate of cancer mortality and cancer incidence among former employees who were potentially exposed to chemicals could be compared with the rate among the general population or other employees. It also appears feasible to evaluate the risk of cancer mortality and cancer incidence according to the duration of exposure. There may be some misclassification if workers who were last employed prior to 1984 are included in this analysis. The amount of the misclassification is expected to be small, however, since the majority of the cohort is likely to have worked in 1984 or later, only jobs held for less than one year for employees who worked only prior to 1984 would be missed, and the duration of other jobs held by employees who worked only prior to 1984 could be estimated to within one year.

It may also be possible to determine whether former employees were potentially exposed to some specific chemicals or groups of chemicals based on the department(s) where they worked.

The current feasibility assessment provides preliminary information on some of the specific chemicals that were used in various departments but does not provide information on when these chemicals were first and last used. This information would have to be elucidated to determine whether employees were potentially exposed to specific chemicals or groups of chemicals based on the department(s) where they worked. An alternative would be to determine whether employees were potentially exposed to groups of chemicals based on unique combinations of division, department and position in a manner analogous to that used by Herrick and colleagues in a study of three other IBM facilities (Herrick et al., 2005). In that study, unique combinations of division, department, and position were used to assign workers to workgroups. Qualitative exposure categories for groups of agents such as solvents were then developed for each workgroup. Another alternative would be to base exposure assignments on related processes since departments appeared to be organized around certain processes or process lines. These alternatives may be less specific than assigning exposure (yes/no) based on department, but may avoid misclassification due to the limited information available for some departments.

It does not appear scientifically feasible to determine potential exposures on an individual basis prior to 1965 because the available data do not capture jobs held prior to 1965 for all former employees.

Feasibility of a qualitative exposure assessment

It may be possible for some specific chemicals or groups of chemicals to assign qualitative levels of exposure (e.g., high versus low) based on the time period of exposure, information on the process, and frequency of potential exposure.

Feasibility of a quantitative exposure assessment

We also evaluated the scientific feasibility of developing quantitative estimates of exposure since surrogates of exposure, (e.g., duration of exposure), and even qualitative estimates of exposure (e.g., high, medium, low) are crude and can mask true associations between exposure and cancer risk. It does not appear scientifically feasible to develop quantitative estimates of exposure for former employees because of the limited quantity of industrial hygiene sampling data.

Feasibility of evaluating other health outcomes

We did not evaluate the scientific feasibility of linking a cohort of former employees to other national or state databases to evaluate other health outcomes (e.g., birth defects among children of former employees).

Questions that would be answered by a retrospective cohort study of cancer

A retrospective cohort study of cancer among former employees would be able to evaluate whether employees are more likely to develop or die of certain cancers than the general population. A study would also be able to evaluate whether former employees who had potential exposure to chemicals or who worked in some departments are more likely to develop or die of certain cancers than the general population or other workers.

However, this type of cancer study would also have limitations that may reduce the ability of the study to answer the question of whether or not any identified excess of cancer was work-related. Some of these limitations are:

- Key data probably are not available in existing company records on employees' medical histories, lifestyle choices (such as smoking), and environmental exposures to chemicals outside the job, which are factors that may be needed to determine whether or not cancers are work-related.

- The industrial hygiene data are sparse. Using surrogates of exposure, which may be necessary, could hamper a study's ability to detect an exposure-response relationship.

Despite these limitations, the findings of a study could be evaluated to make some conclusions about whether a specific type of cancer, if elevated among the cohort, is likely to be work-related. Epidemiologists routinely use established criteria such as those proposed by Hill (1965) for causal inference. For example, if an increase in lung cancer is observed, the researchers may conclude that the observed increase in lung cancer is likely to be work-related (even in the absence of smoking data) if the magnitude of the increase is larger than the magnitude that can be explained by smoking (Siemiatycki J, et al., 1988), an exposure-response relationship is observed, lung cancer is biologically plausible, and if the findings are consistent with other research. Although quantitative exposure estimates do not appear scientifically feasible, it may be possible to develop qualitative exposure estimates or surrogates of exposure such as duration of exposure that could be used to assess exposure-response relationships. If an increase in a specific cancer was observed for which questions remained about the contribution of workplace exposures to chemicals versus non-occupational risk factors for the cancer, a follow-up nested case control study could be conducted. In such a follow-up study, additional details could be obtained on risk factors, such as smoking, and exposure to overcome some of the limitations of a retrospective cohort study of cancer. These data could then be used to compare former workers with cancer to a group of workers without cancer.

This type of study may not answer the following questions:

- Are certain subsets of former employees who were exposed to a specific chemical or chemicals at an increased risk of cancer? Industrial hygiene records are not available for the majority of the departments within the plant, and most of the former employees who were exposed to chemicals at work were probably exposed to many different chemicals. This means that if a higher-than-expected occurrence of cancer exists only in a subset of workers who were exposed to a specific chemical or chemicals, the study might not detect it. It also means that it may not be possible to link an observed increase in cancer to exposure to a specific chemical.

- What level of exposure to a specific chemical is associated with an increase in the risk of cancer? Because the industrial hygiene data are sparse, a study is also unlikely to provide information on the level of exposure to a specific chemical associated with an increase in the risk of cancer, if an increased risk of cancer exists.

- Do former employees have a statistically significantly increased risk for relatively rare cancers? The study would have limited ability to detect small, statistically significant increases in relatively rare cancers.

Recommendations for how a study of cancer might be conducted

Identifying the cohort

If a cancer study is conducted, we recommend constructing a cohort of former employees from IBM's electronic personnel data. Several factors should be considered when deciding the time period to include in the study. Some of these factors are summarized in Table A.

We also recommend exploring the availability of other data on former employees to assess the completeness of IBM's electronic personnel files. Such data also could be used to correct invalid data in IBM's electronic personnel files. Potential data sources include the hard copy personnel records, internal company telephone directories, company medical records, and IBM's ECHOES database. We also recommend evaluating the hard copy personnel records to determine whether they contain detailed work history information for IBM employees who stopped working prior to 1984.

Identifying cancer among the cohort

We recommend identifying cancer deaths among former employees by linking the cohort to the National Death Index (NDI) and the Social Security Administration Death Master File (SSA DMF). The NDI and the SSA DMF are the primary sources for identifying deaths in cohort studies in the United States. The NDI, which began in 1979, is very effective at identifying deaths. Several investigators have shown it identifies between 93% and 98% of deaths that occurred after 1978 (Wentworth et al., 1983; Bole and Decouflé, 1990; Curb et al., 1985). However, the SSA DMF can miss a large proportion of the deaths that occurred prior to 1979 (Schnorr and Steenland, 1997). Schnorr and Steenland found that the SSA DMF only identified 53% of U.S. deaths among seven cohorts, with the percentage of deaths identified increasing over time (over 89% after 1975). Thus, individuals not identified as deceased by the SSA DMF should not be assumed to be alive as of 1979 unless their vital status can be confirmed through other sources (e.g., company records, credit bureau searches).

We recommend linking records of former employees with state cancer registries to identify individuals diagnosed with cancer. We recommend including state cancer registries other than

New York State's cancer registry based on the distribution of the current state of residence for living cohort members and the state of death for deceased cohort members.

Determining potential exposures to individual employees

We recommend basing the potential for exposure to specific chemicals or groups of chemicals on the department(s) in which employees worked. Data from both the hard copy industrial hygiene records and the CHEMS database should be used to identify potential chemical exposures which occurred in various departments. Differences between these two sources of information should be evaluated and resolved. We also recommend carefully evaluating whether these records identify all departments in which the potential for significant chemical exposures occurred. It may be useful to explore those jobs which appear to have a high potential for wet process or machining type exposures (based on the division, department, and position) that occurred in departments for which no industrial hygiene data exist. The lists of chemicals authorized and requested by departments and interviews with former employees and industrial hygienists may also provide some information on exposure potential by department. We also recommend identifying changes in the potential chemical exposures which occurred in departments over time.

If a cancer study is conducted, the following considerations are recommended:

- Determine the history and structure of the facility

  We only obtained a brief history of the facility from IBM. If a full study is conducted, it is important to more fully understand the history of the facility, the major processes, and the potential for significant chemical exposures prior to the introduction of the circuit board manufacturing process and prior to 1965 when data on the department(s) in which employees worked are limited. Internal company telephone directories, if they can be located, may be helpful in determining the overall structure of the company

- Consider whether the results of the industrial hygiene sampling should be used to determine whether a potential for exposure existed

  The results of many of the industrial hygiene samples were non-detectable. This may indicate that exposures were very low or non-existent. On the other hand, the presence of sampling results for a chemical probably indicates that the chemical was used in the department. Focusing on the results of the industrial hygiene sampling may miss the potential for exposure due to spills, leaks, and dermal contact.

- Consider an alternative approach in which the potential for exposure is based on workgroups, processes or process lines.
- Consider the possibility of developing qualitative estimates of exposure

Exploring the availability of data on other risk factors for cancer

If a cancer study is conducted, we recommend exploring the availability of data on other risk factors for cancer (e.g., smoking status) in other company records (e.g., the medical records)

Considering a follow-up nested case control study

A follow-up nested case control study should be considered if an increase in a specific cancer is observed for which questions remained about the contribution of workplace exposures to chemicals versus non-occupational risk factors for the cancer. If this type of follow-up study is done, the investigators could collect more details on risk factors, such as smoking, and conduct a more detailed exposure assessment. These data could then be used to compare former workers with cancer to a group of workers without cancer.

Practical considerations

Although a retrospective cohort study of cancer incidence and cancer mortality is scientifically feasible, the overall feasibility is dependent on the cooperation of IBM and the availability of resources. If a study is conducted, the study researchers would need access to the relevant records at IBM. For this scientific feasibility assessment, NIOSH obtained the "year end" personnel files and the work history file, from which a cohort of workers could be assembled, from IBM but NIOSH did not obtain other relevant records such as the industrial hygiene records.

A study would require considerable resources, costing an estimated $3.1 million. The availability of electronic personnel data is a major advantage. Nonetheless, a number of problems in the electronic data would need to be resolved if a study cohort is constructed, including missing data, discrepancies in dates and other data, and data that are clearly incorrect.

The magnitude of some of these problems is described in this report and Battelle's attached final report. However, some problems in the data are difficult to quantify. We made no attempt to correct these problems in this scientific feasibility assessment. Based on our experience working with the files, combining the data in the "year end" personnel files with the work history file to create a cohort and assembling the work history of each cohort member will be a challenge.

Summary

Based on an assessment of company records, a retrospective cohort study of cancer mortality and cancer incidence is scientifically feasible. The overall feasibility of a restrospective cohort study of cancer mortality and cancer incidence also depends on the cooperation of IBM and the availability of resources. If a study is conducted, the study researchers would need access to relevant records at IBM. A study would also require considerable resources, costing an estimated $3.1 million.

A retrospective cohort study of cancer among former employees would be able to evaluate whether employees are more likely to develop or die of certain cancers than the general population. This type of cancer study would also be able to evaluate whether former employees who had potential exposure to chemicals or who worked in some departments are more likely to develop or die of certain cancers than the general population or other workers. However, this type of study would have limitations because 1) data on known non-occupational risk factors for cancer may not be in the company records (e.g., smoking, family history) and 2) only limited industrial hygiene data are available. This may reduce the ability of the study to answer the question of whether or not any identified excess of cancer was work-related. Despite the limitations, the study would have value in addressing the concerns of the community about the risk of cancer among former employees. If an increase in a specific cancer was observed for which questions remained about the contribution of workplace exposures to chemicals versus non-occupational risk factors for the cancer, a follow-up nested case control study could be conducted. In such a follow-up study, additional details could be obtained on exposure and risk factors, such as smoking, to overcome some of the limitations of a retrospective cohort study of cancer.

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Table A. Study Characteristics According to the Beginning Year of the Study

	Beginning Year of Study		
	1965	**1980**	**1984**
Estimated number of employees who worked one year or more and at least one day in the beginning year of the study or later	~28,000	~22,500	~20,800
Able to identify all workers who worked less than one year?	No	No	Yes
Detailed work histories available?	Available for ~87% of employees*	Available for ~98% of employees*	Available for over 99% of employees*
% of workforce with 10 years or more of latency by 2007	95%	93%	93%
Maximum years of follow-up by 2007**	42	27	23
National mortality data available?	Yes, but may not be complete prior to 1979	Yes	Yes
State cancer registry data available?	Not until 1976 for NY (1984 for PA)	Yes	Yes
Industrial hygiene (i.e., exposure) information	No exposure information available back to 1965	Exposure information available	Exposure information available
Exposure levels	Likely higher than in the later years	Likely lower than in the earlier years	Likely lower than in the earlier years
% of workforce that worked prior to 1980 (when exposure levels were probably higher but exposure data are limited)	60%	50%	46%
% of workforce that was hired prior to 1965 (the year the "year end" personnel files begin)***	28%	21%	18%
Median (range) year of first employment according to the first hire date in the "year end" personnel files***	1977 (1923-2002)	1979 (1933-2002)	1979 (1933-2002)
Median (range) year of first employment according to the first job in the electronic files****	1978 (1942-2003)	1981 (1965-2003)	1981 (1965-2003)

* employees who worked one year or more and at least one day in the beginning year of the study or later

** years of follow-up for evaluating cancer mortality; years of follow-up for evaluating cancer incidence would start as late as 1984 (for residents of Pennsylvania)

*** the date hired by IBM is not necessarily the date the employee first worked for IBM at Endicott. Jobs held prior to 1965 may not be captured by the electronic files since the "year end" personnel files begin in 1965. The average absolute difference between the hire date and the year first employed according to the first job in the electronic files is 7 years (median, 1 year).

**** if the year first employed according to the first job in the "year end" personnel files and the work history file was different, the later year was used because the earlier year was sometimes judged to be impossible based on the other data in the files

Appendix I
Feasibility Assessment for Exposure Assessment for a Study of Cancer in the Electronics Industry

FINAL REPORT

Contract No. 200-2000-08018
Task Order No. 14
FG480114

Feasibility Assessment for Exposure Assessment for a Study of Cancer in the Electronics Industry

Presented to:

National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

by:

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Battelle
The Business of Innovation

July 29, 2005

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1.0 Overview

Battelle is pleased to present this report in response to Task Order 14 entitled "Feasibility Assessment for Exposure Assessment for a Study of Cancer in the Electronics Industry" in which we provide assistance to the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) in evaluating the work history and exposure data available with regard to the former IBM facility in Endicott, New York. The Microelectronics Division of this facility was sold to Endicott Interconnect Technology (E.I.T.) in November 2002. E.I.T. retained approximately 1,800 former IBM employees who continued to design, manufacture, and service chip packaging, printed circuit boards, and electro-mechanical equipment.

The Battelle research team includes Dr. Nicholas Heyer (epidemiologist), and Mr. James Catalano (industrial hygienist). Dr. Lynne Pinkerton is our NIOSH Task Order Technical Monitor.

1.1 Why NIOSH Conducted this Study

The Endicott, New York facility is the birthplace of IBM in 1911. Over its history, the facility has been involved in the production of various products ranging from clocks and guns to typewriters and mechanical calculating machines. Since the 1960's the IBM Endicott facility has been involved in the construction of circuit boards. This production process involves the use of considerable quantities of chemicals. Initial concerns with ground water contamination in Endicott spread to concerns about occupational exposures to the Endicott workforce.

The New York State Department of Health, Senator Clinton, and Congressman Hinchey have approached the Centers for Disease Control and Prevention (CDC) about the health concerns of former employees. Although a number of health concerns have been raised, the major concern appears to focus on whether former employees have an increased risk of cancer. This report supports the commitment NIOSH has made to this community to evaluate the feasibility of conducting a cancer study among these workers.

1.2 What We Cover in this Report

This report is designed to provide NIOSH with information that will be useful in making a decision on the feasibility of a full-scale epidemiologic study of the IBM Endicott facility. Furthermore, it is designed to give a summary overview of the potential problem of exposure to harmful chemicals, particularly carcinogens, at this facility. This report consists of the following sections:

- A listing of sources of information available for conducting an epidemiologic study of cancer occurrence among former IBM employees at their Endicott, NY facility, including an evaluation on their usefulness for supporting such a study.
- A listing of the main exposures of concern with a primary focus on cancer.
- An expert opinion on whether a retrospective exposure assessment from 1965 through 2002 is feasible.

- A plan for such an assessment, including the recommended level of detail – categorical, semi-quantitative, or quantitative.

1.3 The Process

In approaching this task, NIOSH took full responsibility for all negotiations with IBM. This included both the release of historical records directly to the study team, and the arrangement of meetings with IBM to review data that were not being released. This process took a substantial amount of time, and was ongoing throughout the evaluation period.

As a result of these negotiations, IBM sent some information to NIOSH prior to our site visits to IBM Somers headquarters. These included:

- Electronic year end personnel and work history files, including descriptions and field definitions for these files.
- A small sample of copies of paper industrial hygiene (IH) reports.
- A description of various processes at the Endicott facility with associated chemicals used in these processes.

NIOSH shared this information and a published paper describing IBM's ECHOES database (Hillman G. ECHOES: IBM's Environmental, Chemical and Occupational Evaluation System. Journal of Occupational Medicine 1982;24(10):827-835) with Battelle's research team. All other data made available by IBM were stored at their headquarters in Somers, New York. These were available for review only during two trips by the research team to IBM's Somers facility. While the team was able to review the material and take notes, we were not allowed to copy any of the files.

Our first evaluation of these data took place during a four-day visit to IBM's Somers headquarters from November 15-18, 2004. Battelle was represented by Dr. Heyer (epidemiologist) and Mr. Catalano (industrial hygienist), and NIOSH was represented by Dr. Pinkerton. These data consisted of:

1. Original paper IH reports and summaries (mostly from 1980 and later) stored in folders labeled by department which were kept in two 5-drawer file cabinets in a room at IBM headquarters.
2. One box of paper copies of microfilms of additional IH reports from earlier years (mostly after1970) which were provided to us on the last day of our visit.
3. Computer printouts of the COINS database of chemicals and supplies requests from central stores at Endicott starting in 1999 (these were not available electronically).
4. Computer printouts of the CDTS and CIMCAN database systems that tracked chemical authorization for use at Endicott by department (these were not available electronically). Available years included 1984 through 1999 with 1985 missing.
5. A subset of the ECHOES exposure database that was stored on a portable computer. This database was used between 1987 and 1992.
6. A small number of schematic drawings for some floors in several buildings within the Endicott facility.

In addition, we were provided with a short verbal history of the IBM Endicott plant including the types of products produced there (e.g., clocks, guns during the war, typewriters, mechanical calculators) and a verbal list of "location" codes that were useful for identifying personnel and work histories that were relevant to the Endicott plant (i.e., 'END', 'CPM' and 'PLE' being valid, while 'EEC' indicated offsite buildings and 'CEL' was an invalid code).

The second trip to Somers lasted two days (April 18-19, 2005) and included only Dr. Heyer. This visit was planned specifically for reviewing the "CHEMS" database, which included IBM Endicott's computerized IH sampling data from 1984 through 2000. We chose to evaluate the IH sampling data in the CHEMS database instead of the ECHOES database because the CHEMS database covered a longer time period and served as the source of the IH sampling data contained in the ECHOES database. The data reviewed during this visit included:

1. A Microsoft Excel download of industrial data extracted from the "CHEMS" database and stored on a personal computer. Summaries of this data, according to our requests, were furnished as paper copies, which we were allowed to review, but not keep or copy.
2. A few additional schematic drawings of the Endicott facility.

In addition to these visits, members of the research team have spoken to a past industrial hygienist at the Endicott facility (identified through the IH reports), past production employees, and other researchers who have evaluated IBM facilities.

It should be noted that the databases referred to above were created and maintained by IBM. The acronyms we have used here were provided to us by IBM, and are the only information we have to define these sources of data.

2.0 Identifying Sources of Data

The research team divided the work involved in assembling and evaluating the various sources of data. NIOSH took responsibility for evaluating the electronic personnel and work history data supplied by IBM, determining which records applied to the Endicott facilities, and establishing an "aggregated" work history file to be used for our feasibility assessment. The Battelle team took responsibility for evaluating the IH data collected during the two trips to IBM's Somers headquarters, and merging this information with the aggregated work history file.

2.1. Personnel and Work History Data

In April, 2004 IBM provided NIOSH with electronic files for their Endicott site, including year-end personnel files for the years 1965 through 2003, and detailed employee work history files. The latter only covered employees who worked during 1984 or later, and included work histories across the entire 1965 through 2003 timeframe. The year end personnel files provided a snapshot of the workforce at the end of each year, and included name, IBM serial number, social security number, date of birth, sex, self-reported race, address, division code, department code, position code, work location code, work location city, date of hire, and active versus inactive status. Department name and position title (not codes) were also included in these files starting in 1975. The employee work history files included name, IBM serial number, social security number, sex, race, date of birth, date of hire, separation date, and other work history information including division code, department code, department name, position code, position title, work shift, work location code, work location city, and the date associated with each change in the work history. IBM did not provide a list of all divisions, departments, and position titles along with their associated codes over time along with these files. In March 2005, IBM provided a list of the division names associated with 215 division codes as of 1996. No hard copy personnel or work history records were made available.

2.2. Industrial Hygiene Data

IH data were available from several sources as explained above. During the first visit to IBM's Somers headquarters, we evaluated the available hard copy data. In addition, we briefly looked at the subset of the ECHOES database that was available. During the second visit, we were also able to look at the CHEMS database. The evaluation team was able to make the following conclusions about the data.

2.2.1. Original Hard Copy Industrial Hygiene Reports and Summaries

We reviewed essentially 100 percent of the original paper IH reports and summaries contained in file cabinets that primarily covered the years 1980 and later. These files contained a significant amount of data including IH descriptions of processes within a number of departments, IH reports describing incidents and reasons for testing, laboratory reports with data, and IH summaries of the laboratory reports. The quality of the IH reports appeared to be professional, and engendered trust in the reported results.

However, the data were sparse. Based upon sampling information contained in the folders, many departments had no or minimal IH information, while many others had only noise, lead or asbestos surveys. Additionally, a large proportion of the departments had just a few IH sampling results covering only one or two days of evaluation. Even those departments with the largest amount of IH sampling information did not have consistent yearly sampling data. Multiple sampling dates within one department during the same year were the exception.

Our team had two major reservations about these data beyond their sparseness:

First, there was no way of determining the completeness of the files and the consistency of the data. There was no overall schedule for or records of IH investigations. There was no complete listing of departments to check off whether each department had a folder. We only had the paper files as they existed at the time of our visit. There were many files with no data or paper of any type in them. We wondered why these files were created. There were many files with information on departments other than the department on the file label. We could not tell if this information was misplaced or whether there was a relation between the two departments (usually only identified by alphanumeric department codes). Even as we reviewed these files by hand, old, dried labels were falling off the folders.

Second, and related to the first reservation, we were provided no information on the overall structure of the Endicott facility, how the departments were organized, or what departments existed over what time periods. We were informed that, in the past, departments would sometimes change names, or perhaps worse, the same department might change functions without having its code changed. We were provided no record of these changes.

2.2.2. Paper Copies of Microfilms of Additional Industrial Hygiene Reports

We also reviewed essentially 100% of the paper copies of microfilms of additional IH records primarily from years prior to 1980. These records had been selected by IBM for our review. IBM estimated that the paper records provided to us represented approximately two-thirds of the microfilm records available. Generally, these records are less complete and less professional than the original IH records we reviewed above. They did, however, provide some additional information on the chemicals used and evaluated prior to 1980. We have no way to judge the completeness of these records, and they suffer from all the reservations we have about the 1980 or later IH records.

2.2.3. Computer Printouts of Purchased Chemicals and Supplies

Computer printouts of the COIN database covering chemicals and supplies moving through IBM Endicott central stores exist since 1999. This limited timeframe reduces the importance of this information, but it does provide a check for chemicals recently used by various departments, and may provide some check for the completeness of the IH data and the departments covered. Unfortunately, our review of this material showed that a large number of the individual records were missing department codes. This may be due to the record being associated with material supplied to central stores rather than a particular department. We were also unable to establish any consistency between the IH and chemical supply data (i.e., we were not able to confirm – testing just two or three cases - that chemicals evaluated by the industrial hygienists in a given department were on the list).The limited scope of our visit to the IBM Somers headquarters and the large volume of these printouts did not allow us to do more than a cursory review of these data.

2.2.4. Computer Printouts of Chemical Authorizations

Computer printouts of the CDTS and CIMCAN database systems tracking chemical authorization by department at the IBM Endicott facility were available only for the years 1984 through 1999, with 1985 missing. We were informed that authorization did not necessarily imply that a particular chemical was used by that department. A brief comparison by department between the 1999 chemical purchase data and the authorization data showed that purchased chemicals were generally on the authorization list, and the authorization list usually contained more chemicals than were purchased. Again, our scope of work did not include a full evaluation of these extensive lists. These data, though limited, could provide an additional check at several points of time on chemicals potentially used by various departments, and demark when certain chemicals were replaced by others.

2.2.5. Subset of the ECHOES Exposure Database

A subset of the ECHOES exposure database, a system used to track exposures and exposure related activities of individual IBM employees between 1987 and 1992, was downloaded onto a portable computer and available for our review only during our first visit. Unfortunately, the interface designed to allow access to the data did not function properly, and only a few specific examples were able to be reviewed. IBM portrayed this database as incomplete and flawed in its design and implementation. They did not believe that it was important to reconstruct this historical database because they believe that the data are unreliable.

The ECHOES database depended upon having workers check in and out of departments, and other inputs based upon individual initiative, to achieve accurate estimates of individual exposure. Apparently, enforcement of these procedures was soft. However, a CHEMS database of IH measurements and reports was maintained from 1984 through 2000. This was the source of the IH sampling data in the ECHOES system. While IBM representatives would not vouch for the completeness of the CHEMS database, it did appear that data entry into this database would be more complete than for the ECHOES database. As noted earlier, we requested future access to the CHEMS database.

2.2.6. Schematic Drawings

The small number of schematic drawings were of some interest, but appeared too incomplete to allow construction of a visual picture of product flow and the interrelatedness of departments. We did not complete an extensive review of these drawings.

2.2.7. Subset of the CHEMS Database

The content of the subset of the CHEMS database provided by IBM was based upon the fields requested by NIOSH and Battelle. These included the chemical name, department, year and test results expressed as detectable or non-detectable. This subset only included actual IH samples and did not include other information within the CHEMS database such as the process descriptions. We requested the dichotomous test outcomes to respect IBM's concerns for confidentiality, and because we did not feel that specific IH measurements were necessary for the scope of our evaluation.

The subset had been downloaded into an Excel spreadsheet and stored on a portable computer and made available to Dr. Heyer during the second two-day visit to Somers. IBM also provided printouts of summaries of these data at our request. This allowed for very useful comparisons between the CHEMS database and our summaries of the paper IH records reviewed during the first visit, and subsequently computerized, and summarized into our own tables prior to this second visit.

2.2.8. Additional Schematic Drawings

The additional schematic drawings provided by IBM during the second visit were similar to the drawings reviewed earlier. Even with these additional drawings, there was insufficient information to allow useful characterization of the Endicott facility.

2.2.9. Discussions with Former Endicott Employees and other IBM Researchers

We were able to contact several former Endicott employees, including an industrial hygienist who had authored numerous reports found among the original IH records reviewed. While our discussions with these employees were limited, we were able to obtain some information about the IH evaluations, chemical use in various research departments, and some organizational issues. In our discussions with a former IH, we confirmed that the output of IH evaluations since the 1980's could probably be contained in several file cabinets, providing some confirmation that all existent IH records were made available to us. Other IBM researchers confirmed some of our observations about the organization of IBM data and suggested additional sources of information, such as internal telephone directories. These directories apparently provide a complete listing of departments and supervisors, and may provide information on reorganization of departments over time. The existence of these directories was confirmed by past employees, but we were not able to determine whether any of these directories were still available for review.

2.3. Data Sources Relied Upon

While all the data sources made available to us are important to consider with respect to a potential full epidemiological study of IBM's Endicott facility, many of them proved of marginal utility in this limited effort to assess the feasibility of conducting such a study. In particular, an epidemiological study would certainly attempt to describe all departments that existed at Endicott and their years of operation. In this endeavor, the printouts of chemical requests and authorization may be useful. Former employees of IBM Endicott could also provide substantial information on work conditions, types of exposures (e.g., dermal vs. inhalation) and help confirm conclusions drawn from other data during an epidemiological study.

It is doubtful that the limited version of the ECHOES database that was available to us would provide substantial additional information for assigning exposures to individual workers from the 1965 through 2002 time period. However, if IBM restored the full database and made it available to researchers, this would certainly be of use. It appears that the ECHOES database evaluates exposures for individual workers. Thus, even if it were incomplete or inaccurate with respect to durations or intensities of exposure, it would certainly be useful for identifying specific workers, confirming their job locations, and attributing specific chemical exposures or exposure potential to them and to specific departments.

It is unclear how researchers could use the limited number of available schematic drawings to reconstruct an overall view of processes and exposures at IBM Endicott. However, they may be useful in resolving specific questions about departments or locations. The schematics, as mentioned earlier, may be prove useful if former IBM employees and/or IHs provided historical context regarding work locations and processes.

For the purposes of this feasibility assessment, our team focused on data that was both accessible and sufficient for the scope of work. We thus relied primarily upon the aggregated work history compiled by NIOSH and our summaries of the hard copy and microfilm IH records (both before and after 1980). We also relied upon a comparison between our IH summary files and the electronic subset of the CHEMS database that we reviewed.

3.0 Evaluation of the Usefulness of the Data Sources

The process of evaluating the usefulness of the available data for a potential epidemiologic assessment included: 1) combining the electronic year end personnel files and work history files to create the aggregate work history file; 2) identifying and eliminating certain problems in these electronic data; 3) comparing the hard copy vs. the electronic CHEMS IH data sources; 4) linking the IH information with the work history information; and 5) evaluating the linked IH and work history information. Our scope of work did not include attempting to establish a true and complete cohort of IBM Endicott employees, nor a complete record of processes and potential exposures. Our responsibility was limited to examining data made available to the research team and to make an expert recommendation to NIOSH regarding the feasibility of using the data to construct exposure assessments for conducting an epidemiologic investigation. The cleaning of the electronic data provided by IBM, as well as our summaries of the IH data, were conducted to better understand and explain the difficulties in using the available data, and to allow a reasonable approximation of the distributions and numbers of people potentially exposed to various chemicals among former Endicott employees. We made no attempt to establish either a fully defined cohort or exposure linkage that would meet standards for an epidemiologic study, if one were undertaken.

3.1. Work History and Personnel Data

NIOSH received 39 separate year-end personnel data files from IBM, one for each year from 1965 through 2003, which provide information on the individuals employed at the end of the year and the job held by each employee at that time. These files do not capture mid-year changes in the workforce or the jobs held by employees. NIOSH also received a detailed work history file for individuals employed by IBM in 1984 or later which contained a separate record for each job held by an employee. In order to maximize the available information, NIOSH combined these files for assessing the feasibility of conducting an exposure assessment for a study of cancer. This was accomplished by taking the following steps:

- The 39 separate year-end personnel data files were concatenated to create a single year-end personnel file for IBM employees from 1965 through 2003. Before concatenating these files, a variable was added to each file to indicate the appropriate work year.
- A field was identified in the personnel file and work history file which uniquely identifies individuals. Social security number proved to be the best alternative. However, a small percentage of the records contained values in the social security field which were not valid social security numbers and which were used by multiple people (e.g., *********, 000000000, 000000001, 001000010, 1000000001, 111111111, 999999999). Records with these invalid social security numbers were deleted. A total of 2,586 of 724,323 records in the personnel file and 1,075 of 1,121,894 records in the work history file were deleted for this reason. The remaining social security numbers were used to uniquely identify workers.
- Work location codes were used to eliminate jobs that did not involve production work at IBM's Endicott facility. NIOSH identified five location codes that appeared to be associated with IBM facilities in Endicott, NY. According to IBM representatives, two (CPM and PLE) were associated with manufacturing, two (END and EEC) were not associated with manufacturing, and one (CEL) was an invalid code which rarely appeared in the files. NIOSH deleted all records in the personnel file and the work history file except those with location codes of "CPM" and "PLE".
- Records in the personnel file were retained if they had an "active" status so that only records for jobs that were actively held at the end of each year were retained. Records with an "inactive status" were deleted.
- Individuals with only one record in the work history file were deleted because the duration of employment could not be estimated for these employees. Approximately 2,300 individuals were deleted from the work history file because the duration of employment could not be estimated.

- Both the personnel file and the work history file were transposed so that each record had both a beginning and end date. For the work history file, the begin date was the date associated with the record, and the end date was the begin date of the next record for the same employee minus one day. For the year-end personnel file, the begin date was the year associated with the record and the end date was the year associated with the last record for the same employee that contained the same job information (i.e., the same division, department, and position – see Figure A below). In the work history file, the last job for 2,462 workers was deleted because the date the employee last worked was unknown.

Figure A: Assignment of Begin and End Years for Year-End Personnel Files

Original File:

Socsec	Year	Status
123456	1984	Active
123456	1985	Active
123456	1986	Active

Transposed File:

Socsec	Begin_Yr	End_Yr
123456	1984	1986

- The resulting personnel and work history files were combined into an aggregated file. There was no attempt to reconcile the information in the two files when they were combined. Inconsistencies between the two files were noted but the magnitude of this problem was not assessed. Instead, separate variables were created for job information (e.g., division, department, position) from the personnel and work history files. The estimated total duration of employment based on data in the personnel file and the total duration of employment based on data in the work history file were calculated to identify workers who had worked at least one year in work locations of "CPM" and "PLE" (i.e., individuals who actively held jobs in these locations according to at least two consecutive year-end data files and individuals who worked at these locations for at least one year according to the detailed work history file).

- Of the 41,996 workers identified at this point in the cohort reconstruction, only 28,000 had evidence of having worked at least one year at this facility. The file was not fully assessed to identify all potential problems. However, Appendix Table 1 provides information on some of the problems that were noted for the 28,000 workers who worked for at least one year at Endicott. In addition, department name and position title were free format text fields, and the way in which this information was entered varied greatly due to wording and abbreviations. This variability greatly complicates the task of collapsing jobs and linking jobs with other information.

The final Aggregated Work History File contained data on 541,113 jobs (263,530 work histories and 277,583 year-end histories) for 28,000 Endicott employees from 1965 and 2003, who worked a minimum of one year at this facility, and at least one day between January 1st, 1965 and the end of 2003. A sub-cohort of 22,573 IBM employees with similar criteria, but who worked at the IBM Endicott facility at least one day between January 1st, 1980 and the end of

2003 was also established, as this coincided with more complete work history and exposure information. This sub-cohort had just over 80% of the number of employees in the full cohort.

These cohorts were created to evaluate the extent of potential exposures. They could also be used to estimate the duration of potential exposures, but this was beyond the scope of our task. Three fields in the Aggregated Work History File were used to assess the potential for exposure: division, department and position. These were also the fields that were available for linking employees to job related exposures. We describe below how each of these fields was used in our assessment.

Division: We were initially given no information by IBM on how to interpret the Division code. The Aggregated Work History File contained 80 unique Division codes, with 265,744 (almost 50%) records missing Division codes. Six Division codes were associated with only one job, while one code had 67,875 (~13%) work histories associated with it. Based upon the distribution of Department and Position names that were associated with each Division code (without reference to the IH information), an assessment of potential exposure was made for each Division using the following exposure categories: 0=No Chemical Exposures; 1=Possible Chemical Exposures; 2=Probable Chemical Exposures (see Appendix Table 2A). This assessment was made without reference to the IH files. The large number of work histories missing Division codes were assigned the neutral code of 1=Possible Chemical Exposures.

At a later date, IBM supplied us with a file of 1996 Division codes with their title or description (see Appendix Table 2B). These division descriptions did not provide much information on the types of work done at the division, and many of the codes did not match those in our work history files. In our analysis we used our Division ratings based upon the distribution of Departments and Positions within the Division in the Aggregate Work History File.

Department: Many Department codes were associated with department names in the Aggregated Work History data. These Department names provided the only description of the departments we had available (other than the IH records), and they were not necessarily consistent from work history to work history even within the same year. There were 3,849 unique Department eodes included in the work history data, with only 32 jobs (<0.01%) missing Department codes. There were 447 codes associated with only one job, while one code had 4,891 (<1%) jobs associated with it. Based upon the Department names, an assignment of potential exposure was made for each Department code, using the following exposure categories: 0=Unlikely Chemical Exposures; 1=Machining Type Exposures; 2=Wet Process Type Exposures. The few jobs missing Department codes were assigned a 0 = Unlikely Chemical Exposures category.

Position: Many Position codes were associated with Position names in the Aggregated Work History data. As with Department names, Position names were the only description of the positions we had available, and they also were not necessarily consistent from work history to work history even within the same year. There were 2,099 unique Position codes included in the work history data, with only 811 jobs (<1%) missing Position codes. There were 195 codes associated with only one job, while one code had 32,405 (<6%) jobs associated with it. Based upon the Position names, an assignment of potential exposure was made for each Position code using the same exposure codes as employed for Departmental assignments. The few jobs missing Position codes were assigned a 0 = Unlikely Chemical Exposures category.

Job Exposure Assignments: Two job exposure assignments were calculated for each work history, one for each of two processes: "Wet" and "Machining". An initial score was assigned for each process type as follows. If neither the Department nor Position code score (described above) was consistent with the process type, the job was assigned a score of zero for that process. If either Department or Position code was consistent with the process type (but not both), the job was assigned a score of one for that process. If both were consistent with the process type, the job was assigned a score of two for that process. This initial score for each process was then multiplied by the Division code score for potential exposure (the 0-2 score described above), resulting in a final job score for each process type of 0, 1, 2 or 4, defined as "none", "low", "medium" or "high" potential for exposures related to that type of process.

This inexact scoring method reflects the difficulty of interpreting the multitude of job descriptions. It reflects an attempt to assign each job to one of two basic categories of exposure based upon the work process. One process category, "Wet", is associated with numerous chemical solutions used in etching, plating and laminating circuit boards and their substrates. Examples of jobs in this category are "metal platter", "screen maker", "printed circuit process", "solution maintenance specialist", and simply "process equipment operator". The other process category, "Machining", is associated with machining and soldering exposures that were frequently encountered in fabrication and assembly procedures. Examples of jobs in this category are "tool and model maker", "lathe operator", "welder", "sheet metal fabrication", and simply "assembler". Jobs without exposures in either category included sales, engineering and programming activities in support of many different products. Initial exposure assignments were made by one of our team members (Dr. Heyer), and revised after consulting with a former IBM Endicott employee about how to interpret Department and Position names.

The very large numbers of Department and Position codes seriously complicated the assignment of exposure process to specific work histories. There were 46,002 unique Department-Position combinations with 11,301 being associated with only a single work history. Only 16 work histories had neither Department nor Position codes. Over 50% of all work histories in our file had Department and Position combinations associated with less than 20 work histories. It is interesting to note that in the above analysis we used a 3-digit alphanumeric Department code. Many work histories had a 4-digit Department code available. However, we were unable to discover the meaning of the last digit, with the suggestion that, at least in some cases, the last digit indicated shift. It is difficult to understand all the ramifications of classifying job into this many codes, or to imagine how IBM made use of such a discrete classification of jobs.

3.2. Industrial Hygiene Data.

There were two primary sources of IH records. These include the paper files (primarily 1980 or later) and copies of paper files (primarily before 1980) reviewed and abstracted during our first visit to IBM Somers headquarters, and the Excel spreadsheet of selected data from the CHEMS database.

3.2.1. The Industrial Hygiene File

Abstracted information from hard copy Endicott IH records and paper copies of microfilms of earlier IH records were used to create the IH File. There were distinct differences in the type, quality and quantity of IH information before and after 1980. Information before 1980 came predominantly from paper copies of microfilms of records selected by IBM and provided to us. Information after1980 came from apparently original IH records collected for us by IBM. These hard copy records were represented to us as the full and complete set of IH records in the possession of IBM. However, we have no way of assessing the completeness of either set of records.

We conducted a quick, but complete review of all these records. Several types of information were extracted from these records. These include:

- IH samples for specific chemicals.
- Process descriptions, including chemicals used, types of processes (e.g., dip tanks, spray coating, etc.), and ventilation or isolation efforts associated with these processes.
- Department names and descriptions, including changes in departments.
- Reasons for the IH assessment (e.g., complaints, leak, change of process).

All three members of the evaluation team (Mr. Catalano, and Drs. Heyer and Pinkerton) participated in the abstraction process. Because photocopies were not allowed by IBM, we made handwritten notes to record all information. Our evaluation process relied primarily upon the first two types of data collected – IH samples and process descriptions. Thus, we will discuss these in more detail below.

While collecting IH information, we attempted to record the department, chemical, date (year) and a dichotomized result (detectable v. non-detectable) for every sample taken. We did not attempt to record actual levels measured because IBM was sensitive about this data and our scope of work did not require this detail. We did not consistently distinguish between personal and area samples for similar reasons. Furthermore, it was clear that the amount of information available would be insufficient to assign exposures based upon personal sampling. Thus, we made no attempt to link personal samples with any individual.

Even within our restricted goals, the task proved difficult for several reasons. First, sampling information was often included in many different formats, including various laboratory reports and summaries of these reports by the industrial hygienist. Second, the types of reports and summaries included could differ from one folder to the next, and even within departmental folders (across years). Third, there was not always a laboratory report associated with an IH summary or visa-versa. Fourth, the information within a folder was not necessarily arranged in chronological order.

This process had known problems. First, we know that some samples were double-counted with the laboratory report and the summary report both contributing to the count. This happened most frequently early on, before we became more familiar with the format of the records. It is also possible that samples were not counted when we mistakenly decided that reports were redundant. Second, and especially toward the end of our abstraction process, we simply did not have time to record all the information available. Thus, we simply indicated which chemicals were sampled without attempting to record an accurate count.

Process descriptions had varied formats and frequency within the IH files. One departmental folder could contain three or more detailed multi-page descriptions, while others had only a very brief or no description. Each of the three abstractors had different approaches in capturing these data. Furthermore, toward the end of our abstraction process, the capturing of process descriptions was given a lower priority than capturing sampling information, and might have been missed or only partially completed.

After returning from our first visit to IBM or Somers headquarters, Dr. Heyer created a computer database and entered the IH information we had gathered. Data entry was conducted in two phases. In the first phase, only IH samples were entered. Information captured in the database included: 1) department (code and name), 2) building (location of department), 3) year, 4) chemical, 5) total number of samples, 6) number of detectable samples, 7) number of non-detectable samples, and 8) comments. During the second phase, chemical use information abstracted from process descriptions was entered into a compatible database. Information entered from process information had no data on sample numbers (items 5-7 above), but did include an additional item, the process name, when available. Finally, these two databases were joined to create our IH File which identified chemical use by department.

3.2.2. The Chemical Exposure File

A unique file of chemicals in the IH File (either from samples or process descriptions) was created to define chemicals used at the Endicott facility. CAS numbers were assigned to chemical names when possible, and used to detect and eliminate duplicate listings due to: 1) multiple chemical names used to define a single chemical, and 2) misspelled chemical names. In a few cases, a chemical group (e.g., machining fluids, epoxies) was used in place of unknown specific chemicals, and a CAS number could not be assigned. The final Chemical Exposure File was reviewed by one team member (Mr. Catalano), and rated for carcinogenic potential. Four authoritative sources were employed for this rating:

- International Agency for Research on Cancer – World Health Organization – (IARC)
- National Toxicology Program – US Department of Health and Human Services (NTP)
- American Conference of Governmental Industrial Hygienists (ACGIH)
- California State – Proposition 65 (CA)

Based generally upon the highest ratings by these agencies (with greatest weight given to IARC and NTP, and least weight given to CA), we created a five point system for rating "Human Carcinogenic Potential": 1="known", 2="suspected", 3="possible", 4="none" (listed by at least one of these agencies as not having sufficient information for rating) and 9="not rated" (by any of these organizations). The last two categories were combined to create a four point rating system with the fourth category being "not rated". Finally, target organs for these potential carcinogens, as listed in the rating justifications by these agencies and other authoritative summaries of the data (on the internet), were included in our database.

3.2.3. Selected Data from the CHEMS Database

We had been informed that the CHEMS database of IH records covered the years 1984 through 2000. However, reviewing the abstracted information from this database revealed that the coverage was actually from 1980 through 2002. We had no way of checking whether completeness varied by year.

We did not attempt to summarize the information in the CHEMS database for this assessment. Instead, we applied our resources to compare the CHEMS database to printed summaries of the IH File (described above). These printed summaries included:

- A listing of chemical samples from our IH file organized first by department and then by year within department. The sample data included:
    - total number of samples (only chemicals actually sampled)

    - number detectable
    - number not detectable
    - percent detectable
- The Chemical Exposure File list of unique chemicals (including those defined only by process).
- A listing of all departments (3 digit alphanumeric code) with any information in the IH file.

During the second visit, these lists were compared to summaries of the CHEMS database. Matching data was checked off and data missing from either file noted to the extent our time and resources allowed. This exercise demonstrated that there was a great deal of consistency between these two data sources. However, it was also clear that neither source had all the data. We had expected that numbers of samples would not necessarily match given how these numbers were abstracted from the paper records (as described above). However, inconsistencies within departments included: 1) which chemicals had be sampled for, and 2) calendar years during which these samples were collected. There were also inconsistencies in whether samples were recorded as detectable or not. None of these inconsistencies appeared to be systematic, and differences did not appear to be more conspicuous within any given timeframe.

A few glaring inconsistencies were further evaluated. For example, a couple of departments that had a large number of samples recorded in the paper files had no samples in the CHEMS data. Review of the original paper files showed that in at least two cases the department under which the samples were filed (the department folder) was not the same department (by 3-digit alphanumeric department code) as the department that had "requested" the samples. Thus, it is likely that some of these samples were recorded elsewhere in the CHEMS database. This review demonstrated that during an epidemiologic study of this facility, both the paper and the CHEMS database IH data would have to be fully and carefully reviewed and attempts made to reconcile the data. Neither data source should be considered complete by itself.

The remainder of this evaluation study used only the computerized information from the paper IH records. Our list of carcinogens and linkages between work histories and exposure were made using only this one source. Thus, these evaluations are necessarily incomplete and probably conservative with respect to the number of departments associated with specific exposures.

3.3. The Work History Exposure File

The Aggregated Work History File (see 3.1) and our IH File (see 3.2.1) were merged to create the Work History Exposure File. In creating this file, there was no effort made to account for possible exposure changes within any department over the years, as this information was difficult to obtain and necessarily incomplete given the scope of our review.

The first stage of the linkage process identified unique departments in the IH File using 3-digit alphanumeric department codes. This unique list was merged with the Chemical Exposure File to create an intermediate file containing information on carcinogenic rating for each chemical associated with the department. In the next step, this information was summarized by selecting from among the chemicals identified in each department the: 1) overall highest potential human carcinogen ("known">"suspected">"possible"), 2) highest potential human carcinogen for each specific target organ group, and 3) total number of carcinogens ("known", "suspected" or "possible"). Finally, this summary information was appended to the Aggregated Work History File to creating a Work History Exposure File.

3.4. Each Employee's Maximum Carcinogenic Potential Exposure

The Work History Exposure File was used to calculate for each employee their job with the highest carcinogenic potential. These jobs were then used to assign a maximum carcinogenic exposure potential to each IBM Endicott employee. This was accomplished by sorting the Work History Exposure File with first priority on employee identifier (SSN), second priority on carcinogenic potential (highest first), and final priority on the total number of carcinogens in the department (largest first). Then, by selecting the first entry for each employee (all other records being removed) we obtained a file with a unique record for each employee that identifies their job with the highest potential carcinogenic exposure and the highest number of total carcinogens consistent with that maximum potential. A similar process was used to identify each employee's job with maximum carcinogenic potential for each target organ group. These calculations were conducted for two scenarios. First, we used all work histories ending after 1/1/1965 based upon the time period defined for this contract. Second, we used all work histories ending after 1/1/1980 based upon the increased availability and quality of IH data after that date.

4.0 Analysis of the Data

Data analysis was based upon the NIOSH supplied Aggregated Work History File, our IH File abstracted from the original and copied paper IH records (not including the CHEMS database) and our Work History Exposure File created by the merging of the two files. A few comparisons between our IH file and the CHEMS database are included here as a measure of consistency between the two sources.

4.1. The Aggregated Work History Data

The Aggregated Work History data contained information on 541,113 work histories for 28,000 employees who worked at IBM for at least one year and at least one day in 1965 or later. There were 366,588 work histories for 22,573 employees who worked at IBM for at least one year and at least one day in 1980 or later.

4.1.1 Job Exposures Assignments

With respect to job exposure assignments defined in section 3.1, only 7,410 work histories (1.4%) had a high "Wet" process assignment, while 9,142 (1.7%) had a high "Machining" process assignment. The distribution for these two job exposure assignments is provided in Appendix Table 3.

4.1.2 Employee Exposures Assignments

Employee exposure assignments were made using the maximum job exposure assignment from all their jobs. Among the 28,000 employees, only 1,881 (6.7%) had a high employee exposure assignment for "Wet" process, while 2,419 (8.6%) had a high employee exposure assignment for

"Machining" process. The distribution for these two employee exposure assignments is provided in Appendix Table 4.

4.2. The Industrial Hygiene File

We reviewed file folders on 292 departments to create the IH File. Among these, 79 departments had no information on chemical exposures, 196 had chemical exposure information in their file, and another 17 only had references to exposures in their department located in other files. Among the 213 departments which had had chemical information in the IH paper files, 156 departments had actual IH sampling data, while another 57 departments had only process descriptions identifying chemicals used in the department. Both IH sampling results and proccss descriptions were used to define potential chemical exposures at the IBM Endicott plant by department.

4.2.1 Unique List of Potential Exposures Including Potential Carcinogens

The Chemical Exposure File (described in 3.2.2 above) identified 198 unique chemicals and 10 non-specific chemical categories described in our IH file. The file included chemicals actually sampled as well as those simply listed in the process descriptions (including some chemicals only identified by their brand name). Each chemical was evaluated for carcinogenic potential. Among these chemicals, 20 were assigned a carcinogenic potential rating of "known", 16 a rating of "suspected", and 8 a rating of "possible". The remaining 164 were assigned a carcinogenic potential rating of "not rated". The complete list of chemicals, including their rating and identified target organs, is provided in Appendix Table 5.

4.2.2 Potential Exposures Including Potential Carcinogens by Department

Each of the 214 departments at IBM Endicott with some IH information was assigned exposure to only those chemicals identified within the IH files. No attempt was made to attribute exposures from one department to "similar" departments or to incorporate information from the CHEMS database (see 4.2.3 below). Data on departmental chemical exposures were linked with the Chemical Exposure File's unique list of chemical exposures and their carcinogenic potential rating ("known", "suspected" and "possible") as described above. In this manner, each department was assigned a maximum carcinogenic exposure potential rating. A total of 71 departments had a maximum carcinogenic potential rating of "known" (associated with at least one "known" human carcinogen), 24 had a maximum rating of "suspected" and five had a maximum rating of "possible". A complete listing of chemicals associated with each department by year including sampling information is provided in Appendix Table 6A. A similar list, but including only chemicals with an assigned carcinogenic exposure potential and not listing by year, is provided in Appendix Table 6B. The overall and target organ group maximum carcinogenic exposure potential rating for each department (excluding asbestos, silica and lead – see explanation in 4.3.1 below) is provided in Appendix Table 7.

4.2.3 Comparison Between Computerized Industrial Hygiene Files and the CHEMS Database

Comparisons were made between the IH information identified in our search of IH records, and those included in the CHEMS database. Our IH file had results from 156 departments, while the

CHEMS database contained sampling information for 163 departments, with 123 departments included in both sources. In addition, our IH File included only process descriptions for an additional 57 departments (nine of which had sampling information in the CHEMS database). The distribution of IH information by department for these two sources is provided in Appendix Table 8.

4.3. The Work History Exposure File

The Work History Exposure file was evaluated to calculate the number of workers with potential exposure to carcinogens. In addition, the correlation between job-based exposure assignments (re: "Wet" and "Machining" process) and department based potential carcinogenic exposures was explored to suggest alternative methods of examining or assigning exposure information.

4.3.1 Jobs with Potential Carcinogenic Exposures – Full Cohort

Of the 541,113 jobs included in the Work History Exposure File, department codes for 438,374 (81.0%) did match any department code in the IH file and were assigned a potential carcinogenic exposure rating of "missing". Of the remaining jobs, 61,520 (11.4%) had a potential carcinogenic exposure rating of "known", indicating that at least one "known" carcinogen was used in that department. An additional 22,493 jobs had a potential carcinogenic exposure rating of "suspected", while only 1,658 (0.3%) had a rating of "possible". 17,068 departments had chemical exposures which were "not rated". See Appendix Table 9A for the full distribution of IH data by Job.

With 81% of jobs having no IH data associated with them, questions about the completeness of the IH data and our assumption that departments without IH information are generally departments without chemical exposures of concern become more important. We know that the CHEMS database had chemical sampling information on 35 departments that have no chemical information in our IH file. While this information would certainly improve the completeness of our data, we do not believe that it would substantially change the reported distribution of IH data. It is clear that any effort at conducting a full exposure assessment would need to focus on obtaining as complete information as possible on each department to evaluate the completeness of the IH data and the correctness of our assumptions.

4.3.2 Employees with Potential Carcinogenic Exposures – Full Cohort

Potential employee exposure to carcinogens among the 28,000 employees in the full cohort was explored excluding exposure to asbestos, silica and lead. Asbestos exposure was excluded because it was, as far as we could determine, associated with materials in the structure of the facility and not in any of the processes. Thus, while asbestos sampling was associated with a few departments, we did not feel that this indicated a risk particular to that department. Silica was used for sandblasting in particular departments. However, frequently other materials (e.g., pumice) were indicated, which may or may not contain silica. We felt including this particulate carcinogen with the other chemicals would be inconsistent and could add confusion to the analysis. Finally, lead was just recently classified as a carcinogen based upon its organic form. The lead exposure within this industry was predominantly inorganic.

The measures we used were the:

1. Maximum carcinogenic potential ("known", "suspected", "possible" and "not rated") for chemicals associated with all jobs and for all target organ groups,
2. Total number of potential carcinogens ("known", "suspected", "possible") associated with the job which defined (1) above,
3. Maximum carcinogenic potential ("known", "suspected", "possible" and "not rated") for chemicals associated with all jobs for each target organ group.

Among the 28,000 employees, 8,631 (30.8%) worked in a department with at least one "known" human carcinogen, 1,663 (5.9%) additional employees worked in a department with at least one "suspected" human carcinogen, 198 (0.7%) worked with a "possible" human carcinogen, and 1,357 (4.8%) employees worked in departments with IH information, but none with any listing of a chemical rated as a carcinogen ("not rated"). A total of 16,151 (57.7%) had no IH information associated with any department in which they worked. As with the distribution of departments with IH data, the accuracy of this distribution of exposures among employees is dependent upon the completeness of the data and our assumptions about departments without IH data.

The full distribution of employees by departmental maximum carcinogenic potential and numbers of carcinogens is presented in Appendix Table 10. Appendix Table 11 presents the distribution of employees by maximum carcinogenic potential for each target organ group. Among the specific target organ groups, respiratory and circulatory cancers have significant numbers of workers with potential carcinogenic exposures.

4.3.3 Jobs and Employees with Potential Carcinogenic Exposures –1980 or Later Cohort

The analysis of IH information presented above was repeated for the 1980 or later period when IH information was more detailed and consistently reported. Among the 366,588 jobs starting in 1980 or later (67.7% of full cohort jobs) the distribution of IH exposure information is virtually identical to the full cohort (see Appendix Table 9B). Similarly, among the 22,573 employees with jobs starting in1980 or later (80.6% of full cohort employees) the distribution of potential exposures is very similar (see Appendix Table 10B). Besides the overlapping of the time periods, the similarity between the exposure distributions for these two time-periods can be explained by the fact that we did not take time-period into account when assigning IH exposure information to departments. However, if we make the assumptions that 1) department codes were generally changed when major changes in processes were introduced (not always true), and 2) that no major chemical substitutions within processes were introduced prior to 1980, then the observed similarity provides some indication that there is not too much confounding of information based upon missing data, as we would expect this to be a much greater problem prior to 1980.

4.3.4 Comparison of Exposure Assessments

A comparison between the work history (department and position titles) based assessment of "Wet" and "Machining" process exposures and the IH (department based) assessment of potential carcinogenic exposures was conducted to both evaluate the usefulness of work history codes for evaluating exposure, and use this information to evaluate the potential for missing exposure based solely on IH records. It should be pointed out that we would expect differences in these two rating systems. For one, these assessments are based on different information. The process evaluations depended upon both department and position in each work history, while the potential carcinogenic exposure assessments were based only on department (linked to IH records).

"Wet" process jobs may be considered likely to involve a larger number of chemicals and a higher probability of potential carcinogenic exposures. This assumption seems to be validated when we look at the distribution all jobs in our work history with respect to the department's maximum carcinogenic potential and "Wet" process potential (see Appendix Table 12). 74.9% of all jobs with a high "Wet" process potential were in departments which had potential exposures to chemicals rated as "known" or "suspected" human carcinogens (compared to only 15.6% of all jobs independent of their "Wet" process potential). Only 23.3% (1,730) of jobs with a high "Wet" process potential were in departments that had no IH evaluations compared to 81.0% of all jobs. In a full exposure assessment, it would be interesting to focus on those jobs with both a high "Wet" process potential and either a "not rated" or "missing" carcinogenic potential to evaluate the accuracy of these ratings.

"Machining" process jobs involve some chemical exposures and may be considered to have an intermediate potential for carcinogenic exposures. Again, this assumption is borne out in looking at job distribution by "Machining" process potential and the department's maximum carcinogenic potential (see Appendix Table 13). While not as impressive as the distribution for "Wet" process jobs, 21.8% of jobs with high "Machining" process potential were in departments which had potential exposures to chemicals rated as "known" or "suspected" human carcinogens (compared to only 15.6% of all jobs independent of their "Wet" process potential). In addition, 71.4% of jobs with a high "Machining" process potential were in departments that had no IH evaluations compared to 81.0% of all jobs. It should be pointed out in evaluating Table 13 that jobs with less than a high "Machining" process potential may have some potential for "Wet" processing exposures.

Jobs which fall into neither category would be the least likely to involve many chemical exposures. Appendix Table 14 looks at the distribution of jobs with respect to the department's maximum carcinogenic potential and "Wet" process potential, but limited to only those jobs which are rated as having no "Machining" process potential. We see that 94.5% of those jobs with neither "Machining" nor "Wet" process potential were in departments with no IH evaluation, and that only 3.7% were in departments which had potential exposures to chemicals rated as "known" or "suspected" human carcinogens.

5.0 Conclusions

In this section, we will present the conclusions we have reached concerning the feasibility of conducting an exposure assessment for a study of cancer in the electronics industry at the IBM Endicott facility. These conclusions are based upon the ability to: 1) identify occupational exposures at this facility; 2) estimate the potential carcinogenicity of these exposures; and 3) link exposures with employees at this facility, including duration of exposure, through work histories.

5.1. Identification of Occupational Exposures

The IH File provided documentation on the presence of 198 specific chemicals and 10 non-specific chemical categories located in 213 departments. However, there are significant limitations in the IH information which we will discuss. These include:

- Potential for missing information as indicated by divergence with the CHEMS database
- Large number of departments with no sampling information
- Infrequency of sampling
- Large number of samples with non-detectable results

5.1.1 Potential for Missing Information

The potential for missing information is significant. Paper records can be lost or misplaced over time. However, the existence of a computerized record of IH sampling and process descriptions, the CHEMS database, covering much of the relevant time-period, can go a long way towards helping resolve issues of missing data. Our initial comparison of these two data sources showed considerable overlap, but also identified a number of chemical exposures and departments not included in our review of the original paper records. It would be very important to explore and resolve these differences if a full exposure assessment of the Endicott facility were conducted.

5.1.2 Departments with No Sampling

The large number of departments identified in the work history files for which there is no IH information introduces additional concerns about the completeness of the IH information. Many areas of the Endicott facility may have had no significant chemical exposures. Such departments include activities such as sales and programming. The limited number of IH samples taken over the years at the Endicott facility indicates that sampling was not likely to be conducted in areas that were not considered "at-risk". Our analysis in section 4.3.4 above tends to support this assumption. However, in conducting an exposure assessment, it would be important to fully evaluate this assumption, and to document as well as possible that areas that were not sampled did, in fact, represent those without significant chemical exposure.

5.1.3 Infrequency of Sampling

The infrequency of sampling severely limits the usefulness of the IH data. Sampling for specific chemicals did not appear to be conducted on a regular basis. The IH records often described samples as being taken either due to employee complaints, or after modifications to equipment. Thus, these samples would likely not be representative of some "normal" level of exposure. While the IH data included personal samples, and often described a sample taken at a particular position within the process (e.g., "at the loading point"), the infrequency of sampling reduced the usefulness of this level of detail. It would be very difficult, if not impossible, to have any confidence in using the data we reviewed to calculate specific quantitative exposure estimates for any given department for any year or over a period of years. It would be impossible to use those data to assign exposures to a particular person.

The infrequency of sampling also made it difficult to assess changes in exposure over time. While some IH records specifically mentioned changes in processes or chemicals used, this could not be considered as a complete record of these changes. In this feasibility analysis, we have chosen to assign all exposures as a constant over the entire period of evaluation. This is clearly not the case and will overestimate exposures.

The production of circuit boards started around the early to mid 1960's (according to company and employee descriptions) and quickly increased in the quantity produced during the 1970's. These "wet" processes often involved the use of multiple chemicals – some of which turned out to be "known" or "suspected" carcinogens. Understandably, changes over time tended to enclose these processes (reducing exposure) and eliminate the use of the most toxic chemicals. It seems clear the earlier exposures would have been at higher levels and to more dangerous chemicals. Thus, our overestimate of exposures, particularly to potential carcinogens, is most likely found in the later part of the study period. A more detailed investigation of the IH records would probably allow researchers to eliminate most of the overestimation problem. Eliminating consideration of earlier exposures would be a mistake and probably lead to a considerable underestimation of exposures.

5.1.4 Non-detectable Results

Finally, the large number of samples with non-detectable results could indicate that exposures were very low or non-existent, or insensitive equipment or assays were utilized in taking samples. Many of the detectable levels, while not recorded for this evaluation, were also quite low compared to published standards of exposure. This could bring into question the assignment of these exposures to departments independent of the observed levels. This should certainly be evaluated during a full exposure assessment. On the other hand, the frequent concurrence of multiple exposures in departments could argue against using standards set for single exposures, and may substantially increase the risks associated with even very low exposure levels.

The limitations of the IH data discussed above must take into account that other researchers and former employees attribute much of the potential exposures associated with these processes to spills, leaks and skin contact. These situations are not likely to be captured in the available IH data. In the final analysis, the IH data may be most useful for indicating the presence of potential exposures. In addition, process descriptions contained in the data may be useful for potential rankings of exposure into qualitative categories such as "high", "medium" and "low" that could be based upon enclosed vs. open processes, descriptions of ventilation, and the number of hours of operation per week for a given process. Other parameters that may be useful in qualitative categorization may include jobs where exposure was intermittent (i.e., experimental and developmental departments), as compared to more continuous exposures in production related departments.

5.2. Potential Carcinogenicity of Exposures

Potential carcinogenicity of exposures was assigned based upon four authoritative sources well known and frequently referenced for their ratings. These included the:

- International Agency for Research on Cancer – World Health Organization – (IARC)
- National Toxicology Program – US Department of Health and Human Services (NTP)
- American Conference of Governmental Industrial Hygienists (ACGIH)
- California State – Proposition 65 (CA)

Among the chemicals identified through the IH files, 20 are considered "known" human carcinogens, with another 16 rated as "suspected' human carcinogens and 8 rated as "possible" human carcinogens. The prevalence of these "known" or "suspected" carcinogens in the workplace was generally wide spread. Among the 214 departments with any chemical exposure information, 71 (33%) had exposure to at least one chemical considered to be a "known" carcinogen, another 24 (11%) had exposure to at least one "suspected" carcinogen, while five (2%) more had exposure to a "possible" carcinogen.

5.3. Linkage of Exposures with Work Histories

The Aggregate Work History file provides essentially complete (>99%) information on date of birth, gender, race, date of hire, department and date of separation for 28,000 unique individuals (based upon social security number) who worked at Endicott for at least one year after 1965. A histogram of the start year for each work history (job) is provided in Appendix Graph I.

The exposure information we used for this evaluation is contained in our IH file, and was limited to information contained in hard copy IH files and microfilms of earlier hard copy files. It did not include additional data in the CHEMS database. The IH data are organized by department as defined with a 3-digit alphanumeric code. The same departmental code is available in the Aggregate Work History file. This code was used to merge information from the two files.

Analyses of the linked data showed that approximately 30% of the cohort had worked in a department with potential exposure to "known" human carcinogens. This was true for both the entire cohort and the 1980 or later sub-cohort. This estimate is biased upward by the fact that we assigned exposures to departments without consideration of time-period. Therefore, it is possible that some employees worked in departments that had potential carcinogenic exposures in the past, but not at the time they were working there.

Another consideration is whether duration of potential exposure can be calculated accurately using the work history data. Approximately half of the work history files include dates for the beginning and end of the job assignment, while the remainder are based upon year end information and did not capture mid-year changes. Thus, significant misclassification in duration of time spent in departments with exposures could be introduced by relying on year-end information. Interestingly, histograms comparing the starting years for the work histories with the year covered for the year-end personnel files demonstrate that these both cover the same time periods (see Appendix Figure 1 A and B). This is clearly due to the fact that a majority (over 80%) of the cohort worked during or after 1984 and thus had their complete work histories maintained. It was also clear from a visual inspection of the Aggregated Work History File that many job assignments were duplicated between these two types of employment information. Thus, reliance on year-end data may be substantially reduced once the Aggregated Work History File is more thoroughly investigated, and an assessment of potential misclassification could be conducted by comparing the two types of information.

The linkage of exposure data based solely on department does limit the detail with which exposure can be assigned. It appears that Endicott departments were organized around certain processes or process lines. Thus, each IH measurement is essentially an area exposure for a given process or group of processes. This sampling methodology necessarily grouped the various exposures associated with these processes together. We see little prospect for ungrouping these exposures and assigning more specific exposures to individuals given the data we reviewed.

6.0 Recommendations

We believe there is sufficient data available to conduct a formal exposure assessment for a cancer study of the IBM Endicott facility from 1965 through 2003. In particular, there is sufficient potential exposure to "known" carcinogens to investigate cancer outcomes. Additionally, there are sufficient demographic attributes available for the cohort to permit cancer incidence linkage and adjudication. However, there would be severe limitations on what could be expected from an exposure assessment. The quantity of IH sampling appears to be insufficient to allow assignment of quantitative exposures to any specific chemical or group of chemicals. This conclusion is further strengthened by our understanding that specific situations, such as leaks, spills, and skin contact, may represent the greatest exposure risks in this cohort.

We believe that there is sufficient information to assign either specific or grouped potential exposures on a departmental level and recommend this approach. However, we do not believe that it is possible to subdivide exposures within department based upon job assignment. It may be possible for some specific chemicals or chemical groupings to assign qualitative levels of exposure (e.g., high vs. low) for departments based upon time-period of exposure and associated changes in processes (enclosure, ventilation, etc.). It may also be possible to assign qualitative levels based upon the activities within the department that may reflect the frequency of potential exposures. Certain departments such as those associated with product development or experimental design may have similar, but much less frequent exposures than production line departments (employee provided information). In addition, process notes contained within the IH records sometimes described the number of hours per day and days per week that a given process was actually being run.

It would be essential for any exposure assessment that information in the hard copy IH records be fully integrated with the CHEMS database. It is equally important that IH notes on processes and process changes from both the hard copy IH records and the CHEMS database be thoroughly integrated into the analysis. In addition, the ECHOES database, while limited in the time-period covered, would provide valuable information in interpreting job parameters with exposures. Finally, this combined information should be supplemented by interviews with ex-employees, and especially with industrial hygienists formerly employed at the IBM Endicott facility.

We also understand that, while many of the exposure assignments we have made are based upon IH sampling with detectable levels, other exposures had only non-detectable samples or were simply listed as potential exposures within the process. The Endicott facility had many departments with complex groupings of exposures. We would recommend and expect that an exposure assessment of this facility would evaluate various exposure assignment scenarios, taking into account different levels of confidence for certain exposures as well as different groupings of exposure.

Specific exposure information will be particularly scarce prior to 1980, although it is clear that earlier potential exposures were much higher. The IH reports described open processes with limited ventilation during these earlier periods. Thus, in conducting an exposure assessment for a study of cancer at this facility, it would be important to weigh the reduced accuracy of exposure assignment against missing the higher exposures (and longer latency) from the earlier time period. It is certainly possible that somewhat generalized exposures based upon process descriptions might be assigned in order to include the full cohort in the analysis.

Finally, IBM has presented us with cautionary notes about the usefulness of both the work history and IH data. With regard to the work history data, IBM wrote that "the most salient limitations are that (1) the data are a snopshot at year-end and thus do not capture employees that were not employed as of year-end, and (2) neither the listed job titles, position codes, nor department information (nor any other information among this data) defines an employee's job duties, daily activities or potential chemical or other exposures". With respect to the IH data, we were warned that departments could either (1) have their code changed, or (2) have the activity changed without a code change. We did, in fact, see some mention of this in the IH records. We believe that these cautionary notes could be true for most companies over an extended period of time, and believe that every effort has to be made to identify inconsistencies and changes in the departmental data. We also believe that job specifications do not always accurately capture an employee's activities. However, we have observed that there are distinct types of operations defined by departments. These include "Wet" process operations, machining operations, assembly operations, along with sales, programming and design operations. We believe that, while there may have been some migration between these departments, the skills and training associated with these different processes would limit the amount of migration. We thus conclude that, while there will certainly be misclassification associated with any exposure assignments made using the available data, that this would not exceed the level of misclassification in many retrospective occupational epidemiologic and exposure assessment studies.

6.1. Specific Recommendations for an Exposure Assessment

We make the following recommendations based upon our understanding of the data available, and with the expectation that a considerable amount of time and effort would be spent in evaluating the data and finding additional supportive information in terms of additional databases not available to us and extensive interviews with past employees and industrial hygienists. Our recommendations are more general than specific, as final decisions on how to conduct an exposure assessment will be based upon the investigators level of confidence in the data after a level of effort that was beyond the scope of this evaluation.

Recommendations:

- Exposure categorization should be done on a departmental level, without regard to an employee's assigned position. Possible exceptions would be management positions that removed the employee from the production line.
- Specific chemical exposures may be assigned to departments based upon their usage in the department. This is particularly true for identified carcinogens if the exposure assessment is conducted in support of a study of cancers in this cohort. These assignments may include adjustments for the investigator's confidence in the potential for exposure based upon how the chemical is used in the process and properties of the chemical (e.g., volatility, skin absorption). We would be wary of adjustments based primarily on IH sampling as we do not believe there is sufficient sampling to be representative.
- Alternative exposure assignments may be made based upon related processes. This may include the "Wet" process group evaluated here, or more specific process groupings. Such assignments may take into account specific groupings of chemicals common to a

number of processes (e.g., various etching processes). This alternative, while less specific, may avoid misclassification due to limited information on some departments.

- There should be no attempt to assign quantitative levels of exposure. The primary exposure assessment should be dichotomous (exposed vs. unexposed).
- However, there may be sufficient information on a limited number of chemicals (or chemical groupings) of concern to assign more than a dichotomous categorization of exposure. For these chemicals, high vs. low exposures, or even high vs. medium vs. low exposures, may be able to be assigned based upon how chemicals are used and the frequency with which they are used.
- The above recommendations should be evaluated for two time periods. First, the entire time period of interest from 1965-2002, and second, the reduced time-period from 1980-2002. This is because the level of exposure information will be much greater for the latter time-period, and may allow much more confidence and specificity in the exposure assessment.

6.2. Specific Recommendations for Linking Exposure Data to Work History Data

Below we present three recommendations regarding linkage of potential exposure(s) to work history data.

- The linkage between exposure data and work history data should be by department, with possible adjustment using position only for unexposed managers. Department information is virtually complete in these work histories.
- Exact duration of potential exposure calculations may be difficult given the mixture of work history and year-end personnel data. However, we have seen that these two data sources overlap throughout the entire study period. More work will be required to integrate these data to evaluate how many employee jobs are defined only through the year-end data.
- Work history data should be evaluated for the 1965-2002 and the 1980-2002 time periods to determine if there is an important advantage with respect to completeness of data for the latter time period. This may influence how the data are used.

6.3. Specific Recommendations on Important Exposures – Especially Carcinogens

To conclude, we provide additional recommendations regarding priority on "known" or "suspected" carcinogens.

- All identified chemicals used at Endicott have been listed in the Appendix (Table 5).
- Because this feasibility evaluation is for an exposure assessment for a study of cancers, highest priority exposures should be those chemicals that have been identified as "known" or "potential" carcinogens. While all potential carcinogens are important, these chemicals should be prioritized by whether they are "known", "suspected" or "possible" carcinogens. Further refinement of prioritization should be based on an additional

assessment of how these chemicals were used at Endicott, as well as their individual properties (e.g., volatility, skin absorption).

- Alternative prioritization of important chemicals may use the number of departments in which chemicals are found. Table 15 gives the number of departments that each chemical is associated with.
- With respect to using the exposure assessment for conducting a study of cancer, we recommend that primary focus be on respiratory and circulatory carcinogens because more employees in this cohort have potential exposure to chemicals known to cause cancers at these sites than at any other site. Additional consideration should be given to liver carcinogens because more employees in this cohort have potential exposure to chemicals suspected to cause cancers at this site than at any other site.. Although there are also a large number of employees exposed to "suspected" carcinogens related to "Other" target organs, this number is dispersed over a wide range of different organs, and does not represent a cohesive group.

Table 1. Summary of Personnel File Evaluation

Problem	# (%) N=28,000
Missing date of birth	99 (0.35%)
Missing date of hire	100 (0.36%)
Date of Hire < Date of Birth	9 (0.03%)
Separation date < Date of Birth	6 (0.02%)
Separation date < Date of Hire	56 (0.2%)
Other work history date < Date of Birth	0 (0%)
Inconsistent date of birth	484 (1.7%)
Inconsistent date of hire*	6,592 (23.5%)
Inconsistent separation date*	4,955 (17.7%)
Inconsistent sex	1,445 (5.2%)
Inconsistent race	1,227 (4.4%)

* includes workers that were hired, separated, and then re-hired

Table 2A: Division of Exposure Potential as Calculated from Department and Position Titles

Division	Descriptive Title and Exposure Potential	Rating
00	General Support/Test/Repair/Develop – Probable Exposure	Probable
02	Card Lamination and Assembly – Probable Exposure	Probable
05	Human Resources, Procurement and Strategy - Minimal Exposure	None
06	International Assigned Account Manager (only one entry)	None
07	Programming & Development-Business Solutions-IT management-Minimal Exp.	None
08	Engineering Development - Minimal Exposure	None
10	Accounting and Administration, Support Services - Minimal Exposure	None
11	Financial Analysis - Minimal Exposure	None
12	Customer Services, Support Services - Minimal Exposure	None
14	Engineering, Tooling, Special Assembly - Minimal Exposure	None
15	Advanced Product Design and Assembly - Most with Minimal Exposure	Probable
16	Storage Program - Minimal Exposure	None
17	Biomedical Engineering and Project Office - Minimal Exposure	None
18	Computer Imaging - Minimal Exposure	None
19	Education and Support - Minimal Exposure	None
1E	Application Development - Minimal Exposure	None
1N	CCR - Endicott - Primarily Professional and Managment - Minimal Exposure	None
20	Computer Imaging - Minimal Exposure	None
21	Architecture and Design Development	None
22	Code development and Chip design	None
23	Distributed Support, Services and Management - programming - Minimal Exp.	None
24	Environmental Health and Safety and consultants - Minimal Exposure	None
25	Very Broad - Building and Testing Circuit Boards - Probable for Exposure	Probable
26	Product Development - Programming and Engineering - Minimal Exposure	None
27	Banking systems - broad range - probable exposure	Probable
29	Very Broad - Building and Testing Circuit Boards - Probable for Exposure	Probable
2C	Software Development - Minimal Exposure - Minimal Exposure	None
2D	Software Distribution - Minimal Exposure	None
2V	Marketing - Minimal Exposure	None
30	Unknown - Assigned 1 - Possible Exposure	Probable
31	Development Engineering and Modeling - Some probable for exposure	Probable
32	Banking Machine Manufacture - Broad - Some probable for exposure	Probable
33	Developmental Labs - some probable for exposue	Probable
35	Printer production technology - Minimal Exposure	None
36	Support and Training Services - Minimal Exposure	None
37	Printer Development - Minimal Exposures	None
38	Computer Development, Assembly and Support - Broad - Probable for Exp.	Probable
39	Financial Planning and Analysis - Minimal Exposure	None
3Y	Management - Minimal Exposure	None
40	Unknown - Assigned 1 - Possible Exposure	Probable
41	Design Support and Training - Minimal Exposures	None
42	Very Broad - Building and Testing Circuit Boards - Probable for Exposure	Probable
43	Program Development - programming - Minimal Exposure	None
44	Marketing - Minimal Exposure	None
45	Feeder Assembly - Minimal Exposure	None
46	Product Development - Minimal Exposure	None
47	Procurement - Minimal Exposure	None
48	Planning Management and Procurement - Minimal Exposure	None
49	Human Factors - Minimal Exposure	None
4S	Marketing - Minimal Exposure	None
50	Management - Minimal Exposure	None

Table 2A: Division of Exposure Potential as Calculated from Department and Position Titles

Division	Descriptive Title and Exposure Potential	Rating
52	Marketing - Minimal Exposure	None
53	Printer Manufacturing - Minimal Exposure	None
54	System solutions - programming and engineering solutions - Minimal Exposure	None
55	Maintenance, Chem. Control, Environmental Control - Probable for Exposure	Probable
56	Admin/Clerical - Minimal Exposure	None
57	System support - Minimal Exposure	None
59	Administrative - Minimal Exposure	None
5R	Software solutions - Minimal Exposure	None
5T	Marketing - Minimal Exposure	None
60	Customer Service - Minimal Exposure	None
61	Software Engineering - Minimal Exposure	None
62	Product Development - Minimal Exposure	None
63	Multimedia - Minimal Exposure	None
64	Counsel - Minimal Exposure	None
65	Product Engineering, Develop and production - Broad - Probable for Exposure	Probable
66	Technology Development - Minimal Exposure	None
68	Administration and Analysis - Minimal Exposure	None
69	Banking Unit Assembly - Minimal Exposure	None
6E	Management - Minimal Exposure	None
6M	Management - Minimal Exposure	None
6N	Management - Minimal Exposure	None
6S	Project Teams - Minimal Exposure	None
71	Management - Minimal Exposure	None
72	Management - Minimal Exposure	None
74	Planning - Minimal Exposure	None
75	Programming - Minimal Exposure	None
76	Management - Minimal Exposure	None
77	Business Support - Minimal Exposure	None
78	Management - Minimal Exposure	None
79	only one - blank	None
7G	Development - Minimal Exposure	None
7H	Development - Minimal Exposure	None
7J	Development - Minimal Exposure	None
7R	Management - Minimal Exposure	None
7S	Management - Minimal Exposure	None
7T	Systems Development - Minimal Exposure	None
7Y	Management - Minimal Exposure	None
83	Systems Development - Minimal Exposure	None
84	Management - Minimal Exposure	None
85	Planning and Analysis and Maintenance - Some probable in some areas	Probable
88	Reutilization - Some Probable Exposure	Probable
89	Planning and Development - Minimal Exposure	None
8M	Software Engineering - Minimal Exposure	None
90	Management - Minimal Exposure	None
91	Management - Minimal Exposure	None
92	Printer Manufacturing Management - Minimal Exposure	None
93	Planning Management - Minimal Exposure	None
94	Management - Minimal Exposure	None
95	Management - Minimal Exposure	None
96	Programmer - single entry - Minimal Exposure	None

Table 2B: IBM Division Codes and Descriptions – 1996

Code	Description
00	TESTING
06	IBM PERS COMPUTER COMPANY
07	INTGD SYSTMS SOLUTNS CORP (BUSINESS SYSTEMS)
08	SYSTEMS TECH & ARCH
1A	DEFAULT DIVISION FOR TRANSFERS
1C	EARLY CLOUD & CO
1E	IBM GLOBAL SERVICES
1P	PRODIGY
10	CORPORATE HEADQUARTERS
11	PERSONAL SYSTEMS
12	IBM UNITED STATES (MARKET OPERATIONS)
13	PC SERVERS
15	LOCKHEED MARTIN FEDERAL SYSTEMS
16	FED INTEGRATION & SVCES
17	IBM GLOBAL NETWORK-US
18	APPLICATION SOLUTIONS
19	EDUCATION & TRAINING
2C	FAIRWAY TECHNOLOGY
20	GENERAL SECTOR DIVISION
21	IBM MICRO-CHARLOTTE
22	IBM RESEARCH
23	NATIONAL SERVICE DIVISION
24	BUSINESS TRANS SERVICES
25	IBM MICRO-A&SD
26	SYSTEM 390
27	IBM MICRO-HIGH END
28	AMBRA
29	IBM MICRO-LAB
30	INTERNATIONAL SUPPORT
31	IBM FEDERAL SERV ORG
32	NETWORKING APPLIC SVCES DIV
35	STORAGE SYSTEMS DIV
37	POWER PARALLEL SYSTEMS
38	CLIENT/ SERVER
39	LARGE SCALE COMPUTING
41	INFORMATION PRODUCTS
42	IBM MICRO- M&PD
43	NETWORKING SYSTEMS
44	IBM PERS COMPUTER COMPANY
45	INDUSTRY PRODUCTS
46	TIVOLI SYSTEMS DIVISION
47	WORLDWIDE PROCUREMENT
48	ISG SOFTWARE & BUSINESS SVCS
49	NETWORKING HARDWARE DIV

Table 2B: IBM Division Codes and Descriptions – 1996

Code	Description
5B	IBM CS SYSTEMS
5C	CSL TECH SERVICES
50	IBM ASIA PACIFIC
51	POWER PERSONAL SYS
52	DISPLAY BUSINESS UNITS
54	AS/ 400 DIVISION
55	IBM REAL ESTATE SERVICES
56	EMPLOYMENT SOLUTIONS CORP
57	INTEGRATED FED SOLNS
58	LOCKHEED MARTIN FEDERAL SYSTEMS
59	IBM UNITED STATES (MARKET OPERATIONS)
60	TECHNOLOGY SERVICE SOLUTIONS
62	IBM MICRO-PATS PKG
63	BRANCH DELIVERY SERVICE
64	NETWORKING SYSTEMS HQ
65	IBM MICRO-END
66	CELESTICA
68	HUMAN RESOURCES US
69	SERVICES SECTOR DIVISION
70	PERSONAL SYSTEMS GROUP
71	IBM PERS COMPUTER CO - NA
72	IBM UNITED STATES
74	PRINTING SYSTEMS COMPANY
75	RISC SYSTEM 6000 DIV
76	SOFTWARE SOLUTIONS
77	ADVANTIS
78	SERVER DIVISION
79	CONSUMER DIVISION
8E	MERITIS
80	LEXMARK INTERNATIONAL INC. (INDEPENDENT CORP.)
81	LEXMARK INTERNATIONAL INC. (INDEPENDENT CORP.)
82	ROLM COMPANY
83	INDUSTRIAL SECTOR DIV
84	IBM CREDIT CORPORATION
85	TP ENDICOTT SERVICES
86	MiCRUS
88	INTGD SYSTMS SOLUTNS CORP (BUSINESS SYSTEMS)
89	IBM SOFTWARE GROUP
9T	SPEECH / HUM CENTRIC COMPUTING
90	IBM WORLD TRADE CORP
92	PRINTING SYSTEMS COMPANY
93	IBM WORLD TRADE CORP E/ME/A
94	IBM WT LATIN AMERICA
95	PS PERS SOFTWARE PROD

Table 2B: IBM Division Codes and Descriptions – 1996

Code	Description
96	LOCKHEED MARTIN FEDERAL SYSTEMS
D01	REALCOM CORPORATION
D02	SCIENCE RESEARCH ASSOCIATES, INC. (WAS DIV 92)
D07	INTEGRATED SYS SOLUTNS CORP
D08	INTEGRATED SYS SOLUTNS CORP
D13	ENTRY SYS TECH
D14	OFFICE PRODUCTS DIVISION
D15	FEDERAL SYS CO
D17	SYSTEMS SUPPLIES DIV
D30	DATA PROCESSING GROUP
D32	FIREWORKS PARTNERS
D33	COMPONENTS
D34	DATA PROCESSING MKTG GRP
D36	SOUTH-WEST MARKETING DIV
D39	SYSTEMS DEVELOPMENT
D4A	CONSUMER SYSTEMS BUS UNIT
D40	GENERAL BUSINESS GRP
D45	ACADEMIC INFO SYSTEMS
D46	SYSTEM PRODUCTS DIVISION
D47	IBM INFORMATION SERVICES
D53	LOW END STORAGE
D58	IBM FEDERAL SECTOR SVCES CORP
D60	GEMINI SERVICES L.P.
D61	HARRISON ADMINISTRATION
D63	MULTIMEDIA
D73	RETAIL MARKETING
D76	PROGRAMMING SYSTEMS
D78	EDUQUEST
D79	FEDERAL SYSTEMS MARKETING
D86	TEAK
D89	ROLM SYSTEMS
D91	SERVICES BUREAU CORP
+01YY	BRIDGE LOA REC PRIOR TO CURR YR
0100	PROJECT OFFICE TEST
0200	PROJECT OFFICE TEST
06FB	CUSTOMER FULFILLMENT
06LA	WW MANUFACTURING
06MB	FINANCE & PLANNING
06NP	US/MAN/DIS - IBM PA NA
06PA	INFORMATION SYSTEMS
061Q	PRINTED WIRE DBS
07BA	IGS BUSINESS SYSTEMS
07CB	BUSINESS PROCESS RE-ENGINEERING
07DA	IGS BUSINESS SYSTEMS

Table 2B: IBM Division Codes and Descriptions – 1996

Code	Description
07DB	IGS BUSINESS SYSTEMS
07DC	IGS BUSINESS SYSTEMS
07DD	IGS BUSINESS SYSTEMS
07DE	IGS BUSINESS SYSTEMS
07DF	IGS BUSINESS SYSTEMS
07DG	IGS BUSINESS SYSTEMS
07DM	IGS BUSINESS SYSTEMS
07DR	IGS BUSINESS SYSTEMS
07EG	GENERAL COUNSEL
07EH	PERSONNEL & ADMINISTRATION
07JA	BUSINESS SYSTEMS
07JB	BUSINESS SYSTEMS
07JC	BUSINESS SYSTEMS
07JD	BUSINESS SYSTEMS
07JE	BUSINESS SYSTEMS
07JF	BUSINESS SYSTEMS
07JG	BUSINESS SYSTEMS
07JH	BUSINESS SYSTEMS
07JJ	BUSINESS SYSTEMS
07JK	BUSINESS SYSTEMS
07JM	FINANCE
07JP	DIR FIELD ADMINISTRATION
07MA	ISG BUSINESS SYSTEMS
07NA	ISG BUSINESS SYSTEMS
0TD	QUALITY
07TE	QUALITY
07VA	CHAIRMAN/ CEO - ISSC
07VB	VP AEROSPACE
07VC	ISSD PERSONNEL
07VD	VP SYS SOLUTIONS
07VE	VP SYS OPERATIONS
07VF	VP FINANCE & PLANNING
07VG	GM CONSULTING & GLOBAL SYS INTEG
07VH	VP SYSTEMS SOLUTIONS
07VI	ISSD PERSONNEL
07VJ	GM CONSULTING & SYS INTEG
07VK	BUSINESS SYSTEMS
07VL	STRAT ARCH & TECH
07VM	VP GLOBAL NWS MGMT MKTG
07VN	NND INFO SYS
07VP	BUS SUPT SYS
07VQ	MKTG & SYS SUPT
07VR	CUST & FLD SUPT
07VS	GM GLOBAL BUS STRATEGY

Table 2B: IBM Division Codes and Descriptions – 1996

Code	Description
07VT	VP SYS OPERATIONS
07VZ	GM GLOBAL BANKING/ FIN & SECUR
07XA	IBM US ACCOUNTING
07XP	IBM US PERSONNEL
+07YY	BRIDGE LOA REC PRIOR TO CURR YR
0700	ISG BUSINESS SYSTEMS
08AD	STA - FIN & PLANNING
08HE	SYSTEMS TECH & ARCH
08HH	STA - FIN & PLANNING
08VA	ISSD
08VC	ISSD
08VD	ISSD
08VE	ISSD
08VF	ISSD
08VG	ISSD
08VH	ISSD
08VI	ISSD
08VJ	ISSD
08VM	ISSD
08VS	ISSD
08VT	ISSD
0800	UNKNOWN & I/ ASSIGNEES OUT
084A	SYSTEMS TECH & ARCH
ICAA	EARLY CLOUD & CO
ICUD	EARLY CLOUD & CO
1ERA	GLOBAL SERVICES
IERB	IBM CONSULTING GROUP
IERC	IBM CONSULTING SVCES
1ERE	FINANCE & PLANNING
1ERG	IBM GLOBAL NETWORK
+1EYY	BRIDGE LOA REC PRIOR TO CURR YR
1PAA	PRODIGY
10AA	OFFICE OF THE PRESIDENT
10BA	FINANCE & PLANNING
10BB	TREASURER
10BC	BUSINESS PLANS
10BD	SECRETARY
10BE	CONTROLLER
10BF	ECONOMICS

Table 3: Wet and Machine Process Distributions by Job

	Wet Process		Machining Process	
	N	%	N	%
None	443,187	81.9	454,703	84.0
Low	48,750	9.0	39,551	7.3
Moderate	41,766	7.7	37,717	7.0
High	7,410	1.4	9,142	1.7
Total	**541113**	**100.0**	**541113**	**100.0**

Table 4: Wet and Machine Process Distributions by Employee

	Wet Process		Machining Process	
	N	%	N	%
None	17,734	63.3	17,459	62.4
Low	3,413	12.2	3,040	10.9
Moderate	4,972	17.8	5,082	18.2
High	1,881	6.7	2,419	8.6
Total	**28,000**	**100.0**	**28,000**	**100.0**

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Known	7440-38-2	Arsenic	1	1	A1	Yes	lung, blood, skin
Known	1332-21-4	Asbestos	1	1	A1	Yes	lung
Known	71-43-2	Benzene	1	1	A1	Yes	blood
Known	92-87-5	Benzidine	1	1	A1	Yes	liver, kidney, bladder
Known	50-32-8	Benzo(a)pyrene	1	1	A1	Yes	lung, kidney, skin
Known	7440-41-7	Beryllium	1	1	A1	Yes	lung
Known	7440-43-9	Cadmium	1	1	A2	Yes	lung, prostate
Known	7440-47-3	Chromium (as Hexavalent)	1	1	A1	Yes	lung
Known	1333-82-0	Chromium Trioxide (chromic acid) [chrome(VI)oxide]	1	1	A1	Yes	lung
Known	65996-93-2	Coal Tar Pitch Volatiles (see Benzo(a)pyrene)	1	1	A1	Yes	lung, kidney, skin
Known	50-00-0	Formaldehyde	1	2	A2	Yes	nasal, blood
Known	7440-02-0	Nickel	2B	1	A5	Yes	lung, nasal
Known	7718-54-9	Nickel Chloride	1	1	A4	Yes	lung, nasal
Known	557-19-7	Nickel Cyanide [Ni(CN)2]	1	1	A1	Yes	lung, nasal
Known	13770-89-3	Nickel Sulfamate	1	1	A1	Yes	lung, nasal
Known	7786-81-4	Nickel Sulfate	1	1	A4	Yes	lung, nasal
Known	14808-60-7	Silica (Crystaline) [Silicon dioxide--(a-Quartz)]	1	1	A2	Yes	lung
Known	13464-38-5	Sodium Arsenate	1	1	A1	Yes	lung, lymphatic
Known	7664-93-9	Sulfuric Acid	1	1	A2	Yes	lung, nasal, larynx
Known	75-01-4	Vinyl Chloride (vinyl chloride monomer)	1	1	A1	Yes	liver
Suspected	79-06-1	Acrylamide	2A	2	A3	Yes	lungs, testes, thyroid, adrenals
Suspected	107-13-1	Acrylonitrile	2B	2	A3	Yes	brain, lung, bowel
Suspected	1309-64-4	Antimony Trioxide	2B		A2	Yes	lung
Suspected	106-46-7	Dichlorobenzene, p- (1,4-dichlorobenzene)	2B	2	A3	Yes	liver, kidney
Suspected	106-89-8	Epichlorohydrin	2A	2	A3	Yes	nasal
Suspected	107-06-2	Ethylene Dichloride (1,2-dichloroethane)	2B	2		Yes	liver, stomach, lung, uterus
Suspected	8008-20-6	Kerosene	2A		A3	Yes	lung, stomach
Suspected	7439-92-1	Lead	2B	2	A3	Yes	kidney
Suspected	75-09-2	Methylene Chloride (dichloromethane)	2B	2	A3	Yes	lung, liver, salivary, mammary
Suspected	1336-36-3	PCBs	2A	2	A3**	Yes	liver, blood, pituitary
Suspected	127-18-4	Perchloroethylene (Tetrachloroethylene)	2A	2	A3	Yes	liver
Suspected	62-56-6	Thiourea	3	2			liver, thyroid
Suspected	584-84-9	Toluene Diisocyanate (TDI)	2B	2	A4		liver, blood, pancreas, mammary
Suspected	95-53-4	Toluidine, o-	2A	2	A3	Yes	bladder
Suspected	79-01-6	Trichloroethylene	2A	2	A5	Yes	liver, kidney
Suspected	UV	Ultraviolet Light (laser)	2A	2			skin
Possible	8052-42-4	Asphalt	2B		A4	Yes	skin
Possible	1333-86-4	Carbon Black	2B		A4	Yes*	blood

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Possible	7440-48-4	Cobalt	2B		A3	Yes	lung
Possible	100-41-4	Ethyl Benzene	2B		A3		lung, liver, kidney
Possible	91-20-3	Naphthalene	2B			Yes	lung, nasal
Possible	98-95-3	Nitrobenzene	2B		A3	Yes	liver, thyroid
Possible	75-52-5	Nitromethane	2B		A3	Yes	lung, liver
Possible	100-42-5	Styrene (Benzene, ethenyl-)	2B		A4		blood
Not Rated	67-64-1	Acetone					
Not Rated	79-10-7	Acrylic Acid			A4		
Not Rated	7429-90-5	Aluminum					
Not Rated	21645-51-2	Aluminum Hydroxide					
Not Rated	1344-28-1	Aluminum oxide			A4		
Not Rated	7664-41-7	Ammonia					
Not Rated	1336-21-6	Ammonium Hydroxide					
Not Rated	7727-54-0	Ammonium persulfate (ammonium peroxydisulfate)					
Not Rated	7440-36-0	Antimony					
Not Rated	7440-37-1	Argon					
Not Rated	7440-39-3	Barium			A4		
Not Rated	10361-37-2	Barrium Chloride			A4		
Not Rated	119-61-9	Benzophenone (diphenyl-Methanone)					
Not Rated	121-65-3	Benzosulfonic Acid, dodecyl-					
Not Rated	95-14-7	Benzotriazole (BTA)					
Not Rated	100-51-6	Benzyl Alcohol (Benzenemethanol)					
Not Rated	103-83-3	Benzyldimethylamine					
Not Rated	542-88-1	Bischloromethyl Ether (Methane, oxybis[chloro])				Yes	lung
Not Rated	1330-43-4	Borates, tetra sodium salt (anhydrous)					
Not Rated	10043-35-3	Boric Acid					
Not Rated	Brand Names	Brand Names					
Not Rated	7726-95-6	Bromine					
Not Rated	Bronze	Bronze					
Not Rated	71-36-3	Butanol, n-					
Not Rated	78-92-2	Butanol, sec-					
Not Rated	75-65-0	Butanol, tert-					
Not Rated	124-17-4	Butyl Carbitol Acetate (2-[2-butoxyethoxy]ethanol acetate)					
Not Rated	96-48-0	Butyrolactone, gamma-	3				
Not Rated	630-08-0	Carbon Monoxide					
Not Rated	75-73-0	Carbon Tetrafluoride (Freon 14 or Halon 14)					
Not Rated	7782-50-5	Chlorine			A4		
Not Rated	7440-50-8	Copper					
Not Rated	7758-89-6	Copper Chloride					

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Not Rated	10031-48-8	Copper Phosphate					
Not Rated	10102-90-6	Copper Pyrophosphate					
Not Rated	7758-98-7	Copper Sulfate					
Not Rated	2210-79-9	Cresyl Glycidyl Ether, o- (1,2-Epoxy-3-(o-tolyloxy)propane)					
Not Rated	95-48-7	Cresylic acid (phenol, 2-methyl-)					
Not Rated	7447-39-4	Cupric Chloride (Copper(III) Chloride)					
Not Rated	74-90-8	Cyanide (hydrogen cyanide)					
Not Rated	110-82-7	Cyclohexane					
Not Rated	108-94-1	Cyclohexanone	3				
Not Rated	124-02-7	Diallylamine (Di-2-propenylamine)					
Not Rated	95-50-1	Dichlorobenzene, o- (1,2-dichlorobenzene)					
Not Rated	461-58-5	DICY (Dicyandiamide)					
Not Rated	111-46-6	Diethylene Glycol (Ethanol, 2,2'-oxybis-)					
Not Rated	112-36-7	Diethylene Glycol Diethyl Ether					
Not Rated	111-96-6	Diethylene Glycol Dimethyl Ether (diglyme)					
Not Rated	112-34-5	Diethylene Glycol Monobutyl Ether [2-(2-Butoxyethoxy)ethanol]					
Not Rated	112-15-2	Diethylene Glycol Monoethyl Ether Acetate					
Not Rated	111-77-3	Diethylene Glycol Monomethyl Ether (methyl carbitol)					
Not Rated	1675-54-3	Diglycidol Ether of Bis Phenol A [2,2-bis(p-2,3-Epoxypropoxy) phenyl)propane]		3			
Not Rated	108-83-8	Diisobutyl Ketone (2,6-Dimethyl-4-heptanone)					
Not Rated	109-87-5	Dimethoxy Methane (Methylal)					
Not Rated	Not Rated	Dimethyl Acetate					
Not Rated	127-19-5	Dimethylacetamide					
Not Rated	124-40-3	Dimethylamine			A4		
Not Rated	34590-94-8	Dipropylene glycol methyl ether [1-(2-methoxyisopropoxy)-2-propanol]					
Not Rated	60-00-4	EDTA (Etheylene Diamine Tetraacetic Acid)					
Not Rated	Epoxies	Epoxies					
Not Rated	64-17-5	Ethanol			A4		
Not Rated	141-43-5	Ethanolamine (Ethanol, 2-amino)					
Not Rated	141-78-6	Ethyl Acetate (Ethyl ethanoate)					
Not Rated	140-88-5	Ethyl Acrylate			A4		stomach
Not Rated	107-21-1	Ethylene Glycol (1,2-dihydroxyethane)			A4		
Not Rated	111-76-2	Ethylene Glycol Monobutyl Ether (butyl cellosolve) [butoxyethanol]			A3		?
Not Rated	112-07-2	Ethylene Glycol Monobutyl Ether Acetate (butyl cellosolve acetate)			A3		?

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Not Rated	110-80-5	Ethylene Glycol Monoethyl Ether (Ethyl Cellosolve) [ethanol, 2-ethoxy]					
Not Rated	111-15-9	Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)[2-ethoxyethanol acetate]					
Not Rated	109-86-4	Ethylene Glycol Monomethyl Ether (Methyl Cellosolve)					
Not Rated	110-49-6	Ethylene Glycol Monomethyl Ether Acetate (Methyl Cellosolve Acetate)					
Not Rated	7705-08-0	Ferric Chloride [Iron(III)Chloride]					
Not Rated	Fiberglass	Fiberglass					
Not Rated	76-12-0	Freon 112 (1,2-Difluoro-1,1,2,2-tetrachloroethane)					
Not Rated	76-13-1	Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)					
Not Rated	64-19-7	Glacial Acetic Acid					
Not Rated	111-30-8	Glutaraldehyde (1,5-pentanedial)					
Not Rated	7440-57-5	Gold					
Not Rated	7647-01-0	Hydrochloric Acid			A4		
Not Rated	7664-39-3	Hydrogen Fluoride (hydrofluoric acid)					
Not Rated	7722-84-1	Hydrogen Peroxide	3		A3		?
Not Rated	7783-06-4	Hydrogen Sulfide					
Not Rated	123-31-9	Hydroquinone	3		A3		liver, kidney
Not Rated	13464-82-9	Indium Sulfate					
Not Rated	Dyes	Inks and Dyes					
Not Rated	7439-89-6	Iron					
Not Rated	75-28-5	Isobutane					
Not Rated	110-19-0	Isobutyl Acetate					
Not Rated	67-63-0	Isopropyl Alcohol (2-propanol)			A4		
Not Rated	7439-93-2	Lithium					
Not Rated	1309-48-4	Magnesium Oxide			A4		
Not Rated	7487-88-9	Magnesium Sulfate					
Not Rated	108-31-6	Maleic Anhydride			A4		
Not Rated	7439-96-5	Manganese					
Not Rated	7487-94-7	Mercuric Chloride [Mercury(II)Chloride]					
Not Rated	7439-97-6	Mercury			A4		
Not Rated	MWF	Metalworking Fluids Group					
Not Rated	67-56-1	Methanol					
Not Rated	79-20-9	Methyl Acetate (methyl ethanoate)					
Not Rated	96-33-3	Methyl Acrylate (2-Propanoic acid, methyl ester)					
Not Rated	71-55-6	Methyl Chloroform (1,1,1-Trichloroethane)			A4		
Not Rated	137-05-3	Methyl Cyanoacrylate					
Not Rated	78-93-3	Methyl Ethyl Ketone (2-Butanone)					
Not Rated	108-10-1	Methyl Isobutyl Ketone (4-methyl-2-pentanone, Hexone)					

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Not Rated	80-62-6	Methyl Methacrylate (2-methyl 2-propenoic acid)			A4		
Not Rated	101-68-8	Methylene-Bisphenyl Isocyanate (MDI) [4,4'-Diphenylmethane diisocyante)					
Not Rated	8052-41-3	Mineral Spirits (stoddard solvent)					
Not Rated	7439-98-7	Molybdenum					
Not Rated	7782-91-4	Molybdic Acid					
Not Rated	123-86-4	N-butyl Acetate (butyl ethanoate)			A4		
Not Rated	8030-30-6	Naphtha (petroleum naphtha)					
Not Rated	64742-94-5	Naphtha, Heavy Aromatic					
Not Rated	7697-37-2	Nitric Acid					
Not Rated	7727-37-9	Nitrogen					
Not Rated	144-62-7	Oxalic Acid (Ethanedioic acid)					
Not Rated	10028-15-6	Ozone			A4		
Not Rated	7440-05-3	Palladium					
Not Rated	7647-10-1	Palladium Chloride					
Not Rated	Particulates	Particulates					
Not Rated	7727-21-1	Persulfate (potassium persulfate					
Not Rated	108-95-2	Phenol			A4		
Not Rated	7664-38-2	Phosphoric Acid					
Not Rated	85-44-9	Phthalic Anhydride			A4		
Not Rated	Plastics	Polyethylene and Nylon Plastics					
Not Rated	9003-31-0	Polyisoprene					
Not Rated	9003-20-7	Polyvinyl Acetate	3				
Not Rated	9002-89-5	Polyvinyl Alcohol (PVA)	3				
Not Rated	584-08-7	Potassium Carbonate					
Not Rated	151-50-8	Potassium Cyanide					
Not Rated	1310-58-3	Potassium Hydroxide					
Not Rated	7681-11-0	Potassium Iodide					
Not Rated	7722-64-7	Potassium Permanganate					
Not Rated	71-23-8	Propanol, 1-			A3		?
Not Rated	19224-20-9	Propylene Glycol Monoethyl Ether Acetate					
Not Rated	110-86-1	Pyridine			A3	Yes	lung
Not Rated	872-50-4	Pyrrolidone, n-Methyl-2- (NMP)					
Not Rated	304-59-6	Rochelle Salts (Potassium sodium tartrate)					
Not Rated	7440-22-4	Silver					
Not Rated	7681-38-1	Sodium Bisulfate					
Not Rated	7631-90-5	Sodium Bisulfite			A4		
Not Rated	497-19-8	Sodium Carbonate					
Not Rated	7758-19-2	Sodium Chlorite	3				
Not Rated	143-33-9	Sodium Cyanide					
Not Rated	1310-73-2	Sodium Hydroxide					

Table 5: Listing of Chemicals at Endicott with Potential Carcinogenicity Ratings

Carcinogen	CAS	Chemical Name	IARC*	NTP	ACGIH	P65	Cancer – Target Organ
Not Rated	7681-52-9	Sodium Hypochlorite					
Not Rated	7775-27-1	Sodium Persulfate					
Not Rated	7772-99-8	Stanous Chloride (Tin(II) Chloride)					
Not Rated	7446-09-5	Sulfur dioxide			A4		
Not Rated	9002-84-0	Teflon					
Not Rated	109-99-9	Tetrahydrofuran (1,4-epoxybutane)					
Not Rated	97-84-7	Tetramethyl Butane Diamine (N,N,N',N'-tetramethyl-1,3,-butanediamine)					
Not Rated	3333-52-6	Tetramethyl Succinonitrile					
Not Rated	7722-88-5	Tetrasodium pyrophosphate					
Not Rated	7440-31-5	Tin					
Not Rated	7440-32-6	Titanium					
Not Rated	108-88-3	Toluene	3		A4		
Not Rated	106-49-0	Toluidine, p-			A3		liver
Not Rated	102-71-6	Triethanolamine (Ethanol, 2,2',2''-nitrilotris-)					
Not Rated	75-50-3	Trimethylamine					
Not Rated	115-86-6	Triphenyl Phosphate			A4		
Not Rated	64741-56-6	Wax, Apiezon					
Not Rated	1330-20-7	Xylene (mixed isomers)			A4		
Not Rated	7440-66-6	Zinc					
Not Rated	7646-85-7	Zinc Chloride					

***Ratings of the various reference groups:**
International Agency for Research on Cancer – WHO (IARC): 1: The agent is carcinogenic to humans; **2A:** The agent is probably carcinogenic to humans; there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals; **2B:** The agent is possibly carcinogenic to humans; there is limited evidence of carcinogenicity in humans in the absence of sufficient evidence of carcinogenicity in experimental animals; **3:** The agent is not classifiable as to its carcinogenicity to humans; **4:** The agent is probably not carcinogenic to humans.
U.S. National Toxicology Program (NTP): 1: Known to be carcinogens; **2:** Reasonably anticipated to be carcinogens.
American Conference of Governmental Industrial Hygienists (ACGIH): A1: Confirmed Human Carcinogen; **A2:** Suspected Human Carcinogen; **A3:** Animal Carcinogen—"Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure."; **A4:** The agent is not classifiable as to its carcinogenicity to humans; **A5:** Not suspected as a Human Carcinogen
Proposition 65 (California) (P65): 1: Known to be carcinogens; **2:** Reasonably anticipated to be carcinogens.

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
006	1985	Sulfuric Acid	20	0	0	20
		Thiourea	14	6	30	20
011	1981	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
	1982	Unknown	0	0	---	0
	1983	_Metalworking Fluids	0	12	100	12
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Mineral Spirits (stoddard solvent)	0	0	---	0
	1985	_Particulates	8	6	43	14
015	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	4	4	50	8
	1986	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	6	60	10
	1987	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	28	0	0	28
		Hydrochloric Acid	6	0	0	6
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
		Perchloroethylene (tetrachloroethylene)	0	28	100	28
		Xylene (mixed isomers)	0	28	100	28
	1990	__Brand Name	0	0	---	0
		_Alkalines	0	0	---	0
		Ammonium Hydroxide	0	0	---	0
		Boric Acid	0	0	---	0
		Chromic Acid (chrome(VI)oxide)	4	0	0	4
		Chromium	0	0	---	0
		Copper Phosphate	0	0	---	0
		Hydrochloric Acid	8	8	31	26
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	4	8	67	12
		Nickel	0	0	---	0
		Nickel Chloride	0	0	---	0
		Nickel Sulfate	0	0	---	0
		Polyvinyl Acetate Liquid	0	0	---	0
		Potassium Hydroxide	0	0	---	0
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	0	---	0
		Sodium Hydroxide	4	0	0	4
		Sodium Hypochlorite	0	0	---	0
		Sulfuric Acid	4	0	0	4
		Teflon spray	0	0	---	0
		Ultraviolet Light (Laser)	0	0	---	0
		Water	0	0	---	0
		Zinc	0	0	---	0
		Zinc Chloride	0	0	---	0
	1993	_Chromates	6	0	0	6
017	1983	_Metalworking Fluids	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	4	100	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
		Mineral Spirits (stoddard solvent)	0	0	---	0
	1984	_Metalworking Fluids	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
019	1983	_Epoxy	0	0	---	0
		_Metalworking Fluids	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
	1987	Methyl Chloroform (1,1,1-trichloroethane)	0	2	**100**	2
020	1984	Chromium	2	0	---	0
		Iron	2	0	---	0
		Lithium	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	2	---	0
		Nickel	2	0	---	0
		Tin	0	0	---	0
		Zinc	2	0	---	0
	1985	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
	1989	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
021	1982	Copper Sulfate	0	0	---	0
		EDTA (Etheylene Diamine Tetraacetic Acid)	0	0	---	0
		Formaldehyde	10	0	**0**	10
		Hydrochloric Acid	16	0	**0**	16
		Lead	1	1	**50**	2
		Sodium Cyanide	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	3	1	**25**	4
	1983	Formaldehyde	22	0	**0**	22
		Hydrochloric Acid	0	2	**100**	2
		Lead	1	0	**0**	1
	1984	__Brand Name	0	0	---	0
		_Unknown	0	0	---	0
		Ammonium Hydroxide	0	0	---	0
		Bromine	0	0	---	0
		EDTA (Etheylene Diamine Tetraacetic Acid)	0	0	---	0
		Formaldehyde	8	4	**33**	12
		Glacial Acid	0	0	---	0
		Heat	0	0	---	0
		Hydrochloric Acid	8	4	**33**	12
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	0	0	---	0
		Magnesium Sulfate	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Nitrogen	0	0	---	0
		Phosphoric Acid	0	0	---	0
		Potassium Iodide	0	0	---	0
		Pyridine	0	0	---	0
		Sodium Arsenate	0	0	---	0
		Sodium Cyanide	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Sulfuric Acid	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Tin	0	0	---	0
		Toluidine, p-	0	0	---	0
	1985	Copper	26	0	**0**	26
		Formaldehyde	46	0	**0**	46
		Sulfuric Acid	24	0	**0**	24
022	1981	Ethyl Acrylate	6	0	**0**	6
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	8	**100**	8
		Hydrochloric Acid	2	12	**86**	14
		Isopropyl Alcohol (2-propanol)	8	0	**0**	8
		Methyl Acrylate (2-propanoic acid, methyl ester)	6	0	**0**	6
		Methyl Ethyl Ketone (2-butanone)	8	0	**0**	8
	1982	Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	4	0	**0**	4
		Hydrochloric Acid	0	15	**100**	15
	1983	Hydrochloric Acid	10	1	**9**	11
		Sodium Hydroxide	8	0	**0**	8
	1984	__Brand Name	0	0	---	0
		_Unknown	0	0	---	0
		Acrylic Acid	0	0	---	0
		Ammonium Hydroxide	0	0	---	0
		Cupric Chloride (copper(III) chloride)	0	0	---	0
		Diethylene Glycol Monobutyl Ether [2-(2-butoxyethoxy)ethanol]	0	0	---	0
		Ethyl Acrylate	4	2	**33**	6
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	6	0	**0**	6
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Heat	0	0	---	0
		Hydrochloric Acid	6	2	**25**	8
		Indium Sulfate	0	0	---	0
		Maleic Anhydride	0	0	---	0
		Methyl Acrylate (2-propanoic acid, methyl ester)	4	2	**33**	6
		Ozone	0	0	---	0
		Pumice	0	0	---	0
		Sodium Carbonate	0	0	---	0
		Sodium Hydroxide	4	0	**0**	4
		Styrene (Benzene, ethenyl-)	0	0	---	0
	1985	Ethyl Acetate (ethyl ethanoate)	8	0	**0**	8
		Hydrochloric Acid	2	8	**80**	10
		Methyl Acetate (methyl ethanoate)	8	0	**0**	8
		Methylene Chloride (dichloromethane)	0	8	**100**	8
	1986	Hydrochloric Acid	8	20	**71**	28
		Nitric Acid	10	0	**0**	10
		Sodium Hydroxide	6	0	**0**	6
	1987	Sodium Hydroxide	10	0	**0**	10
	1989	Acrylic Acid	8	0	**0**	8
		Aluminum	2	0	**0**	2
		Ethyl Acrylate	6	0	**0**	6
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	2	4	**67**	6
		Hydrochloric Acid	4	2	**33**	6

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	**Year**	**Chemical Name**	**# Non-Detect**	**# Detect**	**% Detect**	**# Total**
		Isopropyl Alcohol (2-propanol)	2	6	**75**	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	16	**100**	16
		Methyl Methacrylate (2-methyl 2-propenoic acid)	4	0	**0**	4
		Sodium Hydroxide	14	0	**0**	14
	1990	Sulfuric Acid	12	0	**0**	12
	1991	Hydrochloric Acid	0	4	**100**	4
		Sodium Hydroxide	4	0	**0**	4
		Sulfuric Acid	6	0	**0**	6
023	????	_Metalworking Fluids	0	0	---	0
		Lead	0	0	---	0
		Tin	0	0	---	0
	1983	Lead	9	0	**0**	9
024	????	__Brand Name	0	0	---	0
		_Fiberglass	0	0	---	0
		_Inks & Dyes	0	0	---	0
		Copper	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
027	1981	Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
		Methylene Chloride (dichloromethane)	5	15	**75**	20
	1982	Ethyl Acrylate	20	0	**0**	20
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	2	6	**75**	8
		Methyl Acrylate (2-propanoic acid, methyl ester)	20	0	**0**	20
		Methyl Chloroform (1,1,1-trichloroethane)	3	9	**75**	12
	1984	Ethyl Acrylate	6	0	**0**	6
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	6	0	**0**	6
		Methyl Acrylate (2-propanoic acid, methyl ester)	6	0	**0**	6
		Methyl Chloroform (1,1,1-trichloroethane)	0	18	**100**	18
	1985	Methyl Chloroform (1,1,1-trichloroethane)	0	26	**100**	26
	1987	Methyl Chloroform (1,1,1-trichloroethane)	0	16	**100**	16
	1988	Methyl Chloroform (1,1,1-trichloroethane)	0	8	**100**	8
		Methylene Chloride (dichloromethane)	0	0	---	0
		Pumice	0	0	---	0
	1989	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	4	**100**	4
		Hydrochloric Acid	8	0	**0**	8
		Sodium Hydroxide	0	6	**100**	6
		Sulfuric Acid	4	0	**0**	4
	1992	Ethylene Glycol Monobutyl Ether (butyl cellosolve)	2	0	**0**	2
		Hydrochloric Acid	2	6	**75**	8
		Isopropyl Alcohol (2-propanol)	2	0	**0**	2
	1996	Benzophenone (diphenyl-methanone)	2	0	**0**	2
		Hydrochloric Acid	0	4	**100**	4
		Methanol	4	0	**0**	4
		Tetramethyl Succinonitrile	2	0	**0**	2
	1997	Cupric Chloride (copper(III) chloride)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Hydrochloric Acid	0	0	---	0
		Sodium Carbonate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
	2000	Hydrochloric Acid	0	30	**100**	30
		Sodium Hydroxide	4	0	**0**	4
028	1981	Methylene Chloride (dichloromethane)	0	8	**100**	8
	1982	Ethyl Acrylate	20	0	**0**	20
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	5	0	**0**	5
		Methyl Acrylate (2-propanoic acid, methyl ester)	20	0	**0**	20
		Methyl Chloroform (1,1,1-trichloroethane)	2	23	**92**	25
	1983	Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	8	**100**	8
	1984	Hydrochloric Acid	6	4	**40**	10
		Methylene Chloride (dichloromethane)	0	10	**100**	10
	1985	Methylene Chloride (dichloromethane)	2	14	**88**	16
	1986	Hydrochloric Acid	2	12	**86**	14
		Methylene Chloride (dichloromethane)	0	8	**100**	8
		Nitric Acid	8	2	**20**	10
	1987	Copper	6	0	**0**	6
		Hydrochloric Acid	0	24	**100**	24
		Methylene Chloride (dichloromethane)	6	32	**84**	38
	1988	Cupric Chloride (copper(III) chloride)	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	4	0	**0**	4
		Hydrochloric Acid	0	24	**100**	24
		Methyl Ethyl Ketone (2-butanone)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	6	**100**	6
	1989	Hydrochloric Acid	12	2	**14**	14
		Sodium Hydroxide	12	0	**0**	12
030	1983	Methylene Chloride (dichloromethane)	0	0	---	0
	1986	_Metalworking Fluids	0	0	---	0
		Mineral Spirits (stoddard solvent)	0	0	---	0
		Naphtha (petroleum naphtha)	0	0	---	0
033	1984	Chlorine	0	0	---	0
		Chromic Acid (chrome(VI)oxide)	22	14	**39**	36
		Copper Chloride	0	0	---	0
		Diethylene Glycol Monobutyl Ether [2-(2-butoxyethoxy)ethanol]	0	4	**100**	4
		Ethylene Glycol (1,2-dihydroxyethane)	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	2	4	**67**	6
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	5	**100**	5
		Hydrochloric Acid	10	43	**81**	53
		Methyl Carbitol (diethylene glycol monomethyl ether)	0	8	**100**	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Potassium Hydroxide	0	0	---	0
		Sodium Chlorite	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sodium Persulfate	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
		Trichloroethylene	0	11	**100**	11
	1985	Methyl Carbitol (diethylene glycol monomethyl ether)	0	16	**100**	16
034	1988	Lead	11	0	**0**	11
035	1984	_Metalworking Fluids	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Tin	0	0	---	0
	1987	Lead	11	1	**8**	12
	1989	Lead	0	0	**0**	3
036	1981	Beryllium	6	0	**0**	6
037	1983	Hydrochloric Acid	0	0	---	0
		Lead	1	0	**0**	1
038	1981	Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	0	3	**100**	3
	1982	Ethylene Glycol Monobutyl Ether Acetate (butyl cellosolve acetate)	0	4	**100**	4
		Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)	0	4	**100**	4
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	4	**100**	4
		Formaldehyde	0	4	**100**	4
		Hydrochloric Acid	4	0	**0**	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	6	**100**	6
		Methylene Chloride (dichloromethane)	0	11	**100**	11
		Perchloroethylene (tetrachloroethylene)	0	1	**100**	1
		Trichloroethylene	0	3	**100**	3
	1985	Ferric Chloride [iron(III)chloride]	0	0	---	0
		Formaldehyde	0	0	---	0
		Freon 112 (1,2-difluoro-1,1,2,2-tetrachloroethane)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	**100**	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Potassium Permanganate	0	0	---	0
	1986	Hydrochloric Acid	0	4	**100**	4
	1988	Methylene Chloride (dichloromethane)	0	4	**100**	4
	1989	Formaldehyde	4	0	**0**	4
039	1983	Lead	7	0	**0**	7
045	1981	Ammonia	1	0	**0**	1
		Copper	0	2	**100**	2
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	2	**100**	2
		Formaldehyde	5	2	**29**	7
		Hydrochloric Acid	3	5	**63**	8
		Nitric Acid	6	1	**14**	7
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	2	5	**71**	7
	1982	Copper	0	1	**100**	1
		Formaldehyde	2	0	**0**	2
		Hydrochloric Acid	1	0	**0**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	**% Detect**	# Total
		Nitric Acid	2	0	**0**	2
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	1	**100**	1
	1984	_Fiberglass	0	0	**---**	0
		Ammonia	3	3	**50**	6
		Copper	0	0	**---**	0
		Formaldehyde	0	0	**0**	6
		Hydrochloric Acid	0	0	**0**	5
		Hydrogen Fluoride (hydrofluoric acid)	0	0	**---**	0
		Isopropyl Alcohol (2-propanol)	0	0	**---**	0
		Nitric Acid	0	0	**0**	3
	1985	Hydrochloric Acid	1	0	**0**	1
		Hydrogen Fluoride (hydrofluoric acid)	1	0	**0**	1
	1988	_Potassium Salts Group	0	0	**---**	0
		Copper	0	0	**---**	0
		Copper Sulfate	0	0	**---**	0
		Cupric Chloride (copper(II) chloride)	0	0	**---**	0
		Formaldehyde	0	0	**---**	0
		Hydrochloric Acid	0	0	**---**	0
		Nickel Chloride	0	0	**---**	0
		Nitric Acid	0	0	**---**	0
		Palladium Chloride	0	0	**---**	0
		Rochelle Salts (Potassium sodium tartrate)	0	0	**---**	0
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	0	**---**	0
		Sodium Carbonate	0	0	**---**	0
		Sodium Hydroxide	0	0	**---**	0
		Sodium Persulfate	0	0	**---**	0
		Sulfuric Acid	0	0	**---**	0
		Tin Chloride	0	0	**---**	0
	1993	_Fiberglass	0	0	**0**	2
	1995	Isopropyl Alcohol (2-propanol)	0	3	**100**	3
	1996	Isopropyl Alcohol (2-propanol)	0	3	**100**	3
	1997	_Fiberglass	0	2	**100**	2
		Copper	0	1	**100**	1
046	1976	Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)	0	0	**---**	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	**---**	0
		Methylene Chloride (dichloromethane)	0	0	**---**	0
	1977	__Brand Name	0	18	**100**	18
		Diethylene Glycol Diethyl Ether	18	0	**0**	18
		Methanol	0	0	**---**	0
		Methylene Chloride (dichloromethane)	2	16	**89**	18
		Toluene	3	15	**83**	18
	1978	Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	1	**---**	0
		Methanol	1	0	**---**	0
		Methylene Chloride (dichloromethane)	0	1	**---**	0
	1980	Chromic Acid (chrome(VI)oxide)	0	0	**---**	0
		Epichlorohydrin	1	0	**---**	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	1	---	0
		Methylene Chloride (dichloromethane)	0	1	---	0
		Toluene	1	0	---	0
	1989	Lead	1	0	**0**	1
047	1980	Chromic Acid (chrome(VI)oxide)	0	0	**0**	5
	1987	Methyl Chloroform (1,1,1-trichloroethane)	0	21	**100**	21
		Methylene Chloride (dichloromethane)	0	21	**100**	21
050	????	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
	1983	Hydrochloric Acid	5	4	**44**	9
		Kerosene	0	9	**100**	9
		Methyl Chloroform (1,1,1-trichloroethane)	0	9	**100**	9
		Thiourea	0	3	**100**	3
051	????	_Metalworking Fluids	0	0	---	0
		Toluene Diisocyanate (TDI)	0	0	---	0
	1981	_Metalworking Fluids	5	4	**44**	9
		Toluene Diisocyanate (TDI)	22	3	**12**	25
	1986	Freon 112 (1,2-difluoro-1,1,2,2-tetrachloroethane)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	6	**100**	6
		Isopropyl Alcohol (2-propanol)	0	6	**100**	6
	1987	Isopropyl Alcohol (2-propanol)	0	4	**100**	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
	1988	Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
	1989	_Particulates	1	0	**0**	1
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	2	**100**	2
		Lead	2	0	**0**	2
		Methyl Chloroform (1,1,1-trichloroethane)	0	2	**100**	2
052	1981	Methyl Chloroform (1,1,1-trichloroethane)	3	10	**77**	13
053	1981	Antimony	7	4	**36**	11
		Arsenic	8	1	**11**	9
		Lead	10	1	**9**	11
	1982	Antimony Trioxide	4	0	**0**	4
	1983	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	3	0	**0**	3
		Methyl Acrylate (2-propanoic acid, methyl ester)	3	0	**0**	3
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	3	0	**0**	3
054	????	PCBs	0	1	---	0
055	1974	_Fiberglass	0	1	---	0
	1976	_Fiberglass	0	7	**100**	7
		Benzyldimethylamine	7	0	**0**	7
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	7	0	**0**	7
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
		Methyl Ethyl Ketone (2-butanone)	0	7	**100**	7
		Tetramethyl Butane Diamine (N,N,N',N'-Tetramethyl-1,3,-butanediamine)	7	0	**0**	7
	1977	_Fiberglass	5	0	**0**	5

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level # Non-Detect	# Detect	% Detect	# Total
		Copper	0	0	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	6	0	**0**	6
		Methyl Ethyl Ketone (2-butanone)	2	4	**67**	6
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
	1979	Methyl Ethyl Ketone (2-butanone)	0	9	**100**	9
	1980	_Aliphatic Amines Group	5	0	**0**	5
		Methyl Ethyl Ketone (2-butanone)	0	15	**100**	15
	1981	N-Methyl-2-Pyrrolidone (NMP)	4	0	**0**	4
	1983	_Fiberglass	1	4	**80**	5
		Dicyandiamide (DICY)	0	1	**100**	1
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	4	1	**20**	5
		Methyl Ethyl Ketone (2-butanone)	0	3	**100**	3
	1985	_Fiberglass	3	0	**0**	3
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	21	**100**	21
	1990	_Particulates	1	0	**0**	1
058	1981	_Metalworking Fluids	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
	1985	_Metalworking Fluids	0	4	**100**	4
060	1985	_Fiberglass	0	0	---	0
		_Metalworking Fluids	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
	1987	_Fiberglass	0	5	**100**	5
062	1983	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	6	**100**	6
		Methyl Chloroform (1,1,1-trichloroethane)	0	6	**100**	6
	1985	_Metalworking Fluids	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
066	1986	_Fiberglass	0	0	---	0
		Copper	0	0	---	0
		Cyanide (HCN)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Nickel	0	0	---	0
		Sulfuric Acid	0	0	---	0
	1989	_Fiberglass	2	0	**0**	2
		Copper	2	0	**0**	2
		Cyanide (HCN)	1	0	**0**	1
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	**100**	1
		Nickel	2	0	**0**	2
		Sulfuric Acid	2	0	**0**	2
070	1985	_Metalworking Fluids	3	0	**0**	3
		_Particulates	1	2	**67**	3
075	1985	_Solvents	0	0	---	0
		_Unknown	0	0	---	0
100	1982	_Chromates	3	0	**0**	3
	1983	Chromium	1	1	**50**	2
		Nickel	1	0	**0**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
	1984	Chromic Acid (chrome(VI)oxide)	2	2	**50**	4
		Hydrochloric Acid	2	0	**0**	2
		Molybdenum	2	0	**0**	2
		Nickel	6	0	**0**	6
	1985	__Brand Name	0	0	---	0
		_Metalworking Fluids	0	0	---	0
		Ammonium Hydroxide	0	0	---	0
		Boric Acid	0	0	---	0
		Chromic Acid (chrome(VI)oxide)	0	0	---	0
		Copper Pyrophosphate	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Hydrogen Sulfide	0	0	---	0
		Methanol	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Molybdic Acid	0	0	---	0
		Nickel	0	0	---	0
		Nickel Chloride	0	0	---	0
		Nickel Sulfate	0	0	---	0
		Potassium Hydroxide	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Zinc Chloride	0	0	---	0
	1987	_Chromates	4	0	**0**	4
		Hydrochloric Acid	8	6	**43**	14
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	6	**100**	6
	1990	__Brand Name	0	0	---	0
		Chromium Trioxide (chromic acid)	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		PVA (polyvinyl alcohol)	0	0	---	0
		Sodium Hypochlorite	0	0	---	0
	1992	_Chromates	4	0	**0**	4
		Hydrochloric Acid	2	0	**0**	2
		Nitric Acid	2	0	**0**	2
		Sodium Hydroxide	2	0	**0**	2
	1993	_Chromates	0	2	**100**	2
		Nickel	2	0	**0**	2
		Sulfuric Acid	2	0	**0**	2
120	1985	_Metalworking Fluids	0	0	---	0
		_Solvents	0	0	---	0
123	1983	Benzene	0	6	**100**	6
		Formaldehyde	6	0	**0**	6
		Hydrochloric Acid	0	6	**100**	6
		Toluene	0	6	**100**	6

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
	1985	Benzene	0	6	**100**	6
		Formaldehyde	6	0	**0**	6
		Hydrochloric Acid	4	2	**33**	6
		Toluene	0	6	**100**	6
	1989	Lead	8	0	**0**	8
137	????	Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
139	1987	Benzo(a)pyrene	1	0	**0**	1
156	1989	Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	2	0	**0**	2
	1996	Lead	3	0	**0**	3
	1997	Lead	4	1	**20**	5
	2000	Isopropyl Alcohol (2-propanol)	0	2	**100**	2
		Lead	7	0	**0**	7
160	1989	Copper	0	0	---	0
		Lead	3	0	**0**	3
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Tin	0	0	---	0
	1991	Copper	0	1	**100**	1
		Lead	0	1	**100**	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	---	0
		Tin	0	1	**100**	1
171	1983	Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	3	0	**0**	3
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	1	2	**67**	3
		Isopropyl Alcohol (2-propanol)	3	0	**0**	3
		Xylene (mixed isomers)	3	0	**0**	3
	1984	Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	2	**100**	2
		Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	2	0	**0**	2
		Lead	2	0	**0**	2
		Tin	2	0	**0**	2
		Xylene (mixed isomers)	2	0	**0**	2
200	1983	Copper	0	10	**100**	10
		Iron	0	10	**100**	10
		Lead	0	10	**100**	10
		Manganese	0	10	**100**	10
		Titanium	0	10	**100**	10
	1985	Aluminum	0	0	---	0
		Cadmium	0	0	---	0
		Chromium	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Titanium	0	0	---	0
	1987	Chromium	1	0	**0**	1
		Iron	0	1	**100**	1
		Manganese	0	1	**100**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Nickel	1	0	0	1
	1991	Chromium	1	0	0	1
		Nickel	1	0	0	1
213	1990	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
		Methyl Ethyl Ketone (2-butanone)	0	0	---	0
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
		Methylene Chloride (dichloromethane)	4	0	0	4
		Mineral Spirits (stoddard solvent)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Tetramethyl Butane Diamine (N,N,N',N'-Tetramethyl-1,3,-butanediamine)	0	0	---	0
		Toluene	0	0	---	0
222	????	Lead	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
244	1986	_Epoxy	0	0	---	0
262	1986	_Epoxy	0	0	---	0
263	1989	Hydrochloric Acid	0	3	100	3
		Sodium Hydroxide	3	0	0	3
	1991	Hydrochloric Acid	0	3	100	3
		Sodium Hydroxide	3	0	0	3
289	1995	Acetone	1	0	0	1
		Benzene	5	0	0	5
		Ethyl Acetate (ethyl ethanoate)	1	0	0	1
		Methyl Ethyl Ketone (2-butanone)	1	0	0	1
		Toluene	1	0	0	1
309	1979	_Inks & Dyes	0	0	---	0
	1984	_Epoxy	0	0	---	0
		_Inks & Dyes	4	0	0	4
		Ammonium Persulfate (ammonium peroxydisulfate)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Tin	0	0	---	0
		Trichloroethylene	0	0	---	0
310	????	Acetone	0	0	---	0
		Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)	0	0	---	0
		Isobutane	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	**% Detect**	# Total
		Toluene	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
320	1989	Hydrochloric Acid	0	2	**100**	2
		Sodium Hydroxide	2	0	**0**	2
	1990	Hydrochloric Acid	3	2	**40**	5
	1991	Hydrochloric Acid	2	0	**0**	2
		Silica (Crystaline) [silicon dioxide–(a-Quartz)]	0	1	**100**	1
		Sodium Hydroxide	4	0	**0**	4
330	1986	Aluminum	0	0	---	0
		Cadmium	0	0	---	0
		Chromium	0	0	---	0
		Iron	0	0	---	0
		Lead	0	0	---	0
		Manganese	0	0	---	0
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
		PCBs	1	0	**0**	1
		Toluene	0	0	---	0
	1987	_Particulates	1	0	**0**	1
		Cadmium	1	0	**0**	1
		Chromium	1	0	**0**	1
		Iron	1	0	**0**	1
		Lead	1	0	**0**	1
		Manganese	1	0	**0**	1
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	1	0	**0**	1
		Toluene	1	0	**0**	1
	1992	Styrene (Benzene, ethenyl-)	0	1	**100**	1
338	1983	Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
	1985	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
339	1983	_Metalworking Fluids	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
340	1987	_Acid Group	0	0	---	0
		_Inks & Dyes	0	0	---	0
		_Unknown	0	0	---	0
		Dicyandiamide (DICY)	0	0	---	0
		Ethylene Glycol Monobutyl Ether (butyl cellosolve)	0	0	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	2	12	**86**	14
		Methyl Ethyl Ketone (2-butanone)	0	12	**100**	12
		Methylene Chloride (dichloromethane)	0	0	---	0
	1988	_Fiberglass	6	10	**63**	16
		_Particulates	12	28	**70**	40
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	10	18	**64**	28
		Methyl Ethyl Ketone (2-butanone)	0	28	**100**	28
	1989	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	6	92	**94**	98

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Methyl Chloroform (1,1,1-trichloroethane)	2	4	67	6
		Methyl Ethyl Ketone (2-butanone)	2	76	97	78
		Sodium Hydroxide	2	0	0	2
	1990	_Particulates	8	20	71	28
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	6	100	6
		Methyl Ethyl Ketone (2-butanone)	0	6	100	6
347	1989	Acrylonitrile	6	0	0	6
		Ethyl Acrylate	6	0	0	6
		Methyl Chloroform (1,1,1-trichloroethane)	0	8	100	8
		Styrene (Benzene, ethenyl-)	6	0	0	6
		Toluene Diisocyanate (TDI)	4	0	0	4
		Xylene (mixed isomers)	4	0	0	4
	1991	Dipropylene glycol methyl ether [1-(2-methoxyisopropoxy)-2-propanol]	0	4	100	4
		Isopropyl Alcohol (2-propanol)	0	4	100	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
		Methyl Ethyl Ketone (2-butanone)	4	0	0	4
		Nitromethane	4	0	0	4
		Toluene	4	0	0	4
	1993	Ethyl Acrylate	2	0	0	2
		Methanol	2	0	0	2
		Methyl Acrylate (2-propanoic acid, methyl ester)	2	0	0	2
		Methylene Chloride (dichloromethane)	0	2	100	2
		Toluene	2	0	0	2
350	1985	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
357	????	Methyl Chloroform (1,1,1-trichloroethane)	0	1	100	1
364	1994	_Particulates	4	5	56	9
366	1989	_Particulates	0	0	---	0
		Aluminum Oxide	0	0	---	0
		Benzotriazole (BTA)	0	0	---	0
		Copper	0	0	---	0
		Cupric Chloride (copper(III) chloride)	0	0	---	0
		Cyanide (HCN)	0	0	---	0
		Formaldehyde	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Tin	0	0	---	0
	1991	_Particulates	1	0	0	1
		Aluminum Oxide	1	0	0	1
		Cyanide (HCN)	1	0	0	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
		Hydrochloric Acid	1	0	0	1
		Oxalic Acid (ethanedioic acid)	1	0	0	1
		Sodium Hydroxide	1	0	0	1
		Sulfuric Acid	1	0	0	1
		Tin	1	0	0	1
368	1981	Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	4	100	4
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	4	100	4
373	1981	Hydrochloric Acid	0	1	100	1
		Methanol	0	6	100	6
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	100	1
		Methylene Chloride (dichloromethane)	0	1	100	1
		Nitrobenzene	2	0	0	2
		Thiourea	2	0	0	2
	1982	Hydrochloric Acid	6	7	54	13
		Hydrogen Fluoride (hydrofluoric acid)	1	0	0	1
		Methanol	4	0	0	4
		Methyl Chloroform (1,1,1-trichloroethane)	1	5	83	6
		Methylene Chloride (dichloromethane)	0	3	100	3
		N-Methyl-2-Pyrrolidone (NMP)	2	3	60	5
		Sulfuric Acid	2	0	0	2
		Thiourea	1	2	67	3
	1984	__Brand Name	0	0	---	0
		Aluminum Oxide	0	0	---	0
		Benzotriazole (BTA)	0	0	---	0
		Chromic Acid (chrome(VI)oxide)	8	0	0	8
		Cupric Chloride (copper(III) chloride)	0	0	---	0
		Hydrochloric Acid	16	0	0	16
		Hydrogen Fluoride (hydrofluoric acid)	10	0	0	10
		Methyl Chloroform (1,1,1-trichloroethane)	0	14	100	14
		N-Methyl-2-Pyrrolidone (NMP)	0	0	---	0
		Palladium Chloride	0	0	---	0
		Potassium Persulfate	0	0	---	0
		Sodium Bisulfate	0	0	---	0
		Sodium Carbonate	0	0	---	0
		Sodium Chlorite	0	0	---	0
		Stanous Chloride (tin(II) chloride)	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Tin	0	0	---	0
	1985	Chromic Acid (chrome(VI)oxide)	12	0	0	12
		Methylene Chloride (dichloromethane)	0	36	100	36
	1988	Formaldehyde	10	0	0	10
		Hydrochloric Acid	8	0	0	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	16	100	16
		Methylene Chloride (dichloromethane)	0	4	100	4
	1989	Acetic Acid	2	0	0	2
		Formaldehyde	10	2	17	12

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Glutaraldehyde (1,5-pentanedial)	4	0	**0**	4
		Hydrochloric Acid	14	0	**0**	14
		Hydroquinone	4	0	**0**	4
		Isopropyl Alcohol (2-propanol)	0	2	**100**	2
		Methyl Chloroform (1,1,1-trichloroethane)	0	8	**100**	8
		Methylene Chloride (dichloromethane)	0	84	**100**	84
		Sodium Hydroxide	12	0	**0**	12
		Sulfuric Acid	8	0	**0**	8
		Tin	4	0	**0**	4
	1990	_Particulates	2	4	**67**	6
		Acrylamide	0	0	**---**	0
		Barium	4	0	**0**	4
		Butanol, n-	2	0	**0**	2
		Copper	2	0	**0**	2
		Cyanide (HCN)	4	0	**0**	4
		Ethanolamine (ethanol, 2-amino)	4	0	**0**	4
		Formaldehyde	4	0	**0**	4
		Glacial Acetic Acid	2	2	**50**	4
		Lead	4	0	**0**	4
		Methanol	4	0	**0**	4
		Methyl Ethyl Ketone (2-butanone)	2	0	**0**	2
		Methylene Chloride (dichloromethane)	0	66	**100**	66
		Phosphoric Acid	4	0	**0**	4
		Potassium Hydroxide	8	0	**0**	8
		Pyridine	0	4	**100**	4
		Tin	4	0	**0**	4
		Toluene	2	0	**0**	2
	1991	_Borates	2	0	**0**	2
		_Fiberglass	2	0	**0**	2
		Acetic Acid	4	0	**0**	4
		Ammonia	2	0	**0**	2
		Barium Chloride	4	0	**0**	4
		Butanol, n-	0	0	**---**	0
		Butanol, tert-	4	0	**0**	4
		Chromic Acid (chrome(VI)oxide)	4	0	**0**	4
		Chromium	6	0	**0**	6
		Copper	4	0	**0**	4
		Dimethoxy Methane (Methylal)	4	0	**0**	4
		Ethanolamine (ethanol, 2-amino)	4	0	**0**	4
		Ethylene Dichloride (1,2-dichloroethane)	4	0	**0**	4
		Formaldehyde	4	0	**0**	4
		Iron	4	0	**0**	4
		Isopropyl Alcohol (2-propanol)	0	0	**---**	0
		Lead	4	0	**0**	4
		Magnesium Oxide	0	4	**100**	4
		Manganese	0	4	**100**	4
		Methyl Ethyl Ketone (2-butanone)	6	0	**0**	6

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level # Non-Detect	# Detect	% Detect	# Total
		Nitromethane	4	0	0	4
		Potassium Hydroxide	4	0	0	4
		Pyridine	0	4	100	4
		Silver	0	2	100	2
		Sodium Bisulfate	2	0	0	2
		Sodium Cyanide	4	0	0	4
		Tin	4	0	0	4
		Toluene	6	0	0	6
	1992	Methylene Chloride (dichloromethane)	0	8	100	8
	1993	Formaldehyde	8	0	0	8
		Hydrochloric Acid	6	0	0	6
		Sulfuric Acid	6	0	0	6
	1997	Cyanide (HCN)	6	0	0	6
		Dimethylamine	2	2	50	4
		Lead	12	0	0	12
		Methanol	2	2	50	4
		Nickel	4	0	0	4
		Nitric Acid	6	0	0	6
		Potassium Hydroxide	6	0	0	6
		Sulfuric Acid	6	0	0	6
		Thiourea	4	0	0	4
		Tin	12	0	0	12
	1998	Ammonia	6	0	0	6
	1999	Benzyl Alcohol (benzenemethanol)	0	10	100	10
		Lead	4	0	0	4
		Tin	4	0	0	4
	2000	Benzyl Alcohol (benzenemethanol)	8	4	33	12
374	1984	_Epoxy	0	0	---	0
	1988	Benzotriazole (BTA)	0	0	---	0
		Ethyl Acrylate	8	0	0	8
		Hydrochloric Acid	0	0	---	0
		Methyl Acrylate (2-propanoic acid, methyl ester)	8	0	0	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	14	100	14
	1989	Acrylic Acid	8	0	0	8
		Aluminum	2	0	0	2
		Hydrochloric Acid	6	0	0	6
		Methyl Methacrylate (2-methyl 2-propenoic acid)	8	0	0	8
		Sodium Hydroxide	6	0	0	6
375	????	_Fiberglass	2	0	0	2
		Hydrochloric Acid	1	0	0	1
	1982	_Fiberglass	2	0	0	2
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	2	100	2
383	1983	_Solvents	0	0	---	0
	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
384	1983	_Particulates	0	0	---	0
		Lead	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
391	1996	_Particulates	6	0	**0**	6
	1997	_Metalworking Fluids	0	4	**100**	4
		Triethanolamine (ethanol, 2,2',2"-nitrilotris-)	0	4	**100**	4
395	1985	Lead	0	2	**100**	2
	1991	_Fiberglass	4	4	**50**	8
409	1985	_Fiberglass	0	0	---	0
		Aluminum Hydroxide	0	0	---	0
		Hydrogen Peroxide	0	0	---	0
417	1983	_Particulates	0	3	**100**	3
449	1983	_Epoxy	0	0	---	0
		_Particulates	3	0	**0**	3
460	1976	_Metalworking Fluids	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	1	0	**0**	1
	1978	_Metalworking Fluids	6	0	**0**	6
	1979	Iron	4	2	**33**	6
	1983	_Metalworking Fluids	0	0	---	0
461	1974	Ferric Chloride [iron(III)chloride]	0	2	---	0
	1975	Ferric Chloride [iron(III)chloride]	0	1	---	0
		Formaldehyde	0	1	---	0
		Hydrochloric Acid	0	1	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	---	0
		Sulfur Dioxide	0	1	---	0
		Trichloroethylene	0	1	---	0
	1976	Ferric Chloride [iron(III)chloride]	1	3	**75**	4
		Hydrochloric Acid	2	0	**0**	2
		Methyl Chloroform (1,1,1-trichloroethane)	0	8	**100**	8
		Methyl Methacrylate (2-methyl 2-propenoic acid)	0	4	**100**	4
	1977	Ferric Chloride [iron(III)chloride]	1	0	---	0
		Toluene Diisocyanate (TDI)	0	0	---	0
	1978	Methyl Chloroform (1,1,1-trichloroethane)	0	1	---	0
		Toluene	0	1	---	0
	1981	Phenol	2	4	**67**	6
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	2	**100**	2
	1982	Hydrochloric Acid	0	4	**100**	4
		Sodium Hydroxide	0	4	**100**	4
	1983	Chromic Acid (chrome(VI)oxide)	0	6	**100**	6
		Hydrochloric Acid	4	0	**0**	4
	1985	Chromic Acid (chrome(VI)oxide)	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	2	18	**90**	20
		Sodium Hypochlorite	0	0	---	0
	1986	Chromium	4	0	**0**	4
		Hydrochloric Acid	8	6	**43**	14
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	10	**100**	10

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
	1987	_Chromates	4	0	**0**	4
		Hydrochloric Acid	8	6	**43**	14
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
		Methylene Chloride (dichloromethane)	0	6	**100**	6
477	????	Carbon Monoxide	0	1	---	0
482	????	_Fiberglass	0	0	---	0
		_Metalworking Fluids	0	0	---	0
	1991	_Fiberglass	0	2	**100**	2
483	1985	_Metalworking Fluids	0	0	---	0
486	1981	Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	0	---	0
	1983	Lead	0	0	---	0
490	????	Acetic Acid	6	2	**25**	8
		Cyclohexanone	0	1	**100**	1
		Ethylene Glycol (1,2-dihydroxyethane)	7	0	**0**	7
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	5	**100**	5
		Ethylene Glycol Monoethyl Ether Acetate (cellosolve acetate)	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	1	1	**50**	2
		Hydroquinone	7	0	**0**	7
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	1	0	**0**	1
		Toluene Diisocyanate (TDI)	10	0	**0**	10
		Trichloroethylene	0	5	**100**	5
	1983	Cyclohexanone	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
492	????	Trichloroethylene	0	2	**100**	2
509	1985	Methylene Chloride (dichloromethane)	0	4	**100**	4
	1987	Copper	0	4	**100**	4
	1991	Formaldehyde	4	0	**0**	4
		Hydrochloric Acid	4	0	**0**	4
		Sulfuric Acid	4	0	**0**	4
512	1986	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Mercury	0	0	---	0
521	????	Carbon Monoxide	0	0	---	0
534	1987	Lead	2	1	**33**	3
539	????	Trichloroethylene	0	0	---	0
	1976	Trichloroethylene	0	0	---	0
556	1983	Methyl Chloroform (1,1,1-trichloroethane)	0	4	**100**	4
566	????	Aluminum	0	0	---	0
		Benzotriazole (BTA)	0	0	---	0
		Cadmium	0	0	---	0
		Cresylic Acid (phenol, 2-methyl-)	0	0	---	0
		Diethylene Glycol (ethanol, 2,2'-oxybis-)	0	0	---	0
		Ethanol	0	0	---	0
		Formaldehyde	0	0	---	0
		Hydrochloric Acid	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
		Mercuric Chloride [mercury(II)chloride]	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Palladium	0	0	---	0
		Phosphoric Acid	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Thiourea	0	0	---	0
		Tin	0	0	---	0
		Zinc	0	0	---	0
	1983	Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
	1984	Methyl Chloroform (1,1,1-trichloroethane)	4	1	20	5
	1985	Methyl Chloroform (1,1,1-trichloroethane)	3	15	83	18
		Methylene Chloride (dichloromethane)	0	2	100	2
	1986	Methyl Chloroform (1,1,1-trichloroethane)	0	11	100	11
567	1986	Cyclohexanone	0	1	100	1
		Methyl Ethyl Ketone (2-butanone)	0	0	---	0
		Tetrahydrofuran (1,4-epoxybutane)	0	0	---	0
580	1976	Acetone	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methanol	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		N-butyl Acetate (butyl ethanoate)	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Tetramethyl Succinonitrile	0	0	---	0
		Toluene	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1978	Acetone	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
		Toluene	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1979	_Particulates	0	0	---	0
		Acetone	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Toluene	0	0	---	0
	1983	Chromic Acid (chrome(VI)oxide)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level # Non-Detect	# Detect	% Detect	# Total
		Sodium Bisulfite	0	0	---	0
		Sulfur Dioxide	0	0	---	0
		Sulfuric Acid	0	0	---	0
581	1995	_Fiberglass	0	0	---	0
		_Particulates	0	0	---	0
		Beryllium	0	0	---	0
		Lead	0	0	---	0
	2001	Beryllium	1	0	**0**	1
	2002	_Particulates	0	5	**100**	5
601	????	Ammonia	1	0	**0**	1
605	1979	Perchloroethylene (tetrachloroethylene)	1	0	---	0
	1981	Benzene	0	1	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	1	---	0
		Naphtha (petroleum naphtha)	0	0	---	0
		Toluene	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1982	Ammonia	0	8	**100**	8
631	????	_Particulates	3	0	**0**	3
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
634	????	Perchloroethylene (tetrachloroethylene)	0	1	---	0
635	????	Dichlorobenzene, o- (1,2-dichlorobenzene)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Xylene (mixed isomers)	0	1	---	0
637	1977	Benzene	0	1	---	0
		Isopropyl Alcohol (2-propanol)	0	1	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Xylene (mixed isomers)	0	1	---	0
	1978	Lead	1	1	---	0
		Tin	1	1	---	0
	1979	Lead	1	0	---	0
		Tin	1	0	---	0
		Trichloroethylene	0	1	---	0
	1980	Isopropyl Alcohol (2-propanol)	0	1	---	0
		Methylene Chloride (dichloromethane)	0	1	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Trichloroethylene	0	1	---	0
	1983	Hydrochloric Acid	1	0	**0**	1
		Trichloroethylene	0	1	**100**	1
	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
	1986	_Particulates	25	8	**24**	33
		Formaldehyde	4	0	**0**	4

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Hydrochloric Acid	2	0	**0**	2
	1988	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	4	6	**60**	10
	1994	Lead	0	2	**100**	2
638	1976	Benzene	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	---	0
		Isopropyl Alcohol (2-propanol)	0	1	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Xylene (mixed isomers)	0	0	---	0
	1977	Benzene	1	0	---	0
		Dichlorobenzene, o- (1,2-dichlorobenzene)	1	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	---	0
		Isopropyl Alcohol (2-propanol)	0	1	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Phenol	0	1	---	0
		Xylene (mixed isomers)	0	1	---	0
	1982	_Particulates	0	0	---	0
	1984	__Brand Name	0	0	---	0
		Chromium	0	0	---	0
		Copper	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Nitric Acid	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Wax, Apiezon	0	0	---	0
	1986	Argon	0	0	---	0
		Chromium	0	0	---	0
		Copper	0	0	---	0
		Hydrochloric Acid	2	0	**0**	2
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Nitric Acid	2	0	**0**	2
		Sulfuric Acid	2	0	**0**	2
639	????	Ethylene Glycol Monobutyl Ether Acetate (butyl cellosolve acetate)	0	1	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Tin	0	0	---	0
		Trichloroethylene	0	0	---	0
	1981	Isopropyl Alcohol (2-propanol)	0	1	**100**	1
		Lead	0	1	**100**	1
		Methylene Chloride (dichloromethane)	0	2	**100**	2
		Perchloroethylene (tetrachloroethylene)	0	10	**100**	10
	1982	_Particulates	0	3	**100**	3
		Lead	5	0	**0**	5
		Methylene Chloride (dichloromethane)	0	1	**100**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Tin	6	0	0	6
	1983	Lead	1	0	0	1
		Perchloroethylene (tetrachloroethylene)	0	4	100	4
		Tin	1	0	0	1
	1984	Lead	2	0	0	2
		Methylene Chloride (dichloromethane)	0	4	100	4
		Perchloroethylene (tetrachloroethylene)	0	19	100	19
		Tin	0	2	100	2
	1985	_Acid Group	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	2	100	2
		Methylene Chloride (dichloromethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	17	100	17
	1986	Isopropyl Alcohol (2-propanol)	0	2	100	2
		Lead	5	0	0	5
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	100	1
		Perchloroethylene (tetrachloroethylene)	0	14	100	14
		Tin	4	1	20	5
	1987	Methylene Chloride (dichloromethane)	0	1	100	1
		Perchloroethylene (tetrachloroethylene)	0	6	100	6
	1988	Hydrochloric Acid	2	0	0	2
		Isopropyl Alcohol (2-propanol)	1	3	75	4
		Lead	9	0	0	9
		Perchloroethylene (tetrachloroethylene)	1	1	50	2
	1989	Diallylamine (di-2-propenylamine)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	3	100	3
		Isopropyl Alcohol (2-propanol)	0	5	100	5
		Lead	1	0	0	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	100	1
		Tin	4	0	0	4
	1994	Lead	4	0	0	4
640	1977	Ethylene Glycol Monobutyl Ether Acetate (butyl cellosolve acetate)	0	0	---	0
		Lead	0	1	---	0
		Silver	0	1	---	0
	1979	Ethylene Glycol Monobutyl Ether Acetate (butyl cellosolve acetate)	0	1	---	0
		Lead	0	1	---	0
		Silver	0	1	---	0
	1980	Gold	0	1	---	0
		Lead	0	1	---	0
		Palladium	0	0	---	0
		Silver	0	1	---	0
		Tin	0	1	---	0
	1981	Gold	0	0	---	0
		Lead	5	1	17	6

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Palladium	0	0	---	0
		Silver	0	5	**100**	5
	1982	Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	1	**100**	1
		Lead	5	0	**0**	5
		Palladium	5	0	**0**	5
		Silver	2	3	**60**	5
	1987	Xylene (mixed isomers)	0	6	**100**	6
	1988	_Metalworking Fluids	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	8	**100**	8
		Methylene Chloride (dichloromethane)	0	0	---	0
		Mineral Spirits (stoddard solvent)	6	2	**25**	8
		Naphthalene	10	0	**0**	10
		Nitrogen	0	0	---	0
		Xylene (mixed isomers)	0	10	**100**	10
	1989	Methyl Chloroform (1,1,1-trichloroethane)	0	14	**100**	14
		Mineral Spirits (stoddard solvent)	0	6	**100**	6
643	????	Perchloroethylene (tetrachloroethylene)	0	1	---	0
653	1978	Methylene-Bisphenyl Isocyanate (MDI) [4,4'-diphenylmethane diisocyante)	3	0	**0**	3
662	1978	Isopropyl Alcohol (2-propanol)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Phenol	0	0	---	0
		Xylene (mixed isomers)	0	1	---	0
	1979	Dichlorobenzene, o- (1,2-dichlorobenzene)	0	1	---	0
		Ferric Chloride [iron(III)chloride]	0	1	---	0
		Isopropyl Alcohol (2-propanol)	0	12	**100**	12
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	---	0
		Phenol	7	6	**50**	12
		Potassium Permanganate	0	1	---	0
		Xylene (mixed isomers)	0	12	**100**	12
	1982	Perchloroethylene (tetrachloroethylene)	0	1	**100**	1
	1983	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	3	0	**0**	3
		Hydrochloric Acid	0	2	**100**	2
		Xylene (mixed isomers)	0	3	**100**	3
	1984	Cyolized Polyisoprene	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	16	3	**16**	19
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	5	**100**	5
		Xylene (mixed isomers)	0	20	**100**	20
	1985	Xylene (mixed isomers)	0	1	**100**	1
	1986	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	17	**100**	17

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Perchloroethylene (tetrachloroethylene)	0	12	100	12
		Xylene (mixed isomers)	0	19	100	19
	1988	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	8	0	0	8
		Perchloroethylene (tetrachloroethylene)	2	6	75	8
		Xylene (mixed isomers)	4	4	50	8
	1989	Dichlorobenzene, o- (1,2-dichlorobenzene)	1	0	0	1
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	8	0	0	8
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	2	100	2
		Hydrochloric Acid	1	0	0	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	100	3
		Nitric Acid	1	0	0	1
		Perchloroethylene (tetrachloroethylene)	0	6	100	6
		Xylene (mixed isomers)	0	8	100	8
	1991	Dichlorobenzene, o- (1,2-dichlorobenzene)	2	0	0	2
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	2	0	0	2
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	1	5	83	6
		Hydrochloric Acid	6	1	14	7
		Isopropyl Alcohol (2-propanol)	0	4	100	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	6	100	6
		Oxalic Acid (ethanedioic acid)	7	1	13	8
		Perchloroethylene (tetrachloroethylene)	0	6	100	6
		Phenol	2	0	0	2
		Sodium Hydroxide	7	0	0	7
		Sulfuric Acid	4	0	0	4
		Xylene (mixed isomers)	5	1	17	6
	1992	Hydrochloric Acid	2	0	0	2
		Isopropyl Alcohol (2-propanol)	0	2	100	2
		Oxalic Acid (ethanedioic acid)	2	0	0	2
		Perchloroethylene (tetrachloroethylene)	0	4	100	4
		Phenol	2	2	50	4
		Sodium Hydroxide	2	0	0	2
		Xylene (mixed isomers)	2	2	50	4
	1993	Dipropylene glycol methyl ether [1-(2-methoxyisopropoxy)-2-propanol]	0	2	100	2
		Xylene (mixed isomers)	0	2	100	2
	1996	Dichlorobenzene, o- (1,2-dichlorobenzene)	0	1	100	1
		Isopropyl Alcohol (2-propanol)	0	1	100	1
		Perchloroethylene (tetrachloroethylene)	0	1	100	1
		Phenol	0	1	100	1
		Xylene (mixed isomers)	0	1	100	1
	1997	Ethyl Benzene	2	3	60	5
		Perchloroethylene (tetrachloroethylene)	0	5	100	5
		Xylene (mixed isomers)	0	5	100	5
663	1981	Ferric Chloride [iron(III)chloride]	2	1	33	3
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	3	100	3
		Hydrochloric Acid	1	2	67	3
		Methyl Chloroform (1,1,1-trichloroethane)	0	7	100	7

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
		Oxalic Acid (ethanedioic acid)	3	0	**0**	3
		Potassium Permanganate	1	2	**67**	3
	1982	Oxalic Acid (ethanedioic acid)	0	2	**100**	2
		Phenol	0	1	**100**	1
		Xylene (mixed isomers)	0	2	**100**	2
	1983	Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1984	Oxalic Acid (ethanedioic acid)	1	11	**92**	12
	1985	Methylene Chloride (dichloromethane)	6	7	**54**	13
		Perchloroethylene (tetrachloroethylene)	0	15	**100**	15
		Phenol	10	0	**0**	10
		Sodium Hydroxide	1	0	**0**	1
		Xylene (mixed isomers)	5	10	**67**	15
	1986	Hydrochloric Acid	2	1	**33**	3
		Methylene Chloride (dichloromethane)	0	2	**100**	2
		Oxalic Acid (ethanedioic acid)	0	2	**100**	2
	1987	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	8	**100**	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	6	**100**	6
		Methylene Chloride (dichloromethane)	5	5	**50**	10
		Perchloroethylene (tetrachloroethylene)	2	20	**91**	22
		Phenol	4	0	**0**	4
		Xylene (mixed isomers)	6	16	**73**	22
	1988	__Brand Name	0	0	---	0
		Benzosulfonic Acid, dodecyl-	0	0	---	0
		Carbon Tetrafluoride (freon 14 or halon 14)	0	0	---	0
		Dichlorobenzene, o- (1,2-dichlorobenzene)	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Phenol	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Thiourea	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1989	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	4	**100**	4
		Hydrochloric Acid	3	0	**0**	3
		Isopropyl Alcohol (2-propanol)	0	2	**100**	2
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level # Non-Detect	# Detect	% Detect	# Total
		Methylene Chloride (dichloromethane)	0	3	**100**	3
		Oxalic Acid (ethanedioic acid)	3	0	**0**	3
		Perchloroethylene (tetrachloroethylene)	0	5	**100**	5
		Phenol	2	0	**0**	2
		Sodium Hydroxide	3	0	**0**	3
		Sulfuric Acid	2	0	**0**	2
		Thiourea	2	4	**67**	6
		Xylene (mixed isomers)	1	4	**80**	5
	1991	Chromium	0	2	**100**	2
		Copper	0	3	**100**	3
		Isopropyl Alcohol (2-propanol)	0	1	**100**	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
668	1982	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	**100**	1
		Hydrochloric Acid	0	1	**100**	1
		Isopropyl Alcohol (2-propanol)	0	1	**100**	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
		Oxalic Acid (ethanedioic acid)	1	2	**67**	3
		Perchloroethylene (tetrachloroethylene)	0	1	**100**	1
		Phenol	2	0	**0**	2
		Xylene (mixed isomers)	0	4	**100**	4
	1983	Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Phenol	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Xylene (mixed isomers)	0	0	---	0
	1984	_Metalworking Fluids	1	1	**50**	2
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	19	14	**42**	33
		Perchloroethylene (tetrachloroethylene)	0	10	**100**	10
		Xylene (mixed isomers)	2	31	**94**	33
	1985	__Brand Name	0	0	---	0
		Cyolized Polyisoprene	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	3	0	**0**	3
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		N-Methyl-2-Pyrrolidone (NMP)	0	0	---	0
		Nylon	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	3	**100**	3
		Phenol	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level # Non-Detect	# Detect	% Detect	# Total
		Potassium Hydroxide	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Xylene (mixed isomers)	1	3	**75**	4
	1986	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	6	**100**	6
		Isopropyl Alcohol (2-propanol)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	0	3	**100**	3
		Perchloroethylene (tetrachloroethylene)	0	8	**100**	6
		Xylene (mixed isomers)	0	6	**100**	6
	1987	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	6	0	**0**	6
		Perchloroethylene (tetrachloroethylene)	0	7	**100**	7
		Xylene (mixed isomers)	0	8	**100**	8
	1988	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	19	**100**	19
		Perchloroethylene (tetrachloroethylene)	19	0	**0**	19
		Xylene (mixed isomers)	19	0	**0**	19
	1989	Chromium	0	0	---	0
		Copper	0	0	---	0
		Dichlorobenzene, o- (1,2-dichlorobenzene)	2	0	**0**	2
		Dichlorobenzene, p- (1,4-dichlorobenzene)	2	0	**0**	2
		Ethyl Benzene	2	1	**33**	3
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	10	**100**	10
		Hydrochloric Acid	1	0	**0**	1
		Isopropyl Alcohol (2-propanol)	0	9	**100**	9
		Methyl Chloroform (1,1,1-trichloroethane)	0	6	**100**	6
		N-Methyl-2-Pyrrolidone (NMP)	0	3	**100**	3
		Nitric Acid	1	0	**0**	1
		Perchloroethylene (tetrachloroethylene)	0	8	**100**	8
		Potassium Hydroxide	2	0	**0**	2
		Sodium Hydroxide	5	0	**0**	5
		Sulfuric Acid	8	0	**0**	8
		Xylene (mixed isomers)	5	6	**55**	11
	1992	Ethylene Glycol Monomethyl Ether (methyl cellosolve)	4	0	**0**	4
		Perchloroethylene (tetrachloroethylene)	0	4	**100**	4
		Xylene (mixed isomers)	3	1	**25**	4
673	1986	_Unknown	0	0	---	0
675	1975	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Trichloroethylene	0	0	---	0
692	1986	Ammonium Hydroxide	0	0	---	0
		Hydrogen Peroxide	0	0	---	0
699	1976	Asbestos	0	0	---	0
713	1975	Vinyl Chloride (vinyl chloride monomer)	1	0	---	0
730	????	Bischloromethyl Ether (methane, oxybis[chloro])	0	0	---	0
734	1988	__Brand Name	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Hydrochloric Acid	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Sodium Carbonate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
738	2000	Lead	0	20	**100**	20
	2001	Beryllium	24	0	**0**	24
		Lead	12	18	**60**	30
	2002	Beryllium	12	0	**0**	12
		Lead	6	70	**92**	76
741	1978	_Metalworking Fluids	0	3	**100**	3
	1988	_Metalworking Fluids	0	0	---	0
	1996	Hydrochloric Acid	0	2	**100**	2
		Sulfuric Acid	0	2	**100**	2
	2000	Hydrochloric Acid	0	8	**100**	8
760	????	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
768	1988	Methyl Chloroform (1,1,1-trichloroethane)	0	2	**100**	2
809	1974	Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	1	**100**	1
821	????	Methylene-Bisphenyl Isocyanate (MDI) [4,4'-diphenylmethane diisocyante)	0	2	**100**	2
		Vinyl Chloride (vinyl chloride monomer)	0	2	**100**	2
824	1997	Mineral Spirits (stoddard solvent)	0	10	**100**	10
836	1995	_Particulates	2	4	**67**	6
	1997	_Particulates	3	10	**77**	13
		Ethylene Glycol Monobutyl Ether (butyl cellosolve)	0	2	**100**	2
	1999	_Particulates	2	10	**83**	12
		Butanol, sec-	0	2	**100**	2
		Cyclohexane	2	0	**0**	2
		Diisobutyl Ketone (2,6-Dimethyl-4-heptanone)	2	0	**0**	2
		Ethyl Acetate (ethyl ethanoate)	0	2	**100**	2
		Ethylene Glycol Monobutyl Ether (butyl cellosolve)	0	2	**100**	2
		Isobutyl Acetate	1	1	**50**	2
		Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	1	1	**50**	2
		Nickel	0	2	**100**	2
		Toluene	0	2	**100**	2
		Xylene (mixed isomers)	2	0	**0**	2
	2000	_Particulates	2	2	**50**	4
859	1974	_Particulates	0	0	---	0
		Sulfur Dioxide	0	1	**100**	1
	1976	_Particulates	0	1	**100**	1
878	1981	Acetone	0	1	**100**	1
		Cresyl Glycidyl Ether, o- (1,2-epoxy-3-(o-tolyloxy)	1	0	**0**	1
		Toluene	0	1	**100**	1
		Xylene (mixed isomers)	0	1	**100**	1

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
887	????	Benzene	0	0	---	0
	1981	Cresyl Glycidyl Ether, o- (1,2-epoxy-3-(o-tolyloxy)	4	0	**0**	4
	1984	_Epoxy	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
894	1990	Cyclohexanone	0	0	---	0
		Ethanol	0	0	---	0
		Ethylene Glycol Monobutyl Ether (butyl cellosolve)	1	0	**0**	1
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	1	0	**0**	1
		Isopropyl Alcohol (2-propanol)	1	0	**0**	1
		Methyl Ethyl Ketone (2-butanone)	0	0	---	0
		Toluene Diisocyanate (TDI)	0	0	---	0
	2001	Methyl Ethyl Ketone (2-butanone)	1	0	**0**	1
		Propylene Glycol Monoethyl Ether Acetate	1	0	**0**	1
		Xylene (mixed isomers)	1	0	**0**	1
935	1986	Acetone	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Mineral Spirits (stoddard solvent)	0	0	---	0
		Tetramethyl Butane Diamine (N,N,N',N'-Tetramethyl-1,3,-butanediamine)	0	0	---	0
		Toluene	0	0	---	0
981	????	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
BMK	1985	Hydrogen Fluoride (hydrofluoric acid)	0	0	---	0
	1986	Hydrogen Fluoride (hydrofluoric acid)	0	4	**100**	4
E21	????	_Particulates	0	1	**100**	1
F28	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	1	**100**	1
F87	????	Methylene Chloride (dichloromethane)	0	0	---	0
FJU	1986	Copper	0	0	---	0
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
	1988	Hydrochloric Acid	3	0	**0**	3
	1989	Toluene Diisocyanate (TDI)	2	0	**0**	2
		Xylene (mixed isomers)	2	0	**0**	2
	1991	Hydrochloric Acid	0	1	**100**	1
	1995	_Particulates	1	0	**0**	1
	1996	_Particulates	1	0	**0**	1
FKU	1986	_Epoxy	0	0	---	0
		Acetone	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
FKY	1984	Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	0	3	**100**	3

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
	1985	_Epoxy	0	0	---	0
		Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Methylene Chloride (dichloromethane)	0	3	100	3
		Toluene Diisocyanate (TDI)	0	0	---	0
FLJ	1987	_Fiberglass	1	2	67	3
		Dicyandiamide (DICY)	1	0	0	1
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	3	100	3
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	0	0	---	0
		Methyl Ethyl Ketone (2-butanone)	0	0	---	0
		Tetramethyl Butane Diamine (N,N,N',N'-Tetramethyl-1,3,-butanediamine)	0	0	---	0
	1988	_Fiberglass	0	2	100	2
	1991	Acetic Acid	1	0	0	1
		Ammonia	0	1	100	1
		Ethanol	1	0	0	1
		Hydrochloric Acid	1	0	0	1
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methanol	1	0	0	1
		Sodium Hydroxide	1	0	0	1
		Sulfuric Acid	1	0	0	1
		Tin	1	0	0	1
	1996	_Metalworking Fluids	0	1	100	1
		Ethanolamine (ethanol, 2-amino)	1	0	0	1
		Triethanolamine (ethanol, 2,2',2"-nitrilotris-)	1	0	0	1
FLZ	1985	Mineral Spirits (stoddard solvent)	0	0	---	0
	1998	_Metalworking Fluids	3	0	0	3
FMU	1984	_Epoxy	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
	1989	Isopropyl Alcohol (2-propanol)	0	0	---	0
GJE	????	_Particulates	2	1	33	3
		Carbon Black	0	0	---	0
GLW	1997	Manganese	0	1	100	1
		Oxalic Acid (ethanedioic acid)	5	0	0	5
		Sodium Arsenate	0	0	---	0
		Sodium Hydroxide	4	0	0	4
		Sulfuric Acid	4	0	0	4
	1998	_Particulates	3	0	0	3
		Chromium	3	0	0	3
		Copper	1	2	67	3
GPC	1991	_Particulates	0	0	---	0
		Ammonia	4	0	0	4
		Cobalt	0	0	---	0
		Cyanide (HCN)	4	0	0	4

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Ethanol	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	4	0	0	4
		Methylene Chloride (dichloromethane)	3	1	25	4
		Nickel	4	0	0	4
		Phosphoric Acid	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	4	0	0	4
GPL	1994	Butanol, n-	2	0	0	2
		Ethanol	2	0	0	2
		Ethyl Acetate (ethyl ethanoate)	2	0	0	2
		Isopropyl Alcohol (2-propanol)	2	0	0	2
		Methyl Ethyl Ketone (2-butanone)	0	2	100	2
		Toluene	2	0	0	2
	1996	Arsenic	2	0	0	2
		Butanol, n-	0	0	---	0
		Ethanol	0	0	---	0
		Ethyl Acetate (ethyl ethanoate)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Nickel	1	2	67	3
		Sodium Arsenate	0	0	---	0
GQF	1986	Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
GRZ	1984	_Acid Group	0	0	---	0
		_Inks & Dyes	0	0	---	0
		_Unknown	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Nitrogen	0	0	---	0
	1992	Methanol	0	0	---	0
		Nitromethane	0	0	---	0
GWL	1985	Hydrochloric Acid	0	0	---	0
		Sodium Chlorite	0	0	---	0
	1989	_Fiberglass	4	14	78	18
		Copper	2	0	0	2
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	4	100	4
		Hydrochloric Acid	10	0	0	10
		Sodium Hydroxide	4	0	0	4
	1990	Cupric Chloride (copper(III) chloride)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
	1991	_Particulates	14	2	13	16
		Copper	4	0	0	4
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	8	4	33	12
		Isopropyl Alcohol (2-propanol)	0	2	50	4
	1993	_Fiberglass	4	4	50	8
		Hydrochloric Acid	2	0	0	2
	2000	_Particulates	6	2	25	8

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
GWP	1984	_Epoxy	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
	1988	_Chromates	8	0	0	8
		Methyl Chloroform (1,1,1-trichloroethane)	0	8	100	8
		Sulfuric Acid	8	0	0	8
	1989	_Chromates	2	0	0	2
		Acetic Acid	2	0	0	2
		Aluminum	2	0	0	2
		Copper	0	4	100	4
		Glutaraldehyde (1,5-pentanedial)	2	0	0	2
		Hydroquinone	2	0	0	2
		Methyl Chloroform (1,1,1-trichloroethane)	0	2	100	2
		Potassium Hydroxide	2	0	0	2
		Sulfuric Acid	4	0	0	4
	1991	_Fiberglass	0	4	100	4
		Glacial Acetic Acid	0	2	100	2
		Isopropyl Alcohol (2-propanol)	0	4	100	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	4	100	4
		Potassium Hydroxide	2	0	0	2
		Sodium Bisulfite	2	0	0	2
	1994	_Particulates	6	10	63	16
HBZ	1996	Lead	4	0	0	4
HEA	1985	_Metalworking Fluids	0	0	---	0
	1986	_Metalworking Fluids	0	0	---	0
	1987	_Metalworking Fluids	2	0	0	2
	1993	Ethanolamine (ethanol, 2-amino)	0	4	100	4
		Triethanolamine (ethanol, 2,2',2"-nitrilotris-)	2	2	50	4
HKC	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
	1993	Ethanolamine (ethanol, 2-amino)	0	4	100	4
		Triethanolamine (ethanol, 2,2',2"-nitrilotris-)	4	0	0	4
J6C	1986	Methyl Chloroform (1,1,1-trichloroethane)	0	2	100	2
JD7	1988	Isopropyl Alcohol (2-propanol)	0	0	---	0
JKU	2002	Formaldehyde	0	14	100	14
JNG	1989	Diallylamine (di-2-propenylamine)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	2	100	2
		Isopropyl Alcohol (2-propanol)	0	1	100	1
		Methyl Cyanoacrylate	0	1	100	1
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
	1991	Hydroquinone	1	1	50	2
	1999	Naphthalene	0	2	100	2
KDW	1986	Hydrochloric Acid	6	2	25	8
		Nitric Acid	8	0	0	8
	1996	Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	0	2	100	2
		Propanol, 1-	0	6	100	6
KFN	1994	Ethylene Glycol Monobutyl Ether (butyl cellosolve)	2	4	67	6
		Trimethylamine	4	2	33	6

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
KPG	1994	Butyrolactone, gamma-	0	2	**100**	2
	1995	_Fiberglass	3	0	**0**	3
	1997	Diethylene Glycol Monoethyl Ether Acetate	0	5	**100**	5
		Dipropylene glycol methyl ether [1-(2-methoxyisopropoxy)-2-propanol]	0	5	**100**	5
		Methanol	3	0	**0**	3
		Naphtha (petroleum naphtha)	0	0	---	0
		Naphtha, Heavy Aromatic	0	5	**100**	5
	1999	Isopropyl Alcohol (2-propanol)	0	1	**100**	1
		Methanol	0	1	**100**	1
L50	1982	Phenol	0	1	**100**	1
		Triphenyl Phosphate	0	1	**100**	1
L51	1981	Cadmium	0	0	---	0
		Lead	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Phenol	0	0	---	0
		Silver	0	0	---	0
		Triphenyl Phosphate	0	0	---	0
	1982	Cadmium	0	1	**100**	1
		Lead	0	1	**100**	1
		Phenol	0	1	**100**	1
		Silver	0	1	**100**	1
		Triphenyl Phosphate	0	1	**100**	1
L52	1986	_Metalworking Fluids	0	0	---	0
L54	1981	Cadmium	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Lead	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
	1982	Cadmium	0	1	**100**	1
		Lead	0	1	**100**	1
		Phenol	0	1	**100**	1
		Triphenyl Phosphate	0	1	**100**	1
	1984	__Brand Name	0	0	---	0
		Copper	0	0	---	0
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		Ozone	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
	1987	FICC	0	0	---	0
		Lead	0	0	---	0
LRH	1984	_Particulates	0	6	**100**	6
	1992	Methanol	0	2	**100**	2
		Nitromethane	2	0	**0**	2
LTK	1985	_Potassium Salts Group	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Ammonia	0	0	---	0
		Copper Chloride	0	0	---	0
		Potassium Carbonate	0	0	---	0
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Sulfuric Acid	0	0	---	0
	1986	Hydrochloric Acid	1	1	**50**	2
		Nitric Acid	2	1	**33**	3
	1988	Formaldehyde	4	0	**0**	4
	1990	Butanol, sec-	1	0	**0**	1
		Formaldehyde	2	0	**0**	2
		Hydrochloric Acid	3	1	**25**	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	1	**100**	1
		Naphthalene	2	0	**0**	2
		Nitric Acid	3	0	**0**	3
		Potassium Hydroxide	1	0	**0**	1
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	1	0	**0**	1
		Sodium Hydroxide	1	0	**0**	1
		Sulfuric Acid	3	0	**0**	3
		Toluene	1	0	**0**	1
	1991	Hydrochloric Acid	6	2	**25**	8
		Sulfuric Acid	8	0	**0**	8
	1992	Ammonia	1	0	**0**	1
		Hydrochloric Acid	1	5	**83**	6
		Sulfuric Acid	4	0	**0**	4
	1997	Hydrochloric Acid	9	0	**0**	9
		Sulfuric Acid	9	0	**0**	9
	1998	Copper	0	3	**100**	3
		Tin	2	0	**0**	2
R75	1983	Dimethyl Acetate	0	0	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Nickel	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	0	---	0
		Sodium Cyanide	0	0	---	0
		Sulfuric Acid	0	0	---	0
Sol	1983	_Particulates	1	2	**67**	3
		Acetic Acid	0	3	**100**	3
		Cyclohexanone	0	3	**100**	3
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	4	0	**0**	4
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	0	3	**100**	3
		Perchloroethylene (tetrachloroethylene)	0	3	**100**	3

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Trichloroethylene	0	3	**100**	3
	1984	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	3	**100**	3
		Methyl Chloroform (1,1,1-trichloroethane)	0	3	**100**	3
		Methylene Chloride (dichloromethane)	0	3	**100**	3
		Nickel Cyanide	3	0	**0**	3
		Perchloroethylene (tetrachloroethylene)	0	3	**100**	3
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	1	2	**67**	3
		Trichloroethylene	0	3	**100**	3
T12	1985	Copper	0	0	---	0
		Copper Sulfate	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Sulfuric Acid	0	0	---	0
T24	1985	Lead	0	0	---	0
	1988	Lead	4	0	**0**	4
T28	1985	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	1	4	**80**	5
T29	1985	Lead	0	0	---	0
T32	1991	Acetone	6	0	**0**	6
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	6	0	**0**	6
		Methyl Ethyl Ketone (2-butanone)	0	6	**100**	6
T34	1983	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Lead	0	0	---	0
T36	1985	Lead	0	0	---	0
T41	1985	_Metalworking Fluids	0	0	---	0
T43	1978	Methylene Chloride (dichloromethane)	0	1	**100**	1
		Trichloroethylene	0	1	**100**	1
T46	1985	Cyanide (HCN)	4	0	**0**	4
		Nickel	3	0	**0**	3
		Nickel Chloride	0	0	---	0
		Nickel Sulfamate	0	0	---	0
		Potassium Cyanide	0	0	---	0
T47	1993	Diglyme	2	0	**0**	2
T49	1985	_Acid Group	0	0	---	0
		_Inks & Dyes	0	0	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	0	---	0
		Methyl Ethyl Ketone (2-butanone)	0	0	---	0
	1991	Methyl Ethyl Ketone (2-butanone)	0	2	**100**	2
	1992	Methyl Ethyl Ketone (2-butanone)	0	8	**100**	8
	2000	_Particulates	2	2	**50**	4
	2002	_Particulates	1	1	**50**	2
T56	1978	Ammonium Hydroxide	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Hydrogen Fluoride (hydrofluoric acid)	0	0	---	0
T66	????	Cyanide (HCN)	2	0	**0**	2
T67	1984	Benzotriazole (BTA)	0	0	---	0

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Copper Sulfate	0	0	---	0
		EDTA (Etheylene Diamine Tetraacetic Acid)	0	0	---	0
		Formaldehyde	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Sodium Cyanide	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sodium Persulfate	0	0	---	0
		Sulfuric Acid	0	0	---	0
	1985	Cyanide (HCN)	1	0	0	1
		Formaldehyde	0	2	100	2
	1991	Silica (Crystaline) [silicon dioxide–(a-Quartz)]	1	0	0	1
T84	1978	Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	0	0	---	0
	1983	Ethylene Glycol Monomethyl Ether Acetate (methyl cellosolve acetate)	4	1	20	5
	1984	Cupric Chloride (copper(III) chloride)	0	0	---	0
	1989	Hydrochloric Acid	0	3	100	3
T86	1982	Isopropyl Alcohol (2-propanol)	0	1	100	1
		Perchloroethylene (tetrachloroethylene)	0	1	100	1
		Phenol	0	2	100	2
		Xylene (mixed isomers)	0	4	100	4
	1983	Perchloroethylene (tetrachloroethylene)	0	1	100	1
		Phenol	1	0	0	1
		Xylene (mixed isomers)	0	4	100	4
	1985	Isopropyl Alcohol (2-propanol)	0	1	100	1
	1986	Chromium	0	0	---	0
		Copper	0	0	---	0
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	3	0	0	3
		Ferric Chloride [iron(III)chloride]	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Hydrochloric Acid	0	0	---	0
		Isopropyl Alcohol (2-propanol)	0	1	100	1
		Methyl Chloroform (1,1,1-trichloroethane)	0	0	---	0
		N-Methyl-2-Pyrrolidone (NMP)	0	3	100	3
		Nitric Acid	0	0	---	0
		Oxalic Acid (ethanedioic acid)	0	0	---	0
		Polyimide Type 1	0	0	---	0
		Potassium Hydroxide	0	0	---	0
		Potassium Permanganate	0	0	---	0
		Sodium Hydroxide	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Thiourea	0	0	---	0
		Xylene (mixed isomers)	0	3	100	3
T87	????	Cyanide (HCN)	2	0	0	2
		Formaldehyde	3	3	50	6
T89	1986	Polyethylene Plastic	0	0	---	0
T94	1982	__Brand Name	3	0	0	3

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

Dept.	Year	Chemical Name	Sample Detection Level: # Non-Detect	# Detect	% Detect	# Total
		_Inks & Dyes	0	0	---	0
		Butyl Carbitol Acetate (2-[2-butoxyethoxy]ethanol acet	0	0	---	0
		Diglycidol Ether of Bis Phenol A [2,2-bis(p-2,3-Epoxypropoxy) phenyl)propane]	0	0	---	0
		Dimethylacetamide	3	0	0	3
		Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
		Gold	0	0	---	0
		Iron	0	1	100	1
		Isopropyl Alcohol (2-propanol)	0	0	---	0
		Lead	4	0	0	4
		Maleic Anhydride	0	0	---	0
		Methylene Chloride (dichloromethane)	0	0	---	0
		Nickel Sulfamate	0	0	---	0
		Palladium	0	0	---	0
		Perchloroethylene (tetrachloroethylene)	0	1	100	1
		Phthalic Anhydride	1	0	0	1
		Silver	0	0	---	0
		Sodium Cyanide	0	0	---	0
		Sulfuric Acid	0	0	---	0
		Tin	4	0	0	4
	1984	Asbestos	0	1	100	1
		Ethylene Glycol Monomethyl Ether (methyl cellosolve)	3	4	57	7
		Perchloroethylene (tetrachloroethylene)	0	4	100	4
	1985	Cyanide (HCN)	17	0	0	17
	1986	Isopropyl Alcohol (2-propanol)	0	1	100	1
		Lead	2	0	0	2
		Perchloroethylene (tetrachloroethylene)	0	2	100	2
		Tin	2	0	0	2
U13	1982	Lead	0	0	---	0
	1997	Lead	2	0	0	2
		Tin	2	0	0	2
U54	????	Sulfuric Acid	2	0	0	2
U56	1990	Beryllium	1	0	0	1
U61	1985	Lead	0	0	---	0
U62	1983	Lead	0	0	---	0
U65	1985	Oxalic Acid (ethanedioic acid)	0	0	---	0
	1991	Beryllium	4	0	0	4
		Copper	4	0	0	4
U76	1985	_Metalworking Fluids	0	0	---	0
U91	1986	Isopropyl Alcohol (2-propanol)	0	2	100	2
V05	1984	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
	1991	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	3	100	3
V72	1985	_Metalworking Fluids	0	0	---	0
		Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	0	---	0
W12	????	Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	0	3	100	3

Table 6A: Endicott Industrial Hygiene Sampling by Department / Year / Chemical

			Sample Detection Level			
Dept.	Year	Chemical Name	# Non-Detect	# Detect	% Detect	# Total
		Isopropyl Alcohol (2-propanol)	0	3	100	3
W62	1991	_Particulates	4	1	20	5
		Silica (Crystaline) [silicon dioxide--(a-Quartz)]	4	1	20	5
W63	1983	_Fiberglass	5	1	17	6
X19	1986	Lead	3	0	0	3
	1991	Lead	1	0	0	1

Table 6B: Endicott Industrial Hygiene Sampling for Chemicals Assigned Carcinogenic Potential

Department	Carcinogen Level	Chemname	# Non-Detect	# Detect	% Detect	# Total
006	1	Sulfuric Acid	20	0	**0**	20
006	2	Thiourea	14	6	**30**	20
015	1	Chromates	6	0	**0**	6
015	1	Chromic Acid (chrome(VI)oxide)	4	0	**0**	4
015	1	Sulfuric Acid	4	0	**0**	4
015	2	Methylene Chloride (dichloromethane)	4	8	**67**	12
015	2	Perchloroethylene (tetrachloroethylene)	0	28	**100**	28
020	1	Chromium	2	0	**0**	2
021	1	Sulfuric Acid	27	1	4	28
021	1	Formaldehyde	86	4	4	90
021	*2*	*Lead*	*2*	*1*	***33***	*3*
022	1	Sulfuric Acid	18	0	**0**	18
022	2	Methylene Chloride (dichloromethane)	0	8	**100**	8
023	*2*	*Lead*	*9*	*0*	***0***	*9*
027	1	Sulfuric Acid	4	0	**0**	4
027	2	Methylene Chloride (dichloromethane)	5	15	**75**	20
028	2	Methylene Chloride (dichloromethane)	8	86	**91**	94
033	1	Chromic Acid (chrome(VI)oxide)	22	14	**39**	36
033	2	Trichloroethylene	0	11	**100**	11
034	*2*	*Lead*	*11*	*0*	***0***	*11*
035	*2*	*Lead*	*11*	*1*	***8***	*12*
036	1	Beryllium	6	0	**0**	6
037	*2*	*Lead*	*1*	*0*	***0***	*1*
038	1	Formaldehyde	4	4	**50**	8
038	2	Methylene Chloride (dichloromethane)	0	18	**100**	18
038	2	Perchloroethylene (tetrachloroethylene)	0	1	**100**	1
038	2	Trichloroethylene	0	3	**100**	3
039	*2*	*Lead*	*7*	*0*	***0***	*7*
045	1	Formaldehyde	7	2	**13**	15
045	*1*	*Silica (Crystaline) [silicon dioxide–(a-Quartz)]*	*2*	*6*	***75***	*8*
046	2	Epichlorohydrin	1	0	**0**	1
046	2	Methylene Chloride (dichloromethane)	2	18	**90**	20
046	*2*	*Lead*	*1*	*0*	***0***	*1*
047	2	Methylene Chloride (dichloromethane)	0	21	**100**	21
050	2	Kerosene	0	9	**100**	9
050	2	Thiourea	0	3	**100**	3
051	2	Toluene Diisocyanate (TDI)	22	3	**12**	25
051	*2*	*Lead*	*2*	*0*	***0***	*2*
053	1	Arsenic	8	1	**11**	9
053	2	Antimony Trioxide	4	0	**0**	4
053	2	Methylene Chloride (dichloromethane)	3	0	**0**	3

Table 6B: Endicott Industrial Hygiene Sampling for Chemicals Assigned Carcinogenic Potential

Department	Carcinogen Level	Chemname	# Non-Detect	# Detect	% Detect	# Total
053	*2*	*Lead*	*10*	*1*	*9*	*11*
054	2	PCBs	0	1	100	1
066	1	Sulfuric Acid	2	0	0	2
100	1	Chromates	11	2	15	13
100	1	Chromic Acid (chrome(VI)oxide)	2	2	50	4
100	1	Chromium	1	1	50	2
100	1	Sulfuric Acid	2	0	0	2
100	2	Methylene Chloride (dichloromethane)	0	6	100	6
123	1	Benzene	0	12	100	12
123	1	Formaldehyde	12	0	0	12
123	*2*	*Lead*	*8*	*0*	*0*	*8*
139	1	Benzo(a)pyrene	1	0	0	1
156	*2*	*Lead*	*16*	*1*	*6*	*17*
160	*2*	*Lead*	*3*	*1*	*25*	*4*
171	*2*	*Lead*	*2*	*0*	*0*	*2*
200	1	Chromium	2	0	0	2
200	*2*	*Lead*	*0*	*10*	*100*	*10*
213	2	Methylene Chloride (dichloromethane)	4	0	0	4
289	1	Benzene	5	0	0	5
320	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*0*	*1*	*100*	*1*
330	1	Cadmium	1	0	0	1
330	1	Chromium	1	0	0	1
330	2	PCBs	1	0	0	1
330	3	Styrene (Benzene, ethenyl-)	0	1	100	1
330	*2*	*Lead*	*1*	*0*	*0*	*1*
347	2	Acrylonitrile	6	0	0	6
347	2	Methylene Chloride (dichloromethane)	0	2	100	2
347	2	Toluene Diisocyanate (TDI)	4	0	0	4
347	3	Nitromethane	4	0	0	4
347	3	Styrene (Benzene, ethenyl-)	6	0	0	6
366	1	Sulfuric Acid	1	0	0	1
368	2	Methylene Chloride (dichloromethane)	0	4	100	4
373	1	Chromic Acid (chrome(VI)oxide)	24	0	0	24
373	1	Chromium	6	0	0	6
373	1	Sulfuric Acid	22	0	0	22
373	2	Ethylene Dichloride (1,2-dichloroethane)	4	0	0	4
373	1	Formaldehyde	36	2	5	38
373	2	Methylene Chloride (dichloromethane)	0	202	100	202
373	2	Thiourea	7	2	22	9
373	3	Nitrobenzene	2	0	0	2
373	3	Nitromethane	4	0	0	4

Table 6B: Endicott Industrial Hygiene Sampling for Chemicals Assigned Carcinogenic Potential

Department	Carcinogen Level	Chemname	# Non-Detect	# Detect	% Detect	# Total
373	*2*	*Lead*	*24*	*0*	*0*	*24*
395	*2*	*Lead*	*0*	*2*	*100*	*2*
461	1	Chromates	4	0	0	4
461	1	Chromic Acid (chrome(VI)oxide)	0	6	100	6
461	1	Chromium	4	0	0	4
461	1	Formaldehyde	0	1	100	1
461	2	Methylene Chloride (dichloromethane)	2	34	94	36
461	2	Trichloroethylene	0	1	100	1
461	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*0*	*2*	*100*	*2*
490	2	Toluene Diisocyanate (TDI)	10	0	0	10
490	2	Trichloroethylene	0	5	100	5
490	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*1*	*0*	*0*	*1*
492	2	Trichloroethylene	0	2	100	2
509	1	Sulfuric Acid	4	0	0	4
509	1	Formaldehyde	4	0	0	4
509	2	Methylene Chloride (dichloromethane)	0	4	100	4
534	*2*	*Lead*	*2*	*1*	*33*	*3*
566	2	Methylene Chloride (dichloromethane)	0	2	100	2
581	1	Beryllium	1	0	0	1
605	1	Benzene	0	1	100	1
605	2	Methylene Chloride (dichloromethane)	0	1	100	1
605	2	Perchloroethylene (tetrachloroethylene)	1	0	0	1
634	2	Perchloroethylene (tetrachloroethylene)	0	1	100	1
637	1	Benzene	0	1	100	1
637	1	Formaldehyde	4	0	0	4
637	2	Methylene Chloride (dichloromethane)	0	1	100	1
637	2	Perchloroethylene (tetrachloroethylene)	0	2	100	2
637	2	Trichloroethylene	0	3	100	3
637	*2*	*Lead*	2	*3*	*60*	*5*
638	1	Benzene	1	0	0	1
638	1	Sulfuric Acid	2	0	0	2
638	2	Perchloroethylene (tetrachloroethylene)	0	2	100	2
639	2	Methylene Chloride (dichloromethane)	0	8	100	8
639	2	Perchloroethylene (tetrachloroethylene)	1	72	99	73
639	*2*	*Lead*	*27*	*1*	*4*	*28*
640	3	Naphthalene	10	0	0	10
640	*2*	*Lead*	*10*	*4*	*29*	*14*
643	2	Perchloroethylene (tetrachloroethylene)	0	1	100	1
662	1	Sulfuric Acid	4	0	0	4
662	2	Perchloroethylene (tetrachloroethylene)	2	48	96	50
662	3	Ethyl Benzene	2	3	60	5

Table 6B: Endicott Industrial Hygiene Sampling for Chemicals Assigned Carcinogenic Potential

Department	Carcinogen Level	Chemname	# Non-Detect	# Detect	% Detect	# Total
663	1	Chromium	0	2	**100**	2
663	1	Sulfuric Acid	2	0	**0**	2
663	2	Methylene Chloride (dichloromethane)	11	17	**61**	28
663	2	Perchloroethylene (tetrachloroethylene)	2	40	**95**	42
663	2	Thiourea	2	4	**67**	6
668	1	Sulfuric Acid	8	0	**0**	8
668	2	Dichlorobenzene, p- (1,4-dichlorobenzene)	2	0	**0**	2
668	2	Methylene Chloride (dichloromethane)	0	3	**100**	3
668	2	Perchloroethylene (tetrachloroethylene)	19	39	**67**	58
668	3	Ethyl Benzene	2	1	**33**	3
713	1	Vinyl Chloride (vinyl chloride monomer)	1	0	**0**	1
738	1	Beryllium	36	0	**0**	36
738	*2*	*Lead*	*18*	*108*	***86***	*126*
741	1	Sulfuric Acid	0	2	**100**	2
809	*1*	*Silica (Crystaline) [silicon dioxide–(a-Quartz)]*	*0*	*1*	***100***	*1*
821	1	Vinyl Chloride (vinyl chloride monomer)	0	2	**100**	2
FJU	2	Toluene Diisocyanate (TDI)	2	0	**0**	2
FKY	2	Methylene Chloride (dichloromethane)	0	6	**100**	8
FLJ	1	Sulfuric Acid	1	0	**0**	1
GLW	1	Chromium	3	0	**0**	3
GLW	1	Sulfuric Acid	4	0	**0**	4
GPC	1	Sulfuric Acid	4	0	**0**	4
GPC	2	Methylene Chloride (dichloromethane)	3	1	**25**	4
GPL	1	Arsenic	2	0	**0**	2
GWP	1	Chromates	10	0	**0**	10
GWP	1	Sulfuric Acid	12	0	**0**	12
HBZ	*2*	*Lead*	*4*	*0*	***0***	*4*
JKU	1	Formaldehyde	0	14	**100**	14
JNG	3	Naphthalene	0	**2**	**100**	2
L51	1	Cadmium	0	1	**100**	1
L51	*2*	*Lead*	*0*	*1*	***100***	*1*
L54	1	Cadmium	0	1	**100**	1
L54	*2*	*Lead*	*0*	*1*	***100***	*1*
LRH	3	Nitromethane	2	0	**0**	2
LTK	1	Sulfuric Acid	24	0	**0**	24
LTK	1	Formaldehyde	6	0	**0**	6
LTK	3	Naphthalene	2	0	**0**	2
LTK	*1*	*Silica (Crystaline) [silicon dioxide–(a-Quartz)]*	*1*	*0*	***0***	*1*
Sol	1	Nickel Cyanide	3	0	**0**	3
Sol	2	Methylene Chloride (dichloromethane)	0	6	**100**	6
Sol	2	Perchloroethylene (tetrachloroethylene)	0	6	**100**	6

Table 6B: Endicott Industrial Hygiene Sampling for Chemicals Assigned Carcinogenic Potential

Department	Carcinogen Level	Chemname	# Non-Detect	# Detect	% Detect	# Total
Sol	2	Trichloroethylene	0	6	100	6
Sol	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*1*	*2*	*67*	*3*
T24	2	*Lead*	*4*	*0*	*0*	*4*
T43	2	Methylene Chloride (dichloromethane)	0	1	100	1
T43	2	Trichloroethylene	0	1	100	1
T67	1	Formaldehyde	0	2	100	2
T67	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*1*	*0*	*0*	*1*
T86	2	Perchloroethylene (tetrachloroethylene)	0	2	100	2
T87	1	Formaldehyde	3	3	50	6
T94	2	Perchloroethylene (tetrachloroethylene)	0	7	100	7
T94	*1*	*Asbestos*	*0*	*1*	*100*	*1*
T94	2	*Lead*	6	*0*	*0*	6
U13	2	*Lead*	2	*0*	*0*	2
U54	1	Sulfuric Acid	2	0	0	2
U56	1	Beryllium	1	0	0	1
U65	1	Beryllium	4	0	0	4
W62	*1*	*Silica (Crystaline) [silicon dioxide--(a-Quartz)]*	*4*	*1*	*20*	*5*
X19	*2*	*Lead*	*4*	*0*	*0*	*4*

† **Carcinogen Level: 1="known", 2="Suspected", 3="Possible"**

Table 7: Endicott Department Carcinogenic Potential Exposures by Cancer Site

Department	Maximum	Respiratory	Liver	Kidney	Skin	Circulatory	Lymphatic	Thyroid	Other Sites*
006	Known	Known	Suspected	---	---	---	---	Suspected	---
015	Known	Known	Suspected	---	---	---	---	---	Suspected
020	Known	Known	---	---	---	---	---	---	---
021	Known	Known	Suspected	---	---	Known	Known	---	Suspected
022	Known	Known	Suspected	---	---	Possible	Possible	---	Suspected
027	Known	Known	Suspected	---	---	---	---	---	Suspected
028	Known	Known	Suspected	---	---	Known	---	---	Suspected
033	Known	Known	Suspected	Suspected	---	---	---	---	---
036	Known	Known	---	---	---	---	---	---	---
038	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
045	Known	Known	---	---	---	Known	---	---	---
046	Known	Known	Suspected	---	---	---	---	---	Suspected
047	Known	Known	Suspected	---	---	---	---	---	Suspected
053	Known	Known	Suspected	---	Known	Suspected	Known	---	Suspected
055	Known	Known	---	---	---	---	---	---	---
066	Known	Known	---	---	---	---	---	---	---
095	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
100	Known	Known	Suspected	---	---	---	---	---	Suspected
123	Known	Known	---	---	---	Known	---	---	---
161	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
200	Known	Known	Suspected	---	---	---	---	---	Known
213	Known	Known	Suspected	Suspected	---	---	---	---	Suspected
289	Known	---	---	---	---	Known	---	---	---
309	Known	Known	Suspected	Suspected	---	---	---	---	---
330	Known	Known	---	---	---	Possible	Possible	---	Known
366	Known	Known	Suspected	---	---	Known	---	---	Suspected
373	Known	Known	Suspected	---	---	Known	---	Suspected	Suspected
379	Known	Known	---	---	---	---	---	---	---
461	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
509	Known	Known	Suspected	---	---	Known	---	---	Suspected
566	Known	Known	Suspected	---	---	Known	---	Suspected	Known
580	Known	Known	Suspected	---	---	---	---	---	Suspected
581	Known	Known	---	---	---	---	---	---	---
605	Known	Suspected	Suspected	---	---	Known	---	---	Suspected
637	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
638	Known	Known	Suspected	---	---	Known	---	---	---
662	Known	Known	Suspected	Possible	---	---	---	---	---
663	Known	Known	Suspected	---	---	---	---	Suspected	Suspected
668	Known	Known	Suspected	Suspected	---	---	---	---	Suspected
713	Known	---	Known	---	---	---	---	---	---
738	Known	Known	---	---	---	---	---	---	---
741	Known	Known	---	---	---	---	---	---	---
821	Known	---	Known	---	---	---	---	---	---

Table 7: Endicott Department Carcinogenic Potential Exposures by Cancer Site

Department	Maximum	Respiratory	Liver	Kidney	Skin	Circulatory	Lymphatic	Thyroid	Other Sites*
836	Known	Known	---	---	---	---	---	---	---
869	Known	Known	Suspected	---	---	Known	---	---	Suspected
887	Known	Known	Suspected	Suspected	---	Known	---	---	Suspected
A22	Known	Known	Suspected	---	---	---	---	---	Known
FLJ	Known	Known	---	---	---	---	---	---	---
GLW	Known	Known	---	---	---	---	Known	---	---
GPC	Known	Known	Suspected	---	---	---	---	---	Suspected
GPL	Known	Known	---	---	Known	---	Known	---	---
GWP	Known	Known	---	---	---	---	---	---	---
J9C	Known	Known	Suspected	Possible	---	---	---	---	---
JKU	Known	Known	---	---	---	Known	---	---	---
JRD	Known	Known	Suspected	---	---	---	---	---	Suspected
KBF	Known	Known	Suspected	Suspected	---	---	---	---	Suspected
L51	Known	Known	Suspected	---	---	---	---	---	Known
L52	Known	Known	Suspected	---	---	---	---	---	Known
L54	Known	Known	Suspected	---	---	---	---	---	Known
LTK	Known	Known	---	---	---	Known	---	---	---
R75	Known	Known	Suspected	---	---	---	---	---	Suspected
Sol	Known	Known	Suspected	Suspected	---	---	---	---	Suspected
T12	Known	Known	---	---	---	---	---	---	---
T46	Known	Known	---	---	---	---	---	---	---
T67	Known	Known	---	---	---	Known	---	---	---
T86	Known	Known	Suspected	---	---	---	---	Suspected	---
T87	Known	Known	---	---	---	Known	---	---	---
T94	Known	Known	Suspected	---	---	---	---	---	Suspected
U54	Known	Known	---	---	---	---	---	---	---
U56	Known	Known	---	---	---	---	---	---	---
U65	Known	Known	---	---	---	---	---	---	---
030	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
039	Suspected	---	Suspected	---	---	Suspected	---	---	Suspected
050	Suspected	Suspected	Suspected	---	---	---	---	Suspected	Suspected
051	Suspected	Suspected	Suspected	---	---	Suspected	---	Suspected	Suspected
222	Suspected	---	Suspected	---	---	---	---	---	---
340	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
347	Suspected	Suspected	Suspected	---	---	Suspected	Possible	---	Suspected
368	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
490	Suspected	---	Suspected	Suspected	---	Suspected	---	---	Suspected
492	Suspected	---	Suspected	Suspected	---	---	---	---	---
539	Suspected	---	Suspected	Suspected	---	---	---	---	---
631	Suspected	Possible	Suspected	---	---	---	---	---	---
634	Suspected	---	Suspected	---	---	---	---	---	---
635	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
639	Suspected	Suspected	Suspected	Suspected	---	---	---	---	Suspected

Table 7: Endicott Department Carcinogenic Potential Exposures by Cancer Site

Department	Maximum	Respiratory	Liver	Kidney	Skin	Circulatory	Lymphatic	Thyroid	Other Sites*
640	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
643	Suspected	---	Suspected	---	---	---	---	---	---
675	Suspected	---	Suspected	Suspected	---	---	---	---	---
894	Suspected	---	Suspected	---	---	Suspected	---	---	Suspected
F87	Suspected	Suspected	Suspected	---	---	---	---	---	Suspected
FJU	Suspected	---	Suspected	---	---	Suspected	---	---	Suspected
FKY	Suspected	Suspected	Suspected	---	---	Suspected	---	---	Suspected
JNG	Suspected	Possible	Suspected	---	---	---	---	---	---
T43	Suspected	Suspected	Suspected	Suspected	---	---	---	---	Suspected
342	Possible	Possible	Possible	---	---	---	---	---	---
859	Possible	Possible	Possible	---	---	---	---	---	---
GJE	Possible	---	---	---	---	---	Possible	---	---
GRZ	Possible	Possible	Possible	---	---	---	---	---	---
LRH	Possible	Possible	Possible	---	---	---	---	---	---

Table 8: Types of IH Data Available by Department from IH File v. CHEMS Database

		Source of CHEMS Database Information for Departments		Total
		IH Samples	No Record	
Source of Hard Copy IH Information for Departments	IH Sampling	123	33	156
	Process Description	9	48	57
	No Chemical Information	7	72	79
	No Folder or Records	24	0	24
Total		163	85	316

Table 9A: Distribution of Jobs by Maximum Potential Carcinogen

Maximum Potential Carcinogen in Department	Frequency	Percent
Known Carcinogen	61520	11.4
Suspected Carcinogen	22493	4.2
Possible Carcinogen	1658	.3
Not Rated	17068	3.2
No IH Data	438374	81.0
Total	541113	100.0

Table 9B: 1980 and After:
Distribution of Jobs by Maximum Potential Carcinogen

Maximum Potential Carcinogen in Department	Frequency	Percent
Known Carcinogen	42757	11.7
Suspected Carcinogen	15603	4.3
Possible Carcinogen	932	.3
Not Rated	10277	2.8
No IH Data	297019	81.0
Total	366588	100.0

Table 10A: Employee's Maximum Potential Carcinogenic Exposure by Number of Carcinogens

		Department's Maximum Carcinogenic Potential					Total
		Known Carcinogen	Suspected Carcinogen	Possible Carcinogen	Not Rated	Missing	
Number of Potential Carcinogens in Department	0	0	0	0	1357	0	1357
	1	1426	793	198	0	0	2417
	2	1576	391	0	0	0	1967
	3	2123	408	0	0	0	2531
	4	1422	0	0	0	0	1422
	5	702	71	0	0	0	773
	6	577	0	0	0	0	577
	7	84	0	0	0	0	84
	8	136	0	0	0	0	136
	11	585	0	0	0	0	585
	Missing	0	0	0	0	16151	16151
Total		8631	1663	198	1357	16151	28000

Table 10B: 1980 and After:

Employee's Maximum Potential Carcinogenic Exposure by # of Carcinogens

		Department's Maximum Carcinogenic Potential					Total
		Known Carcinogen	Suspected Carcinogen	Possible Carcinogen	Not Rated	Missing	
Number of Potential Carcinogens in Department	0	0	0	0	1043	0	1043
	1	1193	596	107	0	0	1896
	2	1203	332	0	0	0	1535
	3	1649	335	0	0	0	1984
	4	1146	0	0	0	0	1145
	5	571	77	0	0	0	648
	6	471	0	0	0	0	471
	7	23	0	0	0	0	23
	8	113	0	0	0	0	113
	11	529	0	0	0	0	529
	Missing	0	0	0	0	13185	13185
Total		6898	1340	107	1043	13185	22573

Table 11: Distribution of Employee's Potential Maximum Carcinogenic Exposure by Target Organ

Potential	Respiratory	Circulatory	Lymphatic	Skin	Liver	Kidney	Thyroid	Other†
Known	8269	4300	830	547	154		0	408
Suspected	1127	1918	0	0	8206	2932	2011	7070
Possible	240	321	724	0	218	203	0	0
Not Rated	2213	5310	10295	11302	3271	8714	9838	4371
Missing	16151	16151	16151	16151	16151	16151	16151	16151
Total	28000	28000	28000	28000	28000	28000	28000	28000

† Other Target Organs include: Adrenals, Bladder, Bowel, Brain, Mammary Gland, Pancreas, Pituitary Gland, Prostate, Salivary Gland, Stomach, Testes, and Uterus.

Table 12: Departmental Carcinogenic Potential by "Wet" Process Work History Rating

Department's Carcinogenic Potential	Job's Wet Process Potential Rating				Total
	None	Low	Moderate	High	
Known	18617	16019	22061	4823	**61520**
	4.2%	32.9%	52.8%	65.1%	**11.4%**
Suspected	11256	5095	5419	723	**22493**
	2.5%	10.5%	13.0%	9.8%	**(4.2%)**
Possible	1646	11	1	*0*	**1658**
	0.4%	0.0%	0.0%	*0.0%*	**0.3%**
Not Rated	13443	2181	1310	*134*	**17068**
	3.0%	4.5%	3.1%	*1.8%*	**3.2%**
Missing	398225	25444	12975	*1730*	**438374**
	89.9%	52.2%	31.1%	*23.3%*	**81.0%**
Total	**443187**	**48750**	**41766**	**7410**	**541113**

Table 13: Departmental Carcinogenic Potential by "Machining" Process Work History Rating

Department's Carcinogenic Potential	Job's Machining Potential Rating				Total
	None	Low	Moderate	High	
Known	44312	9786	5940	1482	61520
	9.7%	24.7%	15.7%	16.2%	11.4%
Suspected	13885	4811	3283	514	22493
	3.1%	12.2%	8.7%	5.6%	4.2%
Possible	809	353	378	118	1658
	0.2%	0.9%	1.0%	1.3%	0.3%
Not Rated	8422	4939	3208	499	17068
	1.9%	12.5%	8.5%	5.5%	3.2%
Missing	387275	19662	24908	6529	438374
	85.2%	49.7%	66.0%	71.4%	81.0%
Total	454703	39551	37717	9142	541113

Table 14: Departmental Carcinogenic Potential by "Wet Process" Work History Rating Limited to Departments with No "Machining Process" Potential

Department's Maximum Carcinogenic Potential	"Wet" Process Potential				Total
	None	Low	Moderate	High	
Known Carcinogen	9428 2.5%	10066 27.1%	19995 52.8%	4823 65.1%	44312 9.7%
Suspected Carcinogen	4420 1.2%	3716 10.0%	5026 13.3%	723 9.8%	13885 3.1%
Possible Carcinogen	799 0.2%	9 0.0%	1 0.0%	0 0.0%	809 0.2%
Not Rated	5786 1.6%	1521 4.1%	981 2.6%	134 1.8%	8422 1.9%
Missing	351813 94.5%	21879 58.8%	11853 31.3%	1730 23.3%	387275 85.2%
Total	372246	37191	37856	7410	454703

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Methyl Chloroform (1,1,1-trichloroethane)	73	5.20
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	57	4.10
Hydrochloric Acid	57	4.10
Lead	51	3.70
Isopropyl Alcohol (2-propanol)	49	3.50
Methylene Chloride (dichloromethane)	41	2.90
_Particulates	37	2.70
Sulfuric Acid	37	2.70
Sodium Hydroxide	34	2.40
_Metalworking Fluids	33	2.40
Copper	28	2.00
Perchloroethylene (tetrachloroethylene)	28	2.00
Ethylene Glycol Monomethyl Ether (methyl cellosolve)	24	1.70
Xylene (mixed isomers)	22	1.60
_Fiberglass	21	1.50
Tin	20	1.40
Formaldehyde	19	1.40
Toluene	19	1.40
Silica (Crystaline) [silicon dioxide--(a-Quartz)]	17	1.20
Trichloroethylene	16	1.20
Nitric Acid	15	1.10
__Brand Name	14	1.00
_Epoxy	14	1.00
Methanol	14	1.00
Methyl Ethyl Ketone (2-butanone)	14	1.00
Chromium	13	.90
Ethylene Glycol Monoethyl Ether (ethyl cellosolve)	13	.90
Ferric Chloride [iron(III)chloride]	13	90
Phenol	13	.90
Potassium Hydroxide	12	90
Ethylene Glycol Monomethyl Ether Acetate (methyl cello	11	.80
Nickel	11	.80
Oxalic Acid (ethanedioic acid)	11	.80
Toluene Diisocyanate (TDI)	11	.80
Sodium Persulfate	10	.70
Ammonia	9	.60
Cupric Chloride (copper(III) chloride)	9	.60
Cyanide (HCN)	9	.60
Mineral Spirits (stoddard solvent)	9	.60
Potassium Permanganate	9	.60
_Unknown	8	.60
Acetone	8	.60
_Inks & Dyes	7	.50

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Acetic Acid	7	.50
Aluminum	7	.50
Cadmium	7	.50
Chromic Acid (chrome(VI)oxide)	7	.50
Dichlorobenzene, o- (1,2-dichlorobenzene)	7	.50
Ethanolamine (ethanol, 2-amino)	7	.50
Methyl Isobutyl Ketone (4-methyl-2-pentanone, hexone)	7	.50
Thiourea	7	.50
Triethanolamine (ethanol, 2,2',2''-nitrilotris-)	7	.50
_Acid Group	6	.40
Ammonium Hydroxide	6	.40
Benzene	6	.40
Ethanol	6	.40
Ethylene Glycol Monobutyl Ether (butyl cellosolve)	6	.40
Ethylene Glycol Monoethyl Ether Acetate (cellosolve ac	6	.40
Hydroquinone	6	.40
Iron	6	.40
Methyl Acrylate (2-propanoic acid, methyl ester)	6	.40
N-Methyl-2-Pyrrolidone (NMP)	6	.40
Naphtha (petroleum naphtha)	6	.40
Nitromethane	6	.40
Sodium Carbonate	6	.40
Benzotriazole (BTA)	5	.40
Beryllium	5	.40
Copper Sulfate	5	.40
Dipropylene glycol methyl ether [1-(2-methoxyisopropox	5	.40
Ethyl Acrylate	5	.40
Methyl Methacrylate (2-methyl 2-propenoic acid)	5	.40
Naphthalene	5	.40
Nickel Chloride	5	.40
Silver	5	.40
Sodium Cyanide	5	.40
Sulfur Dioxide	5	.40
_Potassium Salts Group	4	.30
Cyclohexanone	4	.30
Cyolized Polyisoprene	4	.30
Diallylamine (di-2-propenylamine)	4	.30
Ethyl Acetate (ethyl ethanoate)	4	.30
Ethyl Benzene	4	.30
Ethylene Glycol Monobutyl Ether Acetate (butyl celloso	4	.30
Hydrogen Fluoride (hydrofluoric acid)	4	.30
Manganese	4	.30
Nitrogen	4	.30

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Phosphoric Acid	4	.30
Sodium Chlorite	4	.30
Tetramethyl Butane Diamine (N,N,N',N'-Tetramethyl-1,3,	4	.30
Triphenyl Phosphate	4	.30
Zinc	4	.30
_Chromates	3	.20
_Solvents	3	.20
Butanol, sec-	3	.20
Copper Chloride	3	.20
Dicyandiamide (DICY)	3	.20
Glutaraldehyde (1,5-pentanedial)	3	.20
Palladium	3	.20
Palladium Chloride	3	.20
Sodium Arsenate	3	.20
Sodium Bisulfite	3	.20
Sodium Hypochlorite	3	.20
Styrene (Benzene, ethenyl-)	3	.20
_Alkalines	2	.10
Acrylic Acid	2	.10
Aluminum Hydroxide	2	.10
Aluminum Oxide	2	.10
Arsenic	2	.10
Asbestos	2	.10
Boric Acid	2	.10
Butanol, n-	2	.10
Butyrolactone, gamma-	2	.10
Carbon Monoxide	2	.10
Copper Phosphate	2	.10
Cresyl Glycidyl Ether, o- (1,2-epoxy-3-(o-tolyloxy)	2	.10
Dichlorobenzene, p- (1,4-dichlorobenzene)	2	.10
Diethylene Glycol Monobutyl Ether [2-(2-butoxyethoxy)e	2	.10
Diethylene Glycol Monoethyl Ether Acetate	2	.10
EDTA (Etheylene Diamine Tetraacetic Acid)	2	.10
Ethylene Glycol (1,2-dihydroxyethane)	2	.10
Freon 112 (1,2-difluoro-1,1,2,2-tetrachloroethane)	2	.10
Gold	2	.10
Heat	2	.10
Hydrogen Peroxide	2	.10
Kerosene	2	.10
Maleic Anhydride	2	.10
Methyl Cyanoacrylate	2	.10
Methylene-Bisphenyl Isocyanate (MDI) [4,4'-diphenylmet	2	.10
Naphtha, Heavy Aromatic	2	.10

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Nickel Sulfamate	2	.10
Nickel Sulfate	2	.10
Nylon	2	.10
Ozone	2	.10
PCBs	2	.10
Polyvinyl Acetate Liquid	2	.10
Potassium Carbonate	2	.10
Propanol, 1-	2	.10
Pumice	2	.10
Pyridine	2	.10
Rochelle Salts (Potassium sodium tartrate)	2	.10
Teflon spray	2	.10
Tetramethyl Succinonitrile	2	.10
Tin Chloride	2	.10
Trimethylamine	2	.10
Ultraviolet Light (Laser)	2	.10
Vinyl Chloride (vinyl chloride monomer)	2	.10
Water	2	.10
Zinc Chloride	2	.10
_Borates	1	.10
Acrylamide	1	.10
Acrylonitrile	1	.10
Ammonium Persulfate (ammonium peroxydisulfate)	1	.10
Antimony	1	.10
Antimony Trioxide	1	.10
Argon	1	.10
Barium	1	.10
Barrium Chloride	1	.10
Benzo(a)pyrene	1	.10
Benzophenone (diphenyl-methanone)	1	.10
Benzosulfonic Acid, dodecyl-	1	.10
Benzyl Alcohol (benzenemethanol)	1	.10
Benzyldimethylamine	1	.10
Bischloromethyl Ether (methane, oxybis[chloro])	1	.10
Bromine	1	.10
Butanol, tert-	1	.10
Butyl Carbitol Acetate (2-[2-butoxyethoxy]ethanol acet	1	.10
Carbon Black	1	.10
Carbon Tetrafluoride (freon 14 or halon 14)	1	.10
Chlorine	1	.10
Cobalt	1	.10
Copper Pyrophosphate	1	.10
Cresylic Acid (phenol, 2-methyl-)	1	.10

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Cyclohexane	1	.10
Diethylene Glycol (ethanol, 2,2'-oxybis-)	1	.10
Diethylene Glycol Diethyl Ether	1	.10
Diglycidol Ether of Bis Phenol A [2,2-bis(p-2,3-Epoxyp	1	.10
Diglyme	1	.10
Diisobutyl Ketone (2,6-Dimethyl-4-heptanone)	1	.10
Dimethoxy Methane (Methylal)	1	.10
Dimethyl Acetate	1	.10
Dimethylacetamide	1	.10
Dimethylamine	1	.10
Epichlorohydrin	1	.10
Ethylene Dichloride (1,2-dichloroethane)	1	.10
FICC	1	.10
Glacial Acid	1	.10
Hydrogen Sulfide	1	.10
Indium Sulfate	1	.10
Isobutane	1	.10
Isobutyl Acetate	1	.10
Lithium	1	.10
Magnesium Oxide	1	.10
Magnesium Sulfate	1	.10
Mercuric Chloride [mercury(II)chloride]	1	.10
Mercury	1	.10
Methyl Acetate (methyl ethanoate)	1	.10
Methyl Carbitol (diethylene glycol monomethyl ether)	1	.10
Molybdenum	1	.10
Molybdic Acid	1	.10
N-butyl Acetate (butyl ethanoate)	1	.10
Nickel Cyanide	1	.10
Nitrobenzene	1	.10
Phthalic Anhydride	1	.10
Polyethylene Plastic	1	.10
Polyimide Type 1	1	.10
Potassium Cyanide	1	.10
Potassium Iodide	1	.10
Potassium Persulfate	1	.10
Propylene Glycol Monoethyl Ether Acetate	1	.10
PVA (polyvinyl alcohol)	1	.10
Sodium Bisulfate	1	.10
Stanous Chloride (tin(II) chloride)	1	.10
Tetrahydrofuran (1,4-epoxybutane)	1	.10
Titanium	1	.10
Toluidine, p-	1	.10

Table 15: Endicott Chemicals by Number of Departments Using the Chemical

Chemicals	Department Frequency	Percent
Unknown	1	.10
Wax, Apiezon	1	.10
Total Departments	**1391**	**100.0**

Figure 1A: Distribution of Personnel Year-End Data by Start-Year

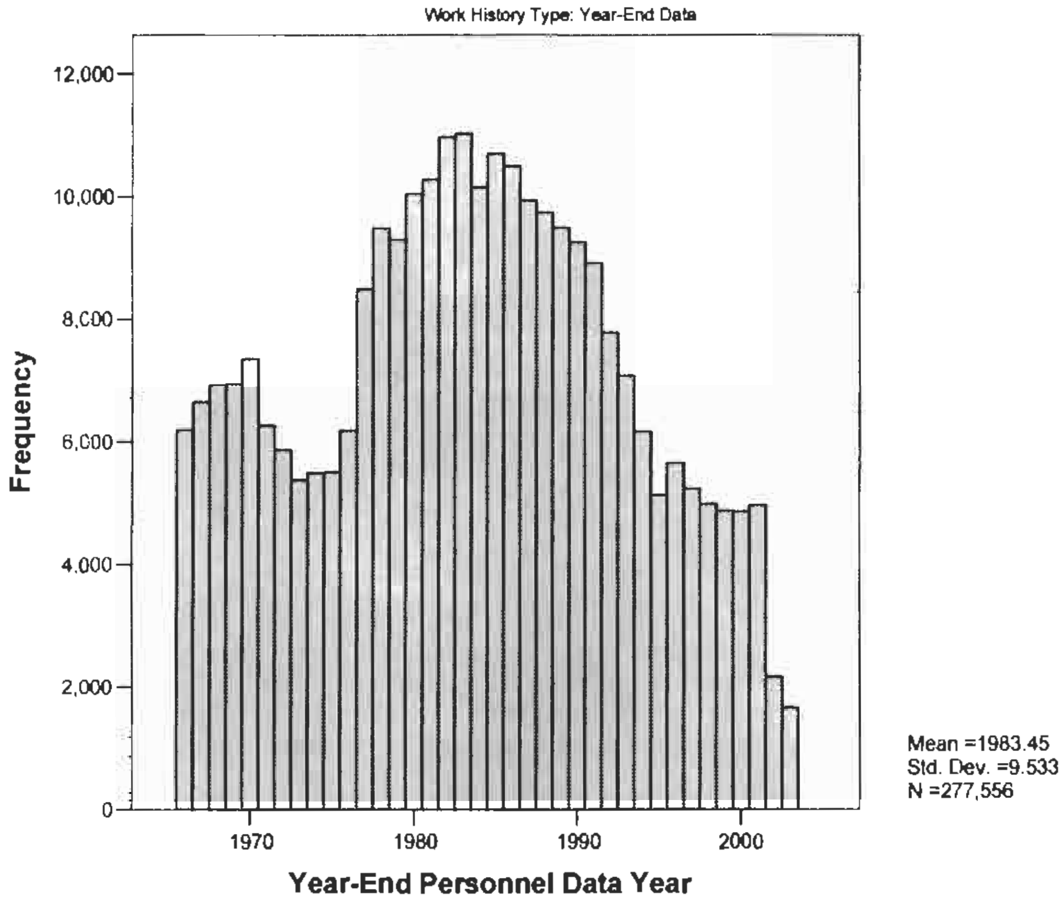
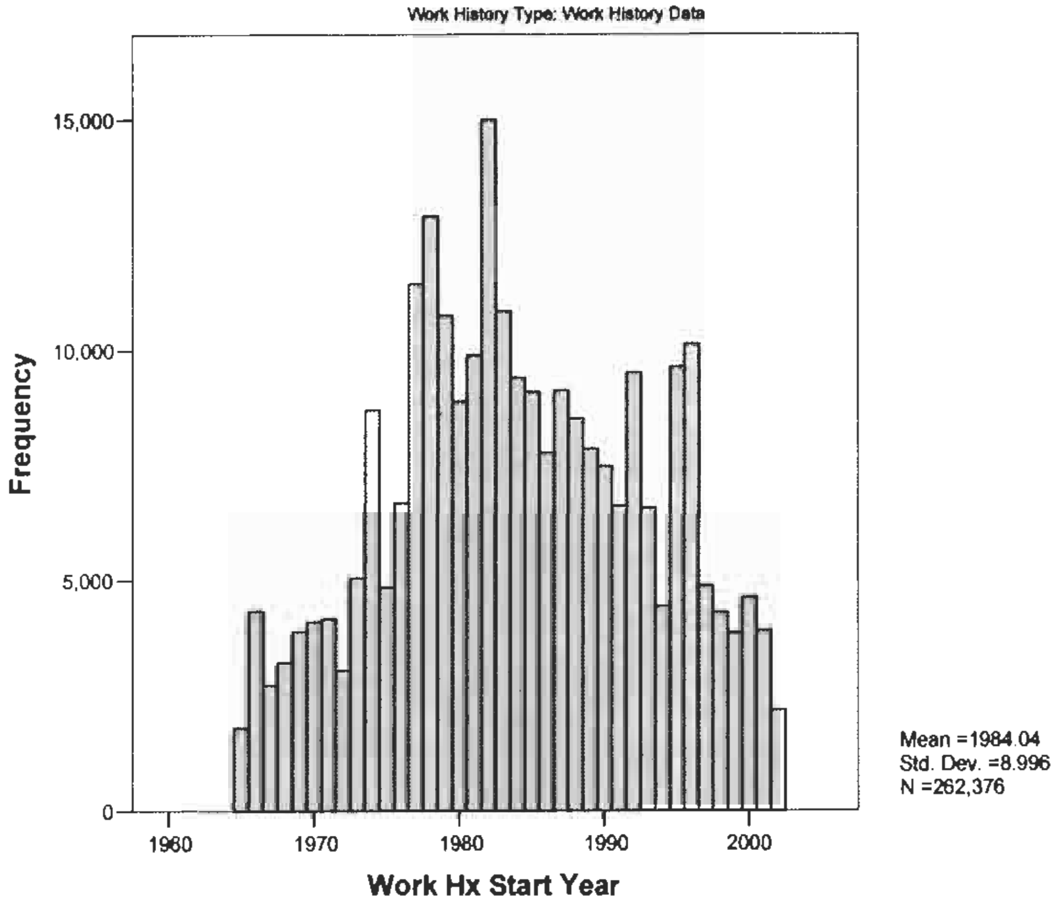


Figure 1B: Distribution of Work History Data by Start-Year



Appendix II
Errata and Other Notes
For "Feasibility Assessment for Exposure Assessment for a Study of Cancer in the Electronics Industry"

by

Nicholas Heyer, Ph.D., Jim Catalano, C.I.H., Diana Echeverria, Ph.D., and Charles Knott, M.P.A.

Errata

Page 2	"CIMCAN" should be "CIM/CAM"
Page 5	"CIMCAN" should be "CIM/CAM"

Other Notes

pages 91-95	The rows labeled "missing" in Tables 10A, 10B, 11, 12, 13 and 14 would more appropriately be labeled "no industrial hygiene data."

Appendix III
A Description of the Major Processes in the Production of Circuit Boards at the Endicott Facility Provided by IBM

The following process descriptions are general in nature and are not intended to describe the process, tooling and chemical changes, over time. The processes, as described, may not accurately reflect the process as it existed at each point in time.

Panel Major Processes			
Process	**Process Description**	**Chemicals (time of sale)**	**Chemicals Used in Past (date last used)**
Impregnation	Manufacture resin impregnated fiberglass cloth. Fiberglass cloth is dipped into resin then dried in a horizontal oven. Process is enclosed and maintained under negative pressure.	Epoxy resin Methyl ethyl ketone Methylimidizole	Dicyandiamide (1993) Ethylene glycol monomethyl ether (1993)
Internal Circuitize			
Preclean	Clean panel boards to ensure a uniform dull surface prior to hole drilling. Process consists of mechanical brushes, pumice and water. Boards are rinsed and dried prior to exiting the process.	Pumice	
Apply Photoresist	Ultraviolet (UV) photo resist sheets are attached to the panel boards through a combination of heat and pressure.	Dry process (dry film applied)	
Expose	Glass artwork of the circuit is placed over the panel board coated with UV sensitive photoresist. Board and artwork is next exposed to ultraviolet light.	Isopropyl alcohol, Methanol	Freon TF (1992) Methyl ethyl ketone
Develop resist	Dissolve unexposed photoresist from the unexposed parts of the panel board.	Potassium carbonate	Sodium carbonate (2002) Methyl chloroform (1993) Trichloroethylene (1985)

			Freon TF (1993)
Etch resist	Remove copper from parts of the panel board not protected by photoresist.	Cupric chloride Hydrochloric acid	
Strip resist	Remove exposed photoresist from panel boards to uncover previously protected copper. The copper circuit next receives a thin layer of anti-oxidant.	Sodium hydroxide Potassium permanganate Sulfuric acid Methanol	Methylene chloride (1993)
Laminate/drill/xray	Drill to different depths (planes) within the panel board. To ensure the accuracy of the holes locations with respect to circuitry layers, X-ray mapping is used.	Dry processes	
Surface prep	Preparation of copper plating.	Sodium hydroxide Sulfuric acid Benzotriazole Dimethylaminoborane Hydrochloric acid	Hydrochloric acid
Smear remove	Clean burrs and debris on boards after hole drilling.	Sodium carbonate Sulfuric acid	
Deburr/Vapor Blast	Remove burrs and prepare both surface and drilled holes for copper plate.	Pumice	Aluminum oxide (1990)
Copper plate	Copper plate the interior walls of the drilled holes resulting in connecting circuits at different levels (circuit planes).	Sodium carbonate Sodium permanganate Sulfuric acid Cupric chloride Hydrochloric acid Copper sulfate Dimethylaminoborane Formaldehyde	Sodium hydroxide Acetic acid methanol Phosphoric acid Potassium hydroxide
Nodule Remove	Remove excessive amounts of copper from the panel boards after copper plating.	Water and abrasive brushes	

External circuitize	Same as Preclean, Develop/Etch/Strip (DES) above.	Same as Preclean, Develop, Etch & Strip (DES) above	
Alternate DES and plating processes for external circuitize			
Develop resist	Similar to Develop Resist process listed above.	Sodium carbonate Sulfuric acid	
Strip resist	Similar to Resist Strip process listed above.	Benzyl alcohol	
Gold plate	Apply Ni/Au and/or Pd to the copper surface for wire bonding and corrosion-resistance.	Sulfuric acid Hydrochloric acid Potassium hydroxide Nitric acid Potassium cyanide Sodium carbonate	Phosphoric acid Ammonium hydroxide
Tin/lead plate	Pattern plate of panels that includes Immersion Tin followed by electrolytic tin/lead plating.	Aqueous tin Aqueous lead Sulfuric acid	
Oxide Remove	Remove oxidation from exposed circuitry prior to optical test.	Hydrochloric acid	Methylene chloride
Surface prep entek	Remove oxidation, etch, and provide protective layer on panels.	Sulfuric acid Sodium persulfate Methanol	
Protective coat	A thin layer of epoxy is screened over locations of copper circuitry to provide circuit protection from atmospheric elements.	Heavy aromatic naphtha resin Diethylene glycol ethyl ether acetate Dipropylene glycol methyl ether Epoxy resin Methanol	Silica - fumed (1980)
Plasma Etch	Surface preparation prior to tin/lead plating. RF plasma in combination with chamber gasses used to remove surface	Carbon tetrafluoride Oxygen	

	organic.	Argon Nitrogen	
Xray develop	Panels are x-rayed to determine custom drilling compositions.	Potassium hydroxide Acetic acid	
Panel Process Operations No Longer Performed			
Process		**Major Chemicals**	
Immersion tin	Vertical plating line.	Thiourea Hydrochloric acid	Mid 80's incorporated into surface prep, tin/lead plate
Solvent degreasing	Solvent degreaser used to prepare/remove chemical residual from boards prior to epoxy coating.	Methyl chloroform (1993) Freon TF (1993) Isopropyl alcohol	Early 90's
Hole clean	Process to remove innerplane debris / residual resulting from drill operation.	Methyl chloroform (1993) Chromic acid Sulfuric acid N-methyl-2-pyrrolidone	Early 90's

Substrates - MC/Cermet Resistor Operations - No Longer Performed (1999)			
Process		**Major Chemicals**	**Last Year Used (1999)**
Evap Pre-clean	Manual wipe and cleaning operation.	Isopropyl alcohol	Freon TF (1993)
Batch Sputter/Balzers Evap	Thin film deposition using Metal Sputter for substrate circuitizing.	Chromium Copper	
Cr-Cu-Cr Evaporation	Thin film deposition using low pressure metal fume for substrate circuitizing.	Chromium Copper	
Bright Dip	Remove copper oxidation from ceramic substrates.	Sulfuric acid Isopropyl alcohol	
Resist Apply KTFR	Apply photo-resist on ceramic substrates.	Xylene Ethyl benzene	Ethylene glycol monomethyl ether (1993) Perchloroethylene (1993)
Resist Apply Polyimide	Apply a polyimide dielectric layer on ceramic substrates.	n-methyl-2-pyrrolidone Ethyl benzene (waycoat) Xylene Potassium hydroxide	Ethylene glycol monoethyl ether (1993)
Expose	Photo-resist exposure to UV. Wiping of circuit artwork to assure absence of debris.	Isopropyl alcohol	Freon TF (1993) Methyl choroform (1993)
Develop	Remove photo-resist on exposed metallized ceramic substrates.	Xylene Butyl acetate Isopropyl alcohol	Freon TF (1993) Methyl choroform (1993)
Etch	Remove metal from non-exposed section of ceramics to form circuit pattern.	Sodium hydroxide Oxalic acid	

		Potassium permanganate Sulfuric acid	
Polyimide Etch	Remove metal from non-exposed section of ceramics to form circuit pattern.	Potassium hydroxide Hydrochloric acid	
Thiourea etch	Remove metal from non-exposed section of ceramics to form circuit pattern.	Thiourea Sulfuric acid	
Plasma	Clean and prepare soldermasked parts to allow better adhesion properties.	Carbon tetrafluoride (CF4) Nitrogen Oxygen	
Strip	Similar to Resist Strip listed above.	Isopropyl alcohol Methyl naphthalene Xylene Dichlorobenzene Phenol Neutraclean (detergent + alcohol)	Perchloroethylene (1993)
Ink screen/remove	Prepare coating screens used for final epoxy protective coat operation.	Process was phased out in 1993	Methyl chloroform (1993) Methylene chloride (1993)
Pin	Clean the oil film from small parts (i.e pins).	Hydrochloric acid	Trichloroethylene (1985) Freon TF (1993)
Tin (Process phased out in early 90's)	Apply tin/lead solder to pins.	Tin Lead Isopropyl alcohol	Perchloroethylene (1993)
Wave solder	Coat solder joints.	Lead Isopropyl alcohol	Methylene chloride (1993) Perchloroethylene

			(1993) Methyl chloroform (1993)
Degreasers	Clean component surface.	Isopropyl alcohol	Methylene chloride (1993) Perchloroethylene (1993) Methyl chloroform (1993)
Trim/Standoff/Inspection	Inspection	Dry Processes	

Appendix IV
Feasibility Cohort

NIOSH investigators assembled a "crude" cohort of former employees of the IBM facility at Endicott, New York for this feasibility study by combining the "year end" personnel files and the work history file. This feasibility cohort consisted of 28,000 workers who worked for at least one year after 1964 at locations in Endicott associated with manufacturing. The steps taken to assemble the cohort are described on pages 8-9 of Battelle's attached report. The feasibility cohort does not meet the standard for a cancer study, if conducted. NIOSH investigators did not attempt to correct problems in the data or to combine the work history information from the "year end" personnel files and the work history file when creating the feasibility cohort. A number of problems in the data were identified that would need to be addressed if a cohort was established for a cancer study. Some of these problems are described in this report and Battelle's attached final report (e.g., Table A on page 22). Discrepancies in the date of hire and date of separation for a given worker were the most commonly noted problems. Some of these discrepancies occurred because the worker was hired, separated, and then re-hired. However, when there was a discrepancy in the hire date, the earlier hire date was sometimes judged to be impossible based on the other data in the file. NIOSH investigators also noted discrepancies between the data in the "year end" personnel files and the work history file when working with the files. For example, the year of first employment at a location in Endicott associated with manufacturing was different in the "year end" personnel files and the work history file for 9% of the workers who were in both sets of files (excluding workers hired before 1965). In addition, the work history file failed to capture approximately 10% of the departments, on average, in which an employee worked prior to 1984 according to the "year end" personnel files.

Appendix V
Power Calculations

Methods

The cohort which was assembled for the purposes of this feasibility assessment consisted of 28,000 workers. Complete demographic information was not available for 95 of the 28,000 workers in this feasibility cohort. Work history data was compiled for the remaining 27,905 workers from two sources: the "year end" personnel files and the work history file. Departments with sampling data or process descriptions that mentioned chemicals in the hard copy industrial hygiene records or CHEMS database were considered "exposed" departments. Workers who did not work in an "exposed" department (n = 12,851) were excluded from the analysis. Workers with missing or inconsistent dates of birth (n = 6) or missing gender (n = 5) were also excluded from the analysis. For the remaining 15,043 workers, date first employed, date first exposed, date last employed and date last exposed were extracted from the source files. A worker may have had information from only the "year end" personnel files (where dates consisted of year only), from only from the work history file (where dates consist of month, day and year), or from both the "year end" personnel files and the work history file, in which case there may have been some inconsistencies between the files.

(a) For workers with information in the "year end" personnel files only (n=1,314), the date first employed and date first exposed were assigned to the midpoint (July 1) of the earliest year employed in any department and any exposed department, respectively, since the "year end" personnel files represent a snap shot of the workforce at the end of each year. Date last employed and date last exposed were assigned to the midpoint (July 1) of the year following the latest year in the personnel file in any department and any exposed department, respectively.

(b) For workers with information in the work history file only (n = 285), date first employed and date first exposed were assigned to the earliest dates employed and exposed, respectively. Date last employed and date last exposed were assigned to the latest dates employed and exposed, respectively.

(c) For workers with information in both the "year end" personnel files and the work history file (n = 13,444), dates in the work history file were used to assign dates first employed, first exposed, last employed and last exposed, unless years indicated in the personnel file suggested a wider range of employment or exposure.

Gender, race, and date of birth was included in each "year end" personnel file and the work history file, but the data on gender, race, and date of birth were not consistent between files for all workers. When these data were not consistent, the earliest data on gender, race, and date of birth was used in these analyses.

Workers were assumed to be alive through the date last employed. Workers were assigned a fictitious date last observed after this date using death rates obtained from a public use mortality data file developed by the Centers for Disease Control and Prevention (CDC). Date last observed was assigned to each worker by generating a sequence of binomial random variables (where n equals 1 and p equals the sex-, race-, age- and calendar year-specific death rate) for each year after the date last employed through a hypothetical study end of 2004. If the binomial random variable was 1 for a given year, the worker was assumed to have "died" in that year. The date last observed was set to the earliest year in which the worker "died". Workers that did not "die" in the study period were censored at the study end date. In the absence of actual follow-up information, the assigned dates last observed were used to provide an estimate of the number of person-years at risk for the proposed study. The CDC Wonder (Wide-ranging Online Data for Epidemiologic Research) database contains gender-, race- (white, black, other), and age-specific (15-19, 20-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85+ years) mortality data for the years 1979-1998 under ICD-9 codes and 1998-2002 under ICD-10 codes (http://wonder.cdc.gov/mortSQL.html). When using these rates, white and Hispanic workers and workers of unknown race were considered "white"; black workers were considered "black"; and American Indian and Asian workers were considered "other". Since the CDC Wonder database only contains death rate information for the years 1979-2002, death rates for 1979 were used for years prior to 1979 and death rates for 2002 were used for years after 2002.

Person time began accumulating on the date the worker first began working in an exposed department, one year after the first employment date, or July 11, 1965, whichever was later; person time ended at the study end date (December 31, 2004) or the randomly assigned date last observed, whichever was earlier. A life-table analysis program (PC-LTAS) developed by the National Institute for Occupational Safety and Health was used to estimate the expected numbers of deaths due to cancers of the lung, liver, kidney and testes in addition to leukemia. Expected numbers of deaths were estimated using U.S. referent rates developed for the years 1940 – 2002; rates for 2000 – 2002 were used to estimate rates for 2003 – 2004 since mortality data for these years are not yet available. Expected numbers of incident cases were estimated using Surveillance, Epidemiology, and End Results (SEER) cancer incident rates developed for the U.S. (based on 9 geographic areas) for years 1970 – 1999; rates for 1973 – 1974 were used to estimate rates for 1970 – 1972 and rates for 1995 – 1996 were used to estimate rates for 1997 – 2004. Since actual analyses would probably use rates based on specific state-based cancer registries, including the New York State Cancer Registry which is generally considered complete enough for analyses beginning in 1976, person time began accumulating on the date the worker first began working in an exposed department, one year after the first employment date, or January 1, 1976, whichever was later, for estimating the number of incidence cases. As a result, workers who "died" prior to 1976 were excluded from the analysis for incident cancers. The exact Poisson distribution was used to estimate power as a function of the expected number of deaths and the expected number of incident cases, the type I error rate, and the relative risk (Breslow NE and Day NE, 1987)

Results

The person-years at risk for a study end date of December 31, 2004, based on the assigned dates last observed, was estimated to be approximately 324,000 for the mortality analysis and 293,000 for the morbidity analysis. Based on U.S. referent rates, the number of expected deaths from cancers of the liver, lung, testes and kidney were 22.6, 290.6, 1.9 and 21.5, respectively; the number of expected deaths from leukemia/aleukemia was 30.9. Estimated power, based on these expected numbers of deaths, is provided in Table 1 for type I error rates of 1% and 5% and relative risks ranging 1.1 – 5.0. Based on the SEER cancer incidence rates, the number of expected incident cases for cancers of the liver, lung, testes and kidney were 27.2, 313.0, 13.9 and 54.1, respectively; the number of expected incident cases for leukemia/aleukemia was 46.1. Estimated power, based on these expected numbers of incident cases, is provided in Table 2 for type I error rates of 1% and 5% and relative risks ranging 1.1 – 5.0.

Table 1. Estimated power for detecting relative risk of mortality based on simulated date last observed.

Relative Risk	Liver Cancer E = 22.6		Lung Cancer E = 290.6		Testicular Cancer E = 1.9		Kidney Cancer E = 21.5		Leukemia/aleukemia E = 30.9	
	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$
1.1	0.10	0.03	0.50	0.25	0.06	0.01	0.12	0.03	0.13	0.03
1.2	0.20	0.08	0.94	0.82	0.08	0.01	0.24	0.07	0.28	0.09
1.3	0.34	0.17	1.00	0.99	0.10	0.01	0.37	0.15	0.47	0.20
1.4	0.50	0.30	1.00	1.00	0.13	0.02	0.53	0.26	0.65	0.36
1.5	0.65	0.45	1.00	1.00	0.16	0.03	0.68	0.40	0.80	0.54
1.6	0.78	0.60	1.00	1.00	0.19	0.04	0.80	0.55	0.90	0.71
1.7	0.87	0.73	1.00	1.00	0.22	0.05	0.88	0.69	0.96	0.83
1.8	0.93	0.83	1.00	1.00	0.26	0.06	0.94	0.80	0.98	0.92
1.9	0.96	0.90	1.00	1.00	0.30	0.07	0.97	0.88	0.99	0.96
2.0	0.98	0.95	1.00	1.00	0.33	0.09	0.98	0.93	1.00	0.98
2.5	1.00	1.00	1.00	1.00	0.51	0.20	1.00	1.00	1.00	1.00
3.0	1.00	1.00	1.00	1.00	0.67	0.35	1.00	1.00	1.00	1.00
4.0	1.00	1.00	1.00	1.00	0.88	0.64	1.00	1.00	1.00	1.00
5.0	1.00	1.00	1.00	1.00	0.96	0.84	1.00	1.00	1.00	1.00

E = expected numbers of deaths based on U.S. referent rates and the simulated follow-up time.

Table 2. Estimated power for detecting relative risk of morbidity based on simulated date last observed.

Relative Risk	Liver Cancer E = 27.2		Lung Cancer E = 313.0		Testicular Cancer E = 13.9		Kidney Cancer E = 54.1		Leukemia/aleukemia E = 46.1	
	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.05$	$\alpha = 0.01$
1.1	0.12	0.03	0.54	0.27	0.10	0.03	0.18	0.05	0.14	0.04
1.2	0.24	0.09	0.96	0.85	0.17	0.05	0.41	0.17	0.33	0.14
1.3	0.41	0.19	1.00	1.00	0.27	0.10	0.67	0.39	0.57	0.32
1.4	0.59	0.34	1.00	1.00	0.39	0.18	0.86	0.64	0.77	0.54
1.5	0.75	0.51	1.00	1.00	0.52	0.27	0.95	0.83	0.90	0.75
1.6	0.86	0.67	1.00	1.00	0.63	0.38	0.99	0.94	0.97	0.89
1.7	0.93	0.80	1.00	1.00	0.73	0.50	1.00	0.98	0.99	0.96
1.8	0.97	0.89	1.00	1.00	0.82	0.61	1.00	1.00	1.00	0.99
1.9	0.99	0.94	1.00	1.00	0.88	0.71	1.00	1.00	1.00	1.00
2.0	0.99	0.97	1.00	1.00	0.92	0.79	1.00	1.00	1.00	1.00
2.5	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00
3.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

E = expected numbers of incident cases based on U.S. referent rates and the simulated follow-up time.