Camp Lejeune – Chapter A Report

Summary and Findings: Analyses and Historical Reconstruction of Drinking Water in the Hadnot Point and Holcomb Boulevard Water Treatment Plants Service Areas

Background

U.S. Marine Corps Base Camp Lejeune, North Carolina was established in 1942. In 1982, the Marine Corps discovered specific volatile organic compounds (VOCs) in the drinking water provided by two of the eight water distribution systems on base. The Agency for Toxic Substances and Disease Registry has several projects underway to help Marines, civilians, health officials, and other interested parties understand more about the drinking water contamination and whether it affected the health of persons living or working on the base during the period 1968-1985.

Using Research to Understand Health Effects

ATSDR is determining associations between human health effects and exposures to VOCs in drinking (finished) water at Camp Lejeune. To accomplish this, ATSDR used water modeling to determine which areas at Marine Corps Base Camp Lejeune received VOC-contaminated drinking water in the past. Water modeling is a method of analysis that enabled ATSDR to estimate drinking water concentrations for the period 1942-2008. This work will help ATSDR epidemiologists determine what populations were exposed to contaminants and at what levels they were exposed.

Chapter A: Summary and Findings presents summaries of analyses and results of reconstructed VOC-contaminant concentrations in water supply wells and drinking water within the Hadnot Point and Holcomb Boulevard water treatment plant service areas. This report summarizes previous analyses and investigations—Chapters B, C, and D—and results of water modeling investigations. Completing Chapter A and the eight supplements required discovery, extraction, and analyses of data and information from tens of thousands of federal and state government documents.

This report is a companion to previously published reports on geohydrologic data (Chapter B), selected groundwater contaminants at Installation Restoration Program sites (Chapter C), and occurrence of selected groundwater contaminants at above- and underground storage tank sites (Chapter D).

Chapter A Supplements

1. Water supply well operations
2. Reconstruction of historical water supply well operations
3. Water level data and groundwater flow
4. Simulation of 3-dimensional groundwater flow
5. Reconstruction of contaminant concentrations using linear control model methodology
6. Reconstruction of VOC concentrations in groundwater
7. Simulation of LNAPL migration and concentrations in groundwater
8. Intermittent transfers of drinking water between the Hadnot Point and Holcomb Boulevard water distribution systems

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Agency for Toxic Substances and Disease Registry

Information in Chapter A

ATSDR's water-modeling techniques and historical reconstruction process were used to estimate monthly contaminant levels in drinking water within the Hadnot Point and Holcomb Boulevard water treatment plant service areas.

ATSDR estimates that drinking water from the Hadnot Point water treatment plant exceeded the current maximum contaminant levels (MCL) for one or more VOCs from August 1953 through January 1985. The specific VOCs that ATSDR examined are:

- trichloroethylene (TCE),
- tetrachloroethylene (PCE),
- *trans* 1,2-dichloroethylene, (1,2-tDCE)
- vinyl chloride, and
- benzene.

With the exception of *trans* 1,2-dichloroethylene, these chemicals have been classified as causing or probably causing cancer (carcinogenic). Non-cancer diseases associated with the chemicals are aplastic anemia, infertility, kidney diseases, liver disease, lupus, miscarriage, Parkinson's disease, scleroderma, and skin disorders.

What is a maximum contaminant level?

The maximum contaminant level (MCL) is the highest level of a contaminant that is allowed in drinking water. Drinking water, including bottled water, reasonably may be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. EPA sets standards for approximately 90 contaminants and indicators in drinking water. The MCL is based on a scientific opinion after a careful review of scientific literature for both cancer and non-cancer health effects.

The Hadnot Point Water Treatment Plant opened in 1942 and provided water to both the Hadnot Point and Holcomb Boulevard service areas. The Hadnot Point water system was contaminated with TCE, PCE and refined petroleum products. The Holcomb Boulevard Water Treatment plant came online in 1972. The Holcomb Boulevard system was not contaminated, except for periodic transfers of water from the Hadnot Point Water System.

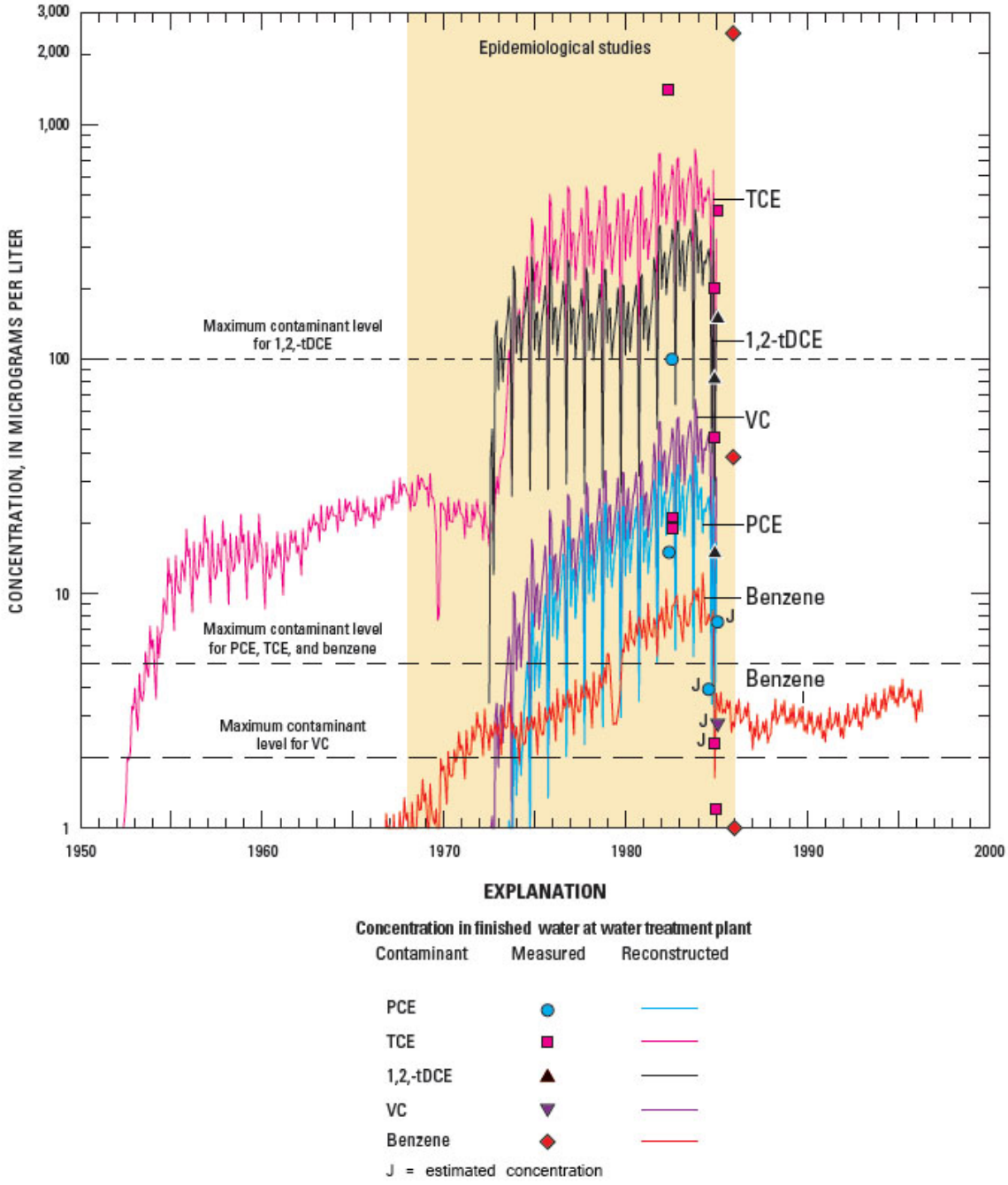
Trichloroethylene

Within the Hadnot Point service area, drinking water concentrations exceeded the maximum contaminant level (MCL) for trichloroethylene (TCE) from August 1953-January 1985. Reconstructed TCE concentrations in Hadnot Point drinking water reached a maximum level of 783 µg/L during November 1983. The maximum TCE level in Holcomb Boulevard was 66 µg/L in February 1985.The MCL for TCE is 5 µg/L. It was set in 1989.

Tetrachloroethylene

Within the Hadnot Point service area, drinking water concentrations exceeded the maximum contaminant level (MCL) for tetrachloroethylene (PCE) from August 1974-January 1985. Reconstructed PCE concentrations in Hadnot Point drinking water reached a maximum level of 39µg/L in November 1983. The maximum PCE level in Holcomb Boulevard drinking water was 3 µg/L in February 1985. The MCL for PCE is 5 µg/L. It was set in 1992.

Reconstructed drinking water concentrations at the Hadnot Point Water Treatment Plant


3,000
2,000
1,000
100
10
1
CONCENTRATION, IN MICROGRAMS PER LITER
1950
1960
1970
1980
1990
2000
Epidemiological studies
Maximum contaminant level for 1,2,-tDCE
Maximum contaminant level for PCE, TCE, and benzene
Maximum contaminant level for VC
TCE
1,2-tDCE
VC
PCE
Benzene
Benzene
J
J
J
J
EXPLANATION
Concentration in finished water at water treatment plant
Contaminant
Measured
Reconstructed
PCE
TCE
1,2,-tDCE
VC
Benzene
J = estimated concentration

Trans-1,2-dichloroethylene

Within the Hadnot Point service area, drinking water concentrations exceeded the maximum contaminant level (MCL) for *trans*-1,2-dichloroethylene (1,2-tDCE) from November 1972-January 1985. Reconstructed 1,2-tDCE concentrations in Hadnot Point drinking water reached a maximum level of 435 µg/L during November 1983. The maximum 1,2-tDCE level in Holcomb Boulevard drinking water was 33 µg/L in February 1985. The MCL for 1,2-tDCE is 100 µg/L. It was set in 1992.

Vinyl chloride

Within the Hadnot Point service area, drinking water concentrations exceeded the maximum contaminant level (MCL) for vinyl chloride from November 1972-January 1985. Reconstructed vinyl chloride concentrations in Hadnot Point drinking water reached a maximum level of 67 µg/L during November 1983. The maximum vinyl chloride level in Holcomb Boulevard drinking water was 6 µg/L during February 1985. The MCL for vinyl chloride is 2 µg/L. It was set in 1989.

Benzene

Within the Hadnot Point service area, drinking water concentrations exceeded the maximum contaminant level (MCL) for benzene from January 1979-January 1985. Reconstructed benzene concentrations in Hadnot Point drinking water reached a maximum level of 12 µg/L during April 1984. The maximum benzene level in Holcomb Boulevard drinking water was 3 µg/L during several months in 1972. The MCL for benzene is 5 µg/L. It became effective in 1989.

Next Steps

The estimated monthly concentrations of selected VOCs in drinking water provided in this report gives epidemiologists information they need to estimate exposure for human health studies. ATSDR is working on four health studies that are expected to be released in 2013 and 2014.

ATSDR Health Studies for Camp Lejeune

Birth Defects and Childhood Cancer Study—Looks at whether children born from 1968-1985 to mothers who were exposed to contaminated drinking water at Camp Lejeune have increased risk for specific birth defects and childhood cancers

Health Survey of Marine Corps Personnel and Civilians—Will help determine whether contaminated water may have affected people's health and provide more information about how environmental and chemical exposures affect human health

Male Breast Cancer Study—Will look at cases of male breast cancer among Marines to determine whether a link exists between cases and exposure to contaminated drinking water at Camp Lejeune

Mortality Study—Looks at all causes of death to determine if there is a link between specific causes of death and exposure to contaminated drinking water at Camp Lejeune