

Results of a NIOSH study of birth defects among children of former **Microelectronics and Business Machines Manufacturing Workers**



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Overview

Residents from the Village of Endicott, New York have been concerned about residential and workplace exposure from a microelectronics and business machines manufacturing facility in Endicott. These concerns led to studies of area residents and also led the New York State Department of Health (NYSDOH), Congressional representatives from New York, and community stakeholders to ask the National Institute for Occupational Safety and Health (NIOSH) to conduct a study of workers from the facility.

In 2009, NIOSH began a multi-year study of former workers using existing records. Our goals for the study were to evaluate:

- 1) overall causes of death among workers,
- 2) testicular cancer diagnoses among workers, and
- 3) birth defects among workers' children.

The first two steps were completed and the results communicated in 2014. Our assessment of birth defects in the children of workers is now complete.

The study found that most types of birth defects we considered were not increased compared to what we would expect from general population statistics for New York State (NYS) excluding New York City (NYC). However, we did find that some birth defects were more common in the study population or more common among workers with certain potential job exposures. These findings could be due to job exposures, other factors we could not assess in this study, or chance.

We are not recommending that workers take any specific actions as a result of this study.

How the Study Was Done

Our study had several steps. Because of data privacy issues, some of the steps were done by NIOSH and others were done by NYSDOH.

Who was included in the study?

1. We first identified workers who met certain requirements: workers employed at the facility for at least 91 days total, including at least one day between 1983 (the first year birth defects information was available for all of NYS) and 2001 (when part of the facility was sold). Totals of 18,456 male workers and 9,288 female workers met these requirements.
2. Next, we identified children born to workers identified in step 1 who worked at the facility during the periods of time relevant to the development of birth defects. New York State Vital Records Department's birth lists were used to identify these children.

3. Certain time periods before and during pregnancy are most relevant to the development of birth defects. These “critical periods” are from one month before conception through three months after conception for mothers and from three months before conception through one month after conception for fathers. Of the children identified in step 2, those with a parent working at the facility during the critical period were included in the study. Totals of 4,164 infants of male workers and 1,469 infants of female workers were included. Some of these children had both parents working at the facility.

How did we identify birth defects among these children?

We matched the list of children identified in step 3 to the NYSDOH Congenital Malformations Registry. This allowed us to identify children who had birth defects diagnosed by age two. We looked at a group of 36 different types of birth defects reported to the registry. 60 children born to male workers and 18 children born to female workers were identified as having at least one of the 36 birth defects. Again, some children had both parents working at the facility.

What workplace exposures did we consider and how did we determine which children’s parents potentially had workplace chemical exposures?

We used existing chemical and work process records, together with input from workers and company representatives. We identified whether work in each department during each year involved potential exposure to the following chemical groups and specific chemicals:

- chlorinated hydrocarbons, for example, trichloroethylene (TCE) and perchloroethylene (PCE)
- metals (primarily lead)
- other hydrocarbons

For each chemical, a child was considered born to a potentially exposed parent if the parent worked during the critical period in a department that used the chemical.

During the study period, some chemicals were used more than others at the facility.

- The most common potential exposure was to a broad group of “other” hydrocarbons which excluded chlorinated and aromatic hydrocarbons and chlorofluorocarbons. This broad chemical group included isopropyl alcohol, which was commonly used as a circuit board cleaner, and a wide variety of other chemicals.
- Potential exposure to lead at the facility was common because lead solder was used in many manufacturing processes.
- TCE use had diminished greatly by the mid-1980s. Very few workers were employed in departments that used TCE during the period of the birth defects study (1983-2001). Because few workers were potentially exposed to TCE during the study period, we were unable to evaluate the risk of birth defects associated with potential TCE exposure. The same was true of PCE.

What comparisons did we make?

We compared birth defects in the workers’ children to birth defects in the general population of children born in NYS (excluding NYC) to see whether any were more common than expected in the children of workers. We also examined whether birth defects were more common among children of workers with potential chemical exposures than in children of workers who did not have those potential chemical exposures.

Findings

What did we find in terms of overall birth defects?

Overall, the number of birth defects in children of male workers was about what would be expected from general population statistics. Female workers had fewer children with birth defects than would be expected from the general population statistics.

Were any specific birth defects more common in children of workers than in children in the general population?

- Yes. Ventricular septal defects (VSDs), a heart defect in which the wall separating the lower chambers of the heart does not close completely, was more common in children of male workers than in the general population. In full-term children of male workers, 22 VSDs occurred, while just under 14 were expected. VSDs were not in excess in children of female workers.
- Conotruncal heart defects, which are rare defects of the cardiac outflow tract, occurred more often than expected among children of female workers-- but the number of cases was so small that we could not evaluate whether the defects might be related to exposures at the facility. None of the children with conotruncal defects had parents thought to have worked in departments that used TCE or other chlorinated hydrocarbons during the critical period. Conotruncal defects were not in excess in children of male workers.

Were any birth defects more common among workers potentially exposed to chemical groups?

- Yes. VSDs were more common among children of male workers with potential exposure to metals (primarily lead) than among children of men at the facility without this exposure. VSDs were also somewhat more common in children of men potentially exposed to chlorinated hydrocarbons or other hydrocarbons than in children of men without these exposures, but the differences were not as large as for metals.
- Few children with VSDs had fathers potentially exposed to TCE or PCE, so we could not assess whether VSDs were more common in children of fathers with these exposures.

What It Means

Overall, birth defects were about as common as what would be expected in the general population. However, one type of defect was more common than expected and had enough cases to evaluate further:

- VSDs were more common among children of male workers than would be expected from the general population.
- VSDs were also more common among children of male workers potentially exposed to metals. The most common metal at the facility was lead.

These findings could be due to male workers' job exposures, mothers being exposed to lead brought home on the skin and clothes of a male facility worker, other factors we could not assess in this study, or chance.

Study Limitations

- Information about other factors that can affect risk for birth defects, such as family history of birth defects, environmental chemical exposures and smoking, was not available.
- Many of the birth defects we studied are rare. For defects with few cases in our study population, we could not assess whether the defects might be linked to parental exposures at the facility.
- We compared workers ever versus never potentially exposed to chemicals of interest but did not compare workers' exposure levels. This could have limited our ability to detect potential associations between exposures and outcomes.

To Learn More

To learn more about how this study was conducted or about the findings of the study of causes of death in these workers, please visit

<http://www.cdc.gov/niosh/pgms/worknotify/pdfs/EndicottOverview.pdf>.

To learn more about studies of community residents, visit

www.health.ny.gov/environmental/investigations/broome/.

Documents about our study and investigations in Endicott may also be reviewed at the George F. Johnson Memorial Library, Village of Endicott, 1001 Park Street, Endicott, NY 13760.

To learn more about the health effects of lead, visit

<http://www.cdc.gov/niosh/topics/lead/>.

To learn more about birth defects, visit

<http://www.cdc.gov/ncbddd/birthdefects/index.html>.

Related Publications

- Fleming DA, Woskie SR, Jones JH, Silver SR, Luo L, Bertke SJ. 2014. Retrospective assessment of exposure to chemicals for a microelectronics and business machine manufacturing facility. *Journal of Occupational and Environmental Hygiene* 11(5):292-305.
- Silver SR, Pinkerton LE, Fleming DA, Jones JH, Allee S, Luo L, Bertke S. 2014. Retrospective cohort study of a microelectronics and business machine facility. *American Journal of Industrial Medicine* 57(4):412-424.
- Silver SR, Pinkerton LE, Rocheleau C, Deddens J, Michalski A, Van Zutphen A. 2016. Birth defects in children born to employees of a microelectronics and business machine manufacturing facility. *Birth Defects Research (Part A)*. [published online ahead of print 25 May 2016]. doi:10.1002/bdra.23520

If you have questions about this study, or to request printed copies of electronic materials available on the NIOSH website, please send an email to GHartle@cdc.gov, or call the NIOSH Industrywide Studies Branch at (513) 458-7118.