Information Collection Request for
"Understanding Long-term Respiratory Morbidity Among Former Styrene-Exposed Workers: Medical Survey"

Supporting Statement B

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B. Collections of Information Employing Statistical Methods

1. Respondent Universe and sampling methods

The sites of field research for this project are Bellingham, WA and Kelso, WA, which were the sites of two reinforced plastic boatbuilding plants that closed in 1989 and 1993, respectively. A cohort of 5,204 workers employed ≥1 day at either Uniflite or Tollycraft boatbuilding plants during January 1, 1959–September 30, 1978 was previously identified by NIOSH and has been followed since 1978. As of 2019, 3,089 members of the cohort were known to be living, and over 65% resided in the Bellingham and Kelso areas. This research project will be open to all living members of the boatbuilder cohort who live in the Bellingham and Kelso, WA areas. Following a single NIOSH industrial hygiene survey in 1978, workers were originally categorized as having worked in departments with either minimal ("low") (n=3,141 [60%]) or high (n=2,063 [40%]) styrene exposure. Based on this existing data, living cohort members will be assigned to one of the following categories:

- • Long-tenured (≥12 months) worker with high-exposure (≥5 ppm 8-hour TWA)
- • Long-tenured with low-exposure (<5 ppm 8-hour TWA)
- • Short tenured (<12 months) with high-exposure
- • Short-tenured with low-exposure

A random sample will be selected from the 3,089 living members of the boatbuilder cohort using a SAS statistical software system. A random sample of 169 cohort members from each of the four tenure and exposure categories (676 total study subjects) living in the surrounding Bellingham, WA and Kelso, WA areas will be recruited to participate in the study and contacted by both mail and telephone. A total of 676 study subjects will be enrolled. A power analysis was conducted to determine the likelihood of identifying a prevalence ratio of 1.75 for lung disease in workers with previous high styrene exposures compared with a comparison group comprised of workers with previous low styrene exposures. The power analysis assumed power = 0.80 and alpha = 0.05. A prevalence ratio of 1.75 was chosen considering a recent mortality analysis of this cohort identified the standardized mortality ratio (SMR) for COPD for workers with high potential styrene exposure who had been employed for <1 year was 2.60 (95% CI = 1.70–3.81) and for those employed ≥1 year was 2.02 (95% CI = 1.08–3.46). The power analysis determined 673 subjects would be needed under these assumptions.

To characterize work exposures for analysis, we will administer a questionnaire (Attachment 3) that includes a detailed job history during and after the worker's tenure; job histories at the boatbuilding plants will be compared with air sampling data from a prior industrial hygiene survey conducted in 1978 to more specifically characterize past styrene exposure for study subjects. Final exposure categories for analysis will be determined by responses in the work history section of the questionnaire. Thirteen job titles in the high-exposure category were associated with 8-hour time weighted average exposures of 11.8–106.0 parts per million.

2. Procedures for the Collection of Information

NIOSH will recruit 676 participants from the boatbuilder cohort for a medical survey. A recruitment letter (Attachment 17) describing the study will be mailed to selected individuals. Data collection will take place at a rented hotel conference space in Bellingham, WA and Kelso, WA.

For the questionnaire and medical testing, trained NIOSH staff will meet with each participant privately to review the informed consent document (Attachment 19). Participants who wish to participate will be required to sign the informed consent document. A trained NIOSH interviewer will conduct the questionnaire in a private area using a laptop computer (Attachment 3). Lung function tests, color vision assessment, and blood draw will take place privately at the same location as the questionnaire.

3. Methods to Maximize Response Rates and Deal with No response

Several components of the study are expected to maximize the response rate, including an in-person information sessions, formal invitation letters, a series of follow-up phone calls, and offering free medical testing.

4. Tests of Procedures or Methods to be Undertaken

The questionnaire (Attachment 3) was developed from standardized data collection instruments used by the American Thoracic Society and the National Health and Nutrition Examination Survey. Similar questionnaires have been used extensively by NIOSH for health hazard evaluations and research studies.

Fraction of exhaled nitric oxide will be measured using a NIOX Mino device (Aerocrine; Solna, Sweden) and the American Thoracic Society guidelines. Measuring increased concentrations of the fraction of exhaled nitric oxide is a potential indicator of uncontrolled eosinophilic airway inflammation.

Spirometry will be measured using a dry rolling-seal volume spirometer that measures exhaled air volume and flow rates. NIOSH technicians will adhere to the American Thoracic Society (ATS)/European Respiratory Society (ERS) criteria for acceptability and repeatability. For spirometric classification, the largest forced vital capacity (FVC) and FEV1 from the acceptable curves will be used for analysis. Reference values will be generated from NHANES III data based on the subject's sex, weight, age, and race.

NIOSH technicians trained in administering lung function tests will use an impulse oscillometry machine (CareFusion Corp., San Diego, CA) to perform impulse oscillometry. This test is conducted using regular breathing and does not require a forceful exhalation. The test calculates 1) the airway resistance at different frequencies including 5 Hertz (R5) and 20 Hertz (R20), and the difference between R5 and R20 (DR5-R20); 2) the reactance at different frequencies including 5 Hertz (X5); 3) resonance frequency (Fres) which is the frequency where there is no airway reactance; and 4) the total reactance (AX) at all frequencies between 5 Hertz and the Fres.

If a research participant has a spirometry outside the normal range, the participant will be administered a bronchodilator inhaler medication (i.e., albuterol), which can open the airways in some persons (e.g., asthmatics), and repeat spirometry and impulse oscillometry. To administer the albuterol, a spacer will be attached to an albuterol metered-dose inhaler and the participant will receive four metered doses (400 mcg total).

NIOSH technicians trained in administering lung function tests will use a portable lung function machine (ndd Medical Technologies, Inc., Andover, MA) to perform a multiple-breath washout test. Multiple-breath washout testing assesses the efficiency of ventilation distribution. Reference values provided by nDD Medical Technologies, Inc. for the device will be used to calculate a percent predicted value.

NIOSH trained technicians will use the Lanthony D-15 Color Test (desaturated) (Richmond Products, Albuquerque, NM) to perform vision assessment following the NIOSH/RHD Standard operating procedure.

NIOSH experienced certified phlebotomist will collect blood samples following the NIOSH/RHD Standard operating procedure.

5. Individuals Consulted on Statistical Aspects and Individuals Collecting and/or Analyzing Data

The primary statistical consultant for the design of this project was:
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The data will be collected and analyzed by:
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