

# Health Survey Study of Individuals Potentially Exposed to VOC-Contaminated Drinking Water at US Marine Corps (USMC) Base Camp Lejeune

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# Site Background

- Two contaminated water treatment plants served base housing
  - Tarawa Terrace (constructed in 1952)
    - Two wells contaminated with tetrachloroethylene (or PCE), a dry cleaning solvent dumped by an off-base dry cleaners
    - Maximum level of PCE detected in the water system was 215 µg/L (MCL = 5 µg/L)
  - Hadnot Point (constructed in the 1943)
    - Contaminated by waste disposal sites, spills, and leaking underground storage tanks containing solvents such as trichloroethylene (TCE)
    - Maximum level of TCE detected in the water system was 1,400 µg/L (MCL = 5 µg/L)
    - Maximum level of trans-1,2-dichloroethane detected in the water system was 407 µg/L (MCL = 100 µg/L)

# Site Background

- Highly contaminated wells at Tarawa Terrace and Hadnot Point were shut down in 1985

# H.R. 4986: National Defense Authorization for FY 2008 (Section 315)

- Enacted January 28, 2008
- Requires ATSDR to develop a health survey of all individuals possibly exposed to contaminated drinking water at Camp Lejeune
- Navy required to send health surveys

# Data Sources

- Defense Manpower Data Center (DMDC)
  - Personnel data on active duty and civilian employees
- ATSDR 1999-2002 survey participants

# DMDC Active Duty Personnel Data

- partial last name (before 1977)
- full name (1977 onward)
- social security number
- date of birth
- sex and race/ethnicity
- home state of record
- unit code (June 1975 onward)
  - can be used to identify base location
- occupational specialty
- pay grade
- dates and years of service
- marital status

# DMDC Active Duty Personnel Data

- 210,222 Marines and Navy personnel stationed at the base anytime 6/75 – 12/85
  - 198,805 Marines; 11,417 Navy
  - 8,214 women (4%)
  - 30% married
  - 95% enlisted; 5% commissioned officers
  - 25% African American; 4% Hispanic
  - Average tour length 3 years
  - 88% under the age of 55 in 2007

# DMDC Civilian Employee Personnel Data

- full name (12/81 onward)
  - name not available before 12/81
- social security number
- date of birth
- sex and race/ethnicity
- home state of record
- occupational code and location of occupation (December 1972 onward)
- employee start date (June 1974 onward)
- years of service
- pay grade



# DMDC Civilian Employee Personnel Data

- 8,085 civilians employed at the base anytime 12/72–12/85
  - 3,687 women (46%)
  - 22% African American
  - Half employed for 5 years or more
  - 80% aged  $\geq 55$  years in 2007

# ATSDR 1999-2002 Survey

- Telephone survey conducted to identify potential birth defects and childhood cancers for the current case-control study
- Interviewed parents of 12,598 children born during 1968-1985 who resided on base anytime during the pregnancy
  - Mothers were slightly more than half of the respondents
- About 4,000 of the Marines/Navy personnel in this survey are not in the DMDC database because they left the base before 1975
- Includes dependents (spouse, child) not in the DMDC databases

# ATSDR 1999-2002 Survey

- Data available
  - Most survey respondents (either mother or father) provided a social security number
  - Full name, date of birth, and address at time of survey for both parents and the study child
  - Dates the parents lived on base

# Health Survey Study Population

- Marines/Navy personnel stationed at Camp Lejeune anytime 6/75 – 12/85 (N=210,222)
- Civilians employed at Camp Lejeune anytime 12/72 – 12/85 (N=8,085)
- Parents/children from ATSDR 1999-2002 survey (N=12,598 families)
  - Children were born between 1968 and 1985 and are adults now
- Decedents' next of kin (identified in concurrent mortality study)
- Unexposed comparison groups from USMC Base Camp Pendleton who were not stationed or employed at Camp Lejeune during the period of drinking water contamination
  - 50,000 Marines/Navy personnel stationed at Camp Pendleton anytime 6/75-12/85
  - 10,000 civilians employed at Camp Pendleton anytime 12/72 – 12/85

# Additional Health Survey Population

- Congress mandated that anyone registering with the USMC should be mailed a health survey
- Information from those registered with the USMC who are not included in the Health Survey Study will be analyzed separately from the information provided by the study population

# Health Survey Items

- Residential history on base
- Work activities on base
- Occupational history
- Other risk factors
  - Smoking
  - Alcohol consumption
  - SES factors

# Health Survey Items

- Information on cancers
  - Type
  - Date, state, and hospital of diagnosis
  - Name of health care provider
- Information on other diseases associated with solvent exposure
  - Similar information as cancers
- Open-ended question about other health concerns
- Request for signed medical records release form or copies of medical records in respondent's possession
- Consent form

# Diseases of Interest

- The following diseases are associated with exposure to the chemicals found in Camp Lejeune's drinking water

kidney cancers (TCE)

liver cancer and liver disease (TCE, VC)

leukemias (TCE, benzene, PCE)

cervical cancer (TCE, PCE)

bladder cancer (PCE)

lung cancer (PCE, VC)

soft tissue sarcoma (VC)

breast cancer (PCE)

scleroderma (TCE, PCE)

generalized skin disorders (TCE)

infertility (PCE, TCE, solvents)

aplastic anemia (benzene)

motor neuron disease/ALS (solvents)

kidney diseases (TCE, PCE)

NHL (TCE, PCE, benzene)

multiple myeloma (TCE, benzene)

Hodgkin's disease (TCE)

pancreatic cancer (PCE)

esophageal cancer (PCE)

brain cancer (VC)

Parkinson's disease (TCE)

Lupus (TCE)

spontaneous abortion (PCE,  
benzene)

endometriosis (solvents)

multiple sclerosis (solvents)



# Confirming Diseases of Interest

- Cancer registrations
- Medical records
- Death certificates/NDI-plus

# Survey Methods

- Dillman's Tailored Design Method for mailed surveys
- Pre-notice letter
  - Signed by high ranking officer of the USMC/Navy
  - Notifies that survey will be mailed soon (1-2 weeks)
  - Strongly encourages participation
- Health survey mailing
  - Preaddressed stamped return envelope
  - Letter signed by the highest ranking officer of USMC/Navy
  - Provides website for on-line version of survey if they prefer to answer electronically
  - Email will also be sent if email address is available

# Survey Methods

- Thank you/reminder postcard (and email) sent 2 weeks later to all respondents
- Second survey mailed/emailed to non-responders four weeks after postcard reminder
- Telephone reminders to non-responders after 2 weeks of second mailing

# State of Residence for USMC Retirees and Cancer Registry Data by State

State	% retirees	Cancer registry data		State	% retirees	Cancer registry data	
		available	% complete			available	% complete
CA	15.38	1988	100.0	NJ	1.01	1979	99.0
NC	10.24	1990	93.0	WI	1.01	1978	100.0
VA	8.52	1990	88.6	KY	.95	1991	99.4
FL	7.79	1981	99.7	HI	.89	1973	100.0
TX	6.52	1992	92.9	AR	.87	1996	85.6
GA	3.52	1995	79.5	MS	.86	.	.
AZ	3.17	1995	86.0	MN	.73	1988	99.9
PA	2.93	1985	100.0	NM	.73	1973	94.9
SC	2.76	1996	97.3	KS	.72	.	.
TN	2.26	1989	.	WV	.63	1993	99.5
MD	2.16	1982	.	IA	.56	1973	100.0
OH	2.15	1996	94.1	ID	.52	1970	97.8
WA	2.06	1992	100.0	CT	.46	1935	100.0
NY	1.97	1976	100.0	ME	.45	1983	97.4
MO	1.96	1985	100.0	UT	.43	1966	96.0
IL	1.76	1986	100.0	NH	.38	1987	95.8
AL	1.58	1996	79.3	MT	.37	1979	97.1
MI	1.52	1985	100.0	NE	.33	1987	99.7
NV	1.43	1995	91.2	RI	.21	1986	100.0
IN	1.34	1987	91.2	DE	.21	1972	99.2
CO	1.32	1988	100.0	SD	.16	.	.
OR	1.22	1996	99.2	DC	.14	1987	100.0
LA	1.18	1988	95.5	AK	.14	1996	100.0
MA	1.11	1982	98.7	WY	.14	1962	94.8
OK	1.04	.	.	VT	.13	.	.
				ND	.07	1997	97.3

# State of Residence at Enlistment

Home State	% retirees	Cancer registry data available	% complete	Home State	% retirees	Cancer registry data available	% complete
NY	10.3	1976	100.0	MS	1.0	.	.
PA	7.2	1985	100.0	WA	0.9	1992	100.0
OH	7.0	1996	94.1	AR	0.8	1996	85.6
FL	5.0	1981	99.7	CO	0.8	1988	100.0
IL	4.7	1986	100.0	OK	0.8	.	.
CA	4.4	1988	100.0	AZ	0.7	1995	86.0
MI	4.2	1985	100.0	ME	0.7	1983	97.4
NC	4.1	1990	93.0	KS	0.7	.	.
TX	4.1	1992	92.9	NH	0.6	1987	95.8
NJ	3.9	1979	99.0	OR	0.6	1996	99.2
VA	3.2	1990	88.6	DC	0.5	1987	100.0
MA	2.9	1982	98.7	NE	0.5	1987	99.7
IN	2.9	1987	91.2	RI	0.5	1986	100.0
MD	2.8	1982	.	NM	0.5	1973	94.9
GA	2.8	1995	79.5	DE	0.4	1972	99.2
MO	2.1	1985	100.0	ID	0.2	1970	97.8
TN	2.1	1989	.	VT	0.2	.	.
WI	2.1	1978	100.0	SD	0.2	.	.
AL	2.1	1996	79.3	MT	0.2	1979	97.1
SC	1.9	1996	97.3	ND	0.2	1997	97.3
KY	1.8	1991	99.4	NV	0.2	1995	91.2
CT	1.6	1935	100.0	UT	0.2	1966	96.0
LA	1.5	1988	95.5	HI	0.1	1973	100.0
MN	1.4	1988	99.9	WY	0.1	1962	94.8
WV	1.2	1993	99.5	AK	0.1	1996	100.0
IA	1.0	1973	100.0				

# Potential Future Study

# ATSDR-Convened Panel of Epidemiologists, March 2008

- Panel Members
  - Han Kang, Dept Veteran Affairs
  - Kyle Steenland, Emory U
  - Elizabeth Delzell, U AL-Birmingham
  - Kenneth Cantor, NCI
  - Maria Schymura, NYS Cancer Registry
  - Chris Rennix, Navy/USMC Public Health Center
  - Richard Clapp, Boston U; member of Lejeune CAP

# Recommendations from March 2008 Panel

- Conduct “data-linkage”, cancer incidence study
  - Using cancer registries from 50 states, VA and DOD
  - Same DMDC cohorts as health survey study except must have started active duty in 6/75 or later or employment in 6/74 or later
  - Include parents and children in the ATSDR 1999-2002 survey with complete base residence info
- If the health survey study has a participation rate  $\geq 65\%$ , then the data-linkage, cancer incidence study may not be necessary
  - However, there still may be an issue of bias from underreporting of conditions by the comparison groups from Camp Pendleton