NIOSH HEALTH HAZARD EVALUATION REPORT

HETA #2003-0097-3018
Belle River Power Plant
China, Michigan

September 2006

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employers or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Chandran Achutan and Elena Page of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Statistical support was provided by Sangwoo Tak of HETAB. Desktop publishing was performed by Robin Smith, and editorial assistance was provided by Ellen Galloway, both of HETAB. Data on cancer cases were obtained from the Michigan Cancer Surveillance Program of the Michigan Department of Community Health.

Copies of this report have been sent to employee and management representatives at Belle River Power Plant, the OSHA Regional Office and the Michigan Department of Community Health. This report is not copyrighted and may be freely reproduced. The report may be viewed and printed from the following internet address: http://www.cdc.gov/niosh/hhe. Copies may be purchased from the National Technical Information Service (NTIS) at 5825 Port Royal Road, Springfield, Virginia 22161.

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

In December 2002, NIOSH received a request from the management at Belle River Power Plant (BRPP) to see if there was an association between hydrazine contamination of drinking water in the 1980s and the occurrence of cancers among current and former employees.

What NIOSH Did

- We reviewed a report about the hydrazine contamination incident written by management and union.
- We asked management for information such as complete name, most recent address, gender, social security numbers, and date of birth for employees working at BRPP during the hydrazine incident.
- We asked the Michigan Cancer Surveillance Program to tell us which BRPP employees had been diagnosed with cancer since 1989, and for cancer rates in the communities near BRPP.
- We calculated overall rates of cancer, and of colon and lung cancers, for BRPP employees and compared them to rates for communities surrounding BRPP.

What NIOSH Found

- We did not find a significant excess of lung, colon, or all cancers combined among BRPP employees.
- We found that cancer rates among BRPP employees were similar to the communities near BRPP.

What Belle River Power Plant Managers Can Do

- Consider providing cancer screening as a health promotion activity or encourage employees to seek screening through their health plan.
- Provide health promotion opportunities for employees, such as smoking cessation and weight management programs, and access to fitness centers.

What the Belle River Power Plant Employees Can Do

- Modify known risk factors for cancer.
- Get screened for certain cancers where validated screening methods exist. Examples include Pap smears for cervical cancer and mammography for breast cancer.

What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA Report #2003-0097-3018

Health Hazard Evaluation Report 2003-0097-3018
Belle River Power Plant
China, Michigan
September 2006

Chandran Achutan, PhD
Elena Page, MD, MPH
Sangwoo Tak, ScD, MPH

SUMMARY

On December 4, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) at the Detroit Edison (DTE) Belle River Power Plant (BRPP) in China, Michigan. The request asked for NIOSH assistance in determining if there was an excess of cancer cases among current and former workers at the power plant. The concern arose because there had been contamination of the potable water with hydrazine, which was used as an anti-corrosive additive in the boilers. An unauthorized cross-connection between the boiler and the potable water system had reportedly been made sometime between 1984 and 1989, and hydrazine was found in the water in August 1989, when the water was noted to be hot and to have a bad taste.

DTE provided us with a list of persons working at BRPP between 1984 and 1989. The list was provided to the Michigan Cancer Surveillance Program in order to determine incident primary cancers in this population. The Michigan Cancer Surveillance Program provided us with a computer datafile of all matches for each primary cancer diagnosed. They also provided us with cancer rates for the time period 1988-2002 (the last year for which information was available) in 5-year intervals for Livingston, Macomb, Oakland, Ogemaw, Roscommon, St. Clair, Sanilac, Washtenaw, and Wayne counties, which are the counties surrounding the BRPP in which BRPP employees had been diagnosed with cancer. The incidence of cancer was analyzed with the NIOSH modified life table analysis system (LTAS) for a cohort of 712 DTE employees assigned to BRPP between 1984-1989. The ratio of observed to expected number of cancers was expressed as the standardized incidence ratio (SIR). We calculated 95% confidence intervals (95% CI) for the SIRs. We also calculated SIRs with a 5-year lag, restricting analysis to those workers who were working in one of the affected areas during 1989 (the year of documented contamination).

Incidence of all cancers from 1988-2002 among BRPP employees was statistically significantly lower than the Michigan combined counties rate (SIR 0.62, 95% CI 0.46 to 0.82), as were lung cancer rates (SIR 0.33, 95% CI 0.09 to 0.85). Colon cancer rates were not significantly elevated (SIR 1.05, 95% CI 0.34 to 2.45) during that time period. The findings were similar with a lag of 5 years, which excludes cases diagnosed in the first 5 years after exposure. When the analysis was restricted to only those working in 1989, there was no statistically significant increase in colon cancer (SIR 1.79, 95% CI 0.58 to 4.19), or no decrease in lung cancer incidence (SIR 0.28, 95% CI 0.03 to 1.01) compared to the Michigan

combined counties rate. Incidence for all cancers in this latter group was significantly lower than the Michigan combined counties rate (SIR 0.60, 95% CI 0.40 to 0.87).

The NIOSH investigation did not find evidence of an excess of cancer among DTE employees assigned to BRPP between 1984 and 1989. NIOSH investigators recommend no further investigation of this issue.

Keywords: NAICS 221112 (Fossil Fuel Electric Power Generation), hydrazine, lung cancer, colon cancer, standardized incidence ratio, life table analysis

Table of Contents

INTRODUCTION

On December 4, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) at the Detroit Edison (DTE) Belle River Power Plant (BRPP) in China, Michigan. The request asked for NIOSH assistance in determining if there was an excess of cancers among current and former workers at the power plant. The concern arose because there had been contamination of the potable water with hydrazine, which was used as an anti-corrosive additive in the boilers. An unauthorized cross-connection between the boiler and the potable water system had reportedly been made sometime between 1984 and 1989, and hydrazine was found in the water in August 1989, when the water was noted to be hot and to have a bad taste.

BACKGROUND

Belle River Power Plant

Belle River Power Plant is a fossil fuel plant located in China, Michigan. Construction took place from the 1970s until 1985, and involved large numbers of contractors in addition to DTE employees. Approximately 325 DTE employees were assigned to BRPP headquarters in the early 1980s. In addition, a large number of DTE start-up, maintenance, and electrical personnel spent varying amounts of time at BRPP, but were not specifically assigned there. Unit one generator began operations in 1984 and unit two in 1985. Boilers in the BRPP were treated with hydrazine to prevent corrosion. A 35% aqueous hydrazine solution obtained from Calgon Corporation was metered into the boilers through a copper connection. During the time hydrazine was used to treat the boilers, the water in the hot water heating system (HWHS) was tested weekly in an onsite laboratory. The concentration of hydrazine ranged from 50 to 500 parts per billion (ppb), with a goal of 200 ppb.

The Hydrazine Contamination Incident

On August 14, 1989, the laboratory at BRPP received many complaints from the employees about the temperature, taste, and odor of the drinking water. The employees called the China water department representative, who recommended flushing the lines. This was done, but on August 15, 1989, the water was again warm, had a foul odor and an unpleasant taste. BRPP laboratory employees tested the drinking water and noted the presence of hydrazine at 15 ppb. This led to a search for the source of the hydrazine, and the discovery of a cross-connection between the boiler and the potable water system. Over 70 samples of potable water were tested for hydrazine. Hydrazine was not detected in a majority of the samples; however, the testing was completed after the system had been flushed. Potable water from the following locations had detectable levels of hydrazine: the lab sink - 15 ppb; the instrument shop sink - 3 ppb; the unit 2 ground floor men's room - 1 to 2 ppb; two samples of ice from the test group icemaker - 18 and 7 ppb; and ice samples made on August 8, 1989 – not detected to 1 ppb and 1 to 2 ppb. Other samples of ice made earlier did not contain detectable levels of hydrazine. The highest concentration of hydrazine noted on testing of the HWHS was 239 ppb between August 8-15, 1989. Soon after the cross-connection was discovered, the Utility Workers Union of America, Local 223, contacted NIOSH for an HHE. At that time, contamination of the drinking water was thought to have occurred for only a few days. NIOSH reviewed risk assessment reports from Wayne State University and Calgon Corporation and concluded that the risk of cancer to DTE employees from drinking water contaminated with hydrazine at levels less than 1 ppm for a few days was exceedingly small.[1]

In 2001, employees raised concerns that several coworkers had been diagnosed with cancer, specifically colon cancer, and that the cancers may be a result of the hydrazine exposure in the 1980s. At their behest, a joint management-union team was formed to investigate the incident retrospectively. After months of

reviewing records and interviewing dozens of employees, the team issued a detailed report of its findings on February 24, 2003.[2] The 2003 HHE request to NIOSH was an outgrowth of the team's work. In addition to the details outlined above, the team, in conjunction with consultants they hired to assist with root cause analysis and engineering issues, determined that the areas that reasonably could have been supplied with contaminated water were the Unit 1 and 2 power blocks, the commons area, the service building, and the fuel supply building. These areas represent the work areas in which approximately 95% of employees were stationed during the time period of interest. Also, employees gave conflicting reports as to the year when the cross-connection was installed, ranging from 1984 to 1989. The team was unable to precisely determine when the connection was made, how long it was in place, or how often conditions were right for it to function (i.e., when pressure in the HWHS exceeded that in the potable water). However, the condition of the potable water on August 14, 1989, was clearly abnormal and noticed by many employees, an event which had not been reported prior to that time. At that time, DTE contracted with an occupational medicine physician from the University of Michigan to perform a risk assessment based on available information. He concluded that it was unlikely there would be systemic toxicity from exposure to hydrazine from drinking or showering, and that there was inadequate evidence to suggest an increased cancer risk among BRPP employees.[3]

Hydrazine

Hydrazine (N_2H_4) is a clear oily liquid that smells like ammonia.[4] There are a substantial number of hydrazine derivatives, with differing uses and health effects. Hydrazine solutions are used as chemical blowing agents, pesticides, and as boiler water treatment agents, as was the case at BRPP. Anhydrous hydrazine is used in high energy fuels and rocket propellants.

There is no federal standard for hydrazine levels in drinking water. However, the State of Washington has set a standard of 0.03 micrograms per liter for groundwater and drinking water.[5] Hydrazine degrades rapidly in the environment.[6,7]

The International Agency for Research on Cancer (IARC) states that there is sufficient evidence in experimental animals for the carcinogenicity of hydrazine in animals, but inadequate evidence in humans.[8] In mice, hydrazine administered orally produced liver, lung, and mammary tumors, while intra-peritoneal administration resulted in lung tumors, leukemia, and sarcomas. Hydrazine given orally to rats produced lung and liver tumors. Inhalation of hydrazine resulted in nasal tumors in rats, and thyroid adenomas and a few colon tumors in hamsters. A study of 423 hydrazine manufacturers noted that all-cause mortality was not elevated, and the only excess of cancer was two cases of lung cancer within the highest exposure category, yielding a relative risk of 1.2 (95% confidence interval [CI], 0.2 - 4.5).[8] Another cohort of 427 men engaged in hydrazine production between 1945 and 1971 was followed until 1992. Exposure levels in the general plant were thought to be 1 to 10 parts per million (ppm) and up to 100 ppm near the hydrazine storage vessels. Observed mortality was close to expected for all cancers, including lung cancer, and all causes, regardless of exposure level.[4] A cohort of 6,017 aerospace workers employed between 1950 and 1993 also was studied.[9] They were exposed to hydrazine, 1-methylhydrazine, and 1,1-dimethylhydrazine during rocket fueling and testing. In addition, some workers were also exposed to asbestos, beryllium, and other potential carcinogens. Smoking status was unknown for these workers. Significantly elevated mortality from lung cancer was noted. Death rates from hematopoietic, bladder, and kidney cancers were also elevated, but not significantly so. The human study of most pertinence to this HHE was a study examining the association between hydrazine and cancer, which was performed among tuberculosis patients treated with isoniazid, which metabolizes to hydrazine.[10] Over 50,000 people were followed for up to 14 years, and the cancer rates did not differ between those treated with isoniazid and those with a placebo.

METHODS

DTE, in cooperation with the Utility Workers Union, Local 223, provided the following information for employees assigned to BRPP at any time between 1984 and 1989:

a. Last, middle, and first names
b. Most recent address
c. Gender
d. Social security number
e. Date of birth

They also provided limited information about contractors who had worked at BRPP during the same time frame. We contacted the Greater Detroit Building and Construction Trades Council to gather complete information about contractors, but they were unable to provide any of the necessary information. Therefore, all analyses are restricted to DTE employees. Twenty-seven employees who were not assigned to BRPP were on the list provided by DTE because they visited BRPP for undetermined amounts of time. These employees were excluded from our analyses.

The list of DTE employees was provided to the Michigan Cancer Surveillance Program in order to determine incident primary cancers in this population. NIOSH investigators supplied the Michigan Cancer Surveillance Program with a spreadsheet, formatted to its specifications, with the identifying information for each worker. Thirty-eight employees had last known addresses outside of Michigan; 16 were in Florida, and the others were scattered. The Florida Cancer Data System was provided with the identifying information on these 16 individuals in order to determine incident primary cancers.

The Michigan Cancer Surveillance Program provided NIOSH investigators with a computer datafile of all matches including, for each primary cancer diagnosed, the date of diagnosis and pertinent International Classification of Diseases for Oncology (ICD-O) Morphology code. They also provided NIOSH investigators with cancer rates for the time period 1988-2002 (the last year in which information is available) in 5-year intervals for Livingston, Macomb, Oakland, Ogemaw, Roscommon, St. Clair, Sanilac, Washtenaw, and Wayne counties, which are the counties surrounding the BRPP in which BRPP employees had been diagnosed with cancer. Rates were provided for colon cancer because it was the type of cancer that was of concern to BRPP personnel, lung cancer because we considered it the most likely type of cancer to result from hydrazine exposure based on human and animal data, and all cancers combined. All employees were checked against the Social Security Administration (SSA) death beneficiary masterfile to determine date of death, if applicable.

The incidence of cancer was analyzed with the NIOSH modified life table analysis system (LTAS).[11] Each cohort member accumulated person-years at risk (PYAR) for each year of life after January 1, 1988, until the date of diagnosis of cancer, the date of death for deceased cohort members, or the ending date of the study (December 31, 2002) for cohort members known to be alive. Cohort members known to be alive after August 15, 1989 (the date that the hydrazine exposure was found) and not identified on the SSA master file as deceased were assumed to be alive as of December 31, 2002. The PYAR were stratified into 10-year intervals by age and calendar time, and were then multiplied by the Michigan combined counties gender- and site-specific incidence rate to calculate the expected number of cancers for that stratum. The resulting expected numbers were summed across strata to obtain site-specific and total expected number of cancers. The ratio of observed to expected number of cancers was expressed as the standardized incidence ratio (SIR). A SIR above one indicates an elevated rate, while a SIR below one indicates a decreased rate of cancer. Ninety-five percent confidence intervals were computed for the SIRs. A 95% CI that does not include 1.0 indicates that the SIR is statistically significant, while a 95% CI that includes 1.0 is not, indicating that the results may be due to chance. The SIRs were recalculated with a 5-year lag period. In addition, the SIR was calculated only for those workers who were working in one of the affected areas during August 1989, the year

in which hydrazine contamination of the potable water was actually documented.

RESULTS

Of the 712 DTE employees assigned to BRPP between 1984 and 1989, 452 were physically present at BRPP in 1989. We are unable to discern if they were working on August 14-15, 1989, the days when hydrazine was found in the potable water. Florida reported that no cancers were diagnosed among former BRPP employees who reside there. The following results are for Michigan residents only.

The incidence of all cancers from 1988-2002 among BRPP employees was statistically significantly lower than the Michigan combined counties rate (SIR 0.62, 95% CI 0.46 to 0.82), as were lung cancer rates (SIR 0.33, 95% CI 0.09 to 0.85). Colon cancer rates were similar to the Michigan combined counties rate (SIR 1.05, 95% CI 0.34 to 2.45) (See Table 1). When applying a lag of 5 years, which excludes cases diagnosed within the first 5 years after exposure, findings were similar (See Table 2).

Table 3 contains results obtained when restricting our analyses to those working in 1989, the year when the hydrazine was documented to be in the potable water during August. Results were similar to those above. There was no statistically significant differences in colon cancer (SIR 1.79, 95% CI 0.58 to 4.19) or lung cancer incidence (SIR 0.28, 95% CI 0.03 to 1.01) compared to the Michigan combined counties rates. Incidence for all cancers was significantly lower for BRPP employees than the Michigan combined counties rate (SIR 0.60, 95% CI 0.40 to 0.87).

DISCUSSION

This HHE did not find evidence of an excess of cancer among DTE employees assigned to BRPP between 1984 and 1989. This finding is consistent with prior assessments, by NIOSH and the University of Michigan, which concluded that the risk to these employees was very low. In addition, this evaluation was confounded by limitations such as inability to pinpoint exactly when the exposure happened, who was exposed, and for how long.

Cancer Clusters

It is useful, when discussing cancer and cancer clusters, to review certain facts and then describe what the important factors are in making a determination of work-relatedness. Cancer is a group of different diseases that have the same feature, the uncontrolled growth and spread of abnormal cells. Each type of cancer may have its own set of causes. Cancer is common in the United States. One of every four deaths in the United States is from cancer. Among adults, cancer is more frequent among men than women, and is more frequent with increasing age. Many factors play a role in the development of cancer. The importance of these factors is different for different types of cancer. Most cancers are caused by a combination of several factors. Some of the factors include: (a) personal characteristics such as age, sex, and race, (b) family history of cancer, (c) diet, (d) personal habits such as cigarette smoking and alcohol consumption, (e) the presence of certain medical conditions, (f) exposure to cancer-causing agents in the environment, and (g) exposure to cancer-causing agents in the workplace. In many cases, these factors may act together or in sequence to cause cancer. Smoking is a known confounder for lung and other cancers. We were not able to distinguish smokers from non-smokers in the study population, and we have no information on other risk factors for any type of cancer among employees. The American Cancer Society estimates at least half of all cancer deaths could be prevented by lifestyle changes.[12]

Cancers often appear to occur in clusters, which scientists define as an unusual concentration of cancer cases in a defined area or time.[13] A cluster also occurs when more cancers are found among workers of a different age or sex group than is usual. The cases of cancer may have a common cause or may be the coincidental occurrence of unrelated causes. The number of cases may seem high, particularly among the

small group of people who have something in common with the cases, such as working in the same building. Although the occurrence of a disease may be random, diseases often are not distributed randomly in the population, and clusters of disease may arise by chance alone.[14]

To assess whether the cancers among employees could be related to occupational exposures, we consider the number of cancer cases, the types of cancer, the likelihood of exposures to potential cancer-causing agents, and the timing of the diagnosis of cancer in relation to the exposure. These issues are discussed below as they relate to BRPP.

Do workers at BRPP have a higher incidence of cancer illnesses than people who don't work at the facility?

Because cancer is a common disease, it can be found among people at any workplace. In the United States, one in two men and one in three women will develop cancer over the course of their lifetimes. These figures show the unfortunate reality that cancer occurs more often than many people realize. When several cases of cancer occur in a workplace, they may be part of a true cluster when the number is greater than we expect compared to other groups of people similar with regard to age, sex, and race. We did not find significantly elevated rates of cancer compared to the rate found in the counties surrounding BRPP. If we had included the 16 employees who moved to Florida in our analyses, the rates would have been even lower because none of them had been diagnosed with cancer. While the rate of colon cancer was elevated among persons employed in 1989, this elevation was not statistically significant. Disease or tumor rates are highly variable in small populations such as at BRPP, and rarely match the overall rate for a larger area, such as the state. For any given time period, some populations will have rates above the overall rate and others will have rates below the overall rate. So, even when there are an excess number of cancers at a worksite, this may be completely consistent with the expected random variability. For example, the Minnesota Department of Health examined rates of 85 types of cancer by county from 1988-1994, and compared them to the average rate for the entire state. They found almost 10,000 instances where the county rate for a particular cancer exceeded the state average by twofold.[15] The New York State Cancer Registry documented that the state wide rate of thyroid cancer among men was 3.1/100,000, but the county rates varied from 0.6 to 6.2/100,000.[16]

Colon Cancer

Colorectal cancer is the third most common cancer in the United States, and has generally not been viewed as an occupational disease due to the many non-occupational factors that have been associated with this type of cancer.[17] These include dietary factors (nitrosamines from cured smoked meats and fish, cheese, beer, and some milk products); cooking methods; insufficient physical activity; use of tobacco or alcohol; genetics (those with inflammatory bowel disease and adenomatous polyps are at increased risk); and other environmental factors such as living in an urban area, being in a higher income and education bracket, or using certain cosmetics, agricultural chemicals, and pharmaceuticals.[17,18,19]

Occupational associations to colorectal cancer have been suggested in studies of automobile workers exposed to woods, metals, plastics, fiberglass, and a variety of fumes and solvents.[18] A weak association between asbestos exposure and colorectal cancer has also been suggested.[18] Other studies have found a suggested increased risk of colorectal cancer with exposures to glass fibers, coke dust, gold compounds, iron oxides, silver compounds, nitric acid, nitrates, propane emissions, felt dust, rosin, leather dust, epoxies, polystyrene, polyurethanes, and perchloroethylene.[20] The one occupational exposure known to cause colorectal cancer is ionizing radiation, as seen in early radiologists, radium dial painters, underground hard rock miners, and atomic bomb survivors.[19] Ionizing radiation exposure would not be expected at BRPP. Hydrazine exposure does not appear to

be associated with colon cancer based on animal and human studies.

Is exposure to a specific chemical or physical agent known or suspected of causing cancer?

The relationship between some agents and certain cancers has been well established. For other agents and cancers, there is a suspicion but the evidence is not definitive. This latter situation is the case with hydrazine. When a known or suspected cancer-causing agent is present and the types of cancer occurring have been linked with these exposures in other settings, we are more likely to make the connection between cancer and a workplace exposure. Animal and human studies of hydrazine exposure reveal that lung cancer is the most common type of cancer reported. However, documentation of actual exposure to hydrazine among BRPP employees is not possible. There was only a brief period in which we can be sure that hydrazine was in the potable water. There is no information on whether or not any worker drank the water or showered in it during that time frame. At best we can consider all workers who were present in the affected areas during that time frame as potentially exposed. This likely led to an overestimate of exposed individuals. We found a statistically significantly lower rate of lung cancer among BRPP workers than expected. In addition, production of electricity from fossil fuels entails potential exposure of workers to other known carcinogens, such as polycyclic aromatic hydrocarbons, arsenic, beryllium, cadmium, and others. BRPP is a polychlorinated biphenyl-(PCB) and asbestos-free plant. It was not possible to identify exposure to the other carcinogenic agents based on the information we had.

Has enough time passed since exposure began?

The time between first exposure to a cancer-causing agent and clinical recognition of the disease is called the latency period. Latency periods vary by cancer type, but usually are 15 to 20 years, or longer. For example, it can take up to 30 years after exposure to asbestos for mesothelioma to develop. The latency period for solid tumors, such as lung cancer averages 15-20 years. We looked at cancer incidence data up to 13 years since the documented exposure, and 18 since the possibility of exposure began. In addition, we calculated SIRs with a 5-year lag to account for at least some of the typical latency period. It is possible that insufficient time has passed since the hydrazine contamination incident for all cancers related to that exposure to have been diagnosed. However, given the findings and limitations outlined above, this is of minor significance.

CONCLUSIONS

Rates of cancer (lung, cancer, and all types combined) among BRPP employees are similar to or less than those in the surrounding counties. Regarding questions about individual exposures at BRPP, we do not believe that fruitful information will be gained with further investigation. It is not possible to determine who was actually exposed to hydrazine, how much hydrazine they were exposed to, or the duration of their exposure. It is possible that in future years there may be an increase in rates, due to the long latency among some cancer types; however, based on the information we have presently, we wouldn't recommend further action at this worksite.

RECOMMENDATIONS

The most important thing BRPP employees can do now is reduce their risk of developing cancer by eliminating modifiable risk factors. These risk factors include smoking, obesity, sedentary lifestyle, and poor diet. DTE should identify and control exposure to other potentially hazardous agents at BRPP. We recommend screening for cancers for which validated screening methods exist, such as cervical and breast cancers. This can be offered to employees as part of a workplace health promotion activity, or through their private physicians. Cancer screening recommendations

are available from the American Cancer Society[21] and from the U. S. Preventive Services Task Force.[22] More information about cancer is available through the NIOSH website.[23] This site contains many useful links about cancer in general, as well as occupational cancer.

REFERENCES

1. Singal M [1989]. National Institute for Occupational Safety and Health. Letter to the Safety Director, Local 223, Utility Workers Union of America.

2. Detroit Edison [2003]. Potable water incident investigation team final report.

3. Garabrant D [2003]. Powerpoint presentation to Belle River Power Plant employees dated January 13, 2003.

4. Morriss J, Densem JW, Wald NJ, Doll R [1995]. Occupational exposure to hydrazine and subsequent risk of cancer. Occup Environ Med 52: 43-45.

5. Adams EB [1992]. Clean Water for Washington: Defining Water Quality. Washington State University, Spokane, WA. [http://cru.cahe.wsu.edu/CEPublications/eb1721/eb1721.html]. Date accessed: September 5, 2006.

6. World Health Organization [1987]. Environmental Health Criteria 68: Hydrazine. Geneva, Switzerland.

7. U.S. Department of Health and Human Services [1993]. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD.

8. IARC [1999]. IARC monograph on the evaluation of carcinogenic risks to humans. Volume 71. Lyon, France: World Health Organization, International Agency for Research on Cancer.

9. Ritz B, Morgenstern H, Froines J, Moncau J [1999]. Chemical exposures of rocket-engine test stand personnel and cancer mortality in a cohort of aerospace workers. J Occup Environ Med 41:903-910.

10. Glassroth JL, White MC, Snider DC [1977]. An assessment of the possible association of isoniazid and human cancer deaths. Am Rev Resp Dis 116:1065-74.

11. National Institute for Occupational Safety and Health, Department of Health and Human Services. [http://www.cdc.gov/niosh/LTAS/]. Date accessed: September 5, 2006.

12. American Cancer Registry Website [2006]. [http://www.cancer.org/docroot/NWS/content/NWS_1_1x_ACS_Report_Half_of_Cancer_DeathPreventable.asp]. Date accessed: September 5, 2006.

13. CDC (Centers for Disease Control) [1990]. Guidelines for investigating clusters of health events. MMWR 39(11).

14. Metz LM, McGuinness S [1997]. Responding to reported clusters of common diseases: the case of multiple sclerosis. Can J Public Health 88(4):277-279.

15. Williams AN [1997]. Minnesota Department of Health. Letter to the Ramsey County Risk Management Department, Minnesota.

16. New York State Department of Health [2006]. [http://www.health.state.ny.us/statistics/cancer/registry/abouts/colorectal.htm]. Date accessed: September 5, 2006.

17. American Cancer Registry Website (Statistics). [http://www.cancer.org/docroot/stt/stt_0.asp]. Date accessed: September 5, 2006.

18. Schottenfeld D, Fraumeni JF, Jr., eds. [1996]. Cancer epidemiology and prevention, 2nd ed. New York: Oxford University Press, pp. 813-840.

19. Rom WN, ed. [1998]. Environmental and Occupational Medicine, 3rd ed. Boston, MA: Little, Brown and Co.; pp. 1228-1232, 1300-1303.

20. Siemiatycki J, ed. [1991]. Risk factors for cancer in the workplace: Boca Raton, FL: CRC Press, pp. 222, 257-261.

21. American Cancer Registry Website (Prevention). [http://www.cancer.org/docroot/ped/ped_1.asp]. Date accessed: September 5, 2006.

22. Agency for Healthcare Research and Quality, US Department of Health and Human Services. [http://healthit.ahrq.gov/search/ahrqsearch.jsp].Date accessed: September 5, 2006.

23. National Institute for Occupational Safety and Health, Department of Health and Human Services. [http://www.cdc.gov/niosh/topics/cancer/]. Date accessed: September 5, 2006.

Table 1
Cancer Incidence Among BRPP Employees, 1988 through 2002

Type of Cancer	Observed Number of Cases	Expected Number of Cases	Standardized Incidence Ratio	95% Confidence Interval
All cancer sites	48	76.99	0.62*	0.46 to 0.83*
Males	44	71.33	0.62*	0.45 to 0.83*
Females	4	5.66	0.71	0.19 to 1.81
Colon	5	4.76	1.05	0.34 to 2.45
Males	5	4.51	1.11	0.36 to 2.59
Females	0	0.26	0.00	0.00 to 14.27
Bronchus and Lung	4	12.02	0.33*	0.09 to 0.85*
Males	4	11.39	0.35*	0.10 to 0.90*
Females	0	0.63	0.00	0.00 to 5.89
All other cancer sites	39	60.2	0.65*	0.46 to 0.89*
Males	35	55.42	0.63*	0.44 to 0.88*
Females	4	4.78	0.84	0.23 to 2.14

*These numbers are significantly lower than the Michigan combined counties rate.

Table 2
Cancer Incidence Among BRPP Employees
(5-year lag applied)

Type of Cancer	Observed Number of Cases	Expected Number of Cases	Standardized Incidence Ratio	95% Confidence Interval
All cancer sites	44	73.97	0.59*	0.43 to 0.80*
Males	41	68.56	0.60*	0.43 to 0.81*
Females	3	5.41	0.55	0.11 to 1.62
Colon	5	4.57	1.09	0.35 to 2.55
Males	5	4.32	1.16	0.37 to2.70
Females	0	0.25	0.00	0.00 to 14.76
Bronchus and Lung	3	11.51	0.26*	0.05 to 0.76*
Males	3	10.90	0.28*	0.06 to 0.80*
Females	0	0.61	0.00	0.00 to 6.07
All other cancer sites	36	36.56	0.57*	0.36 to 0.88*
Males	33	53.34	0.62*	0.43 to 0.87*
Females	3	4.55	0.66	0.14 to 1.93

*These numbers are significantly lower than the Michigan combined counties rate

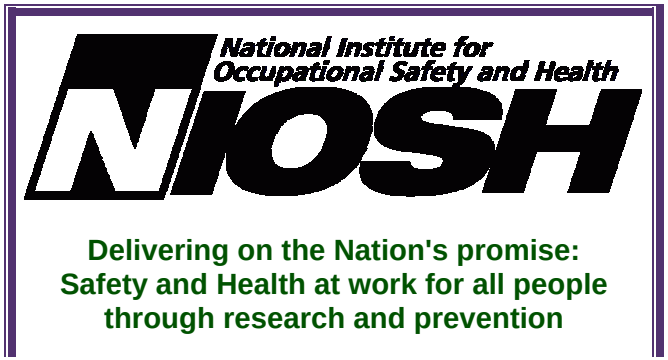
Table 3
Cancer Incidence Among BRPP Employees, 1988 through 2002
(excluding those not employed in 1989)

Type of Cancer	Observed Number of Cases	Expected Number of Cases	Standardized Incidence Ratio	95% Confidence Interval
All cancer sites	28	46.46	0.60*	0.40 to 0.87*
Males	27	43.45	0.62*	0.41 to 0.90*
Females	1	3.01	0.33	0.01 to 1.85
Colon	5	2.79	1.79	0.58 to 4.19
Males	5	2.65	1.88	0.61 to 4.40
Females	0	0.13	0.00	0.00 to 28.05
Bronchus and Lung	2	7.12	0.28	0.03 to 1.01
Males	2	6.80	0.29	0.04 to 1.06
Females	0	0.32	0.00	0.00 to 11.63
All other cancer sites	21	36.56	0.57*	0.36 to 0.88*
Males	20	34.00	0.59*	0.36 to 0.91*
Females	1	2.56	0.39	0.01 to 2.17

*These numbers are significantly lower than the Michigan combined counties rate

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

OFFICIAL BUSINESS
Penalty for private use $300



To receive NIOSH documents or information about occupational safety and health topics contact NIOSH at:

1-800-35-NIOSH (356-4674)
Fax: 1-513-533-8573
E-mail: pubstaft@cdc.gov
or visit the NIOSH web site at:
http://www.cdc.gov/niosh

S A F E R • H E A L T H I E R • P E O P L E™