

# **ATSDR's Current Health Study at Marine Corps Base Camp Lejeune, NC: Use of Water-Modeling Methods**

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**Presentation for Star-News Forum Panel**  
**Wilmington, North Carolina**  
**August 31, 2007**

*The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the  
Agency for Toxic Substances and Disease Registry*



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# Acknowledgments

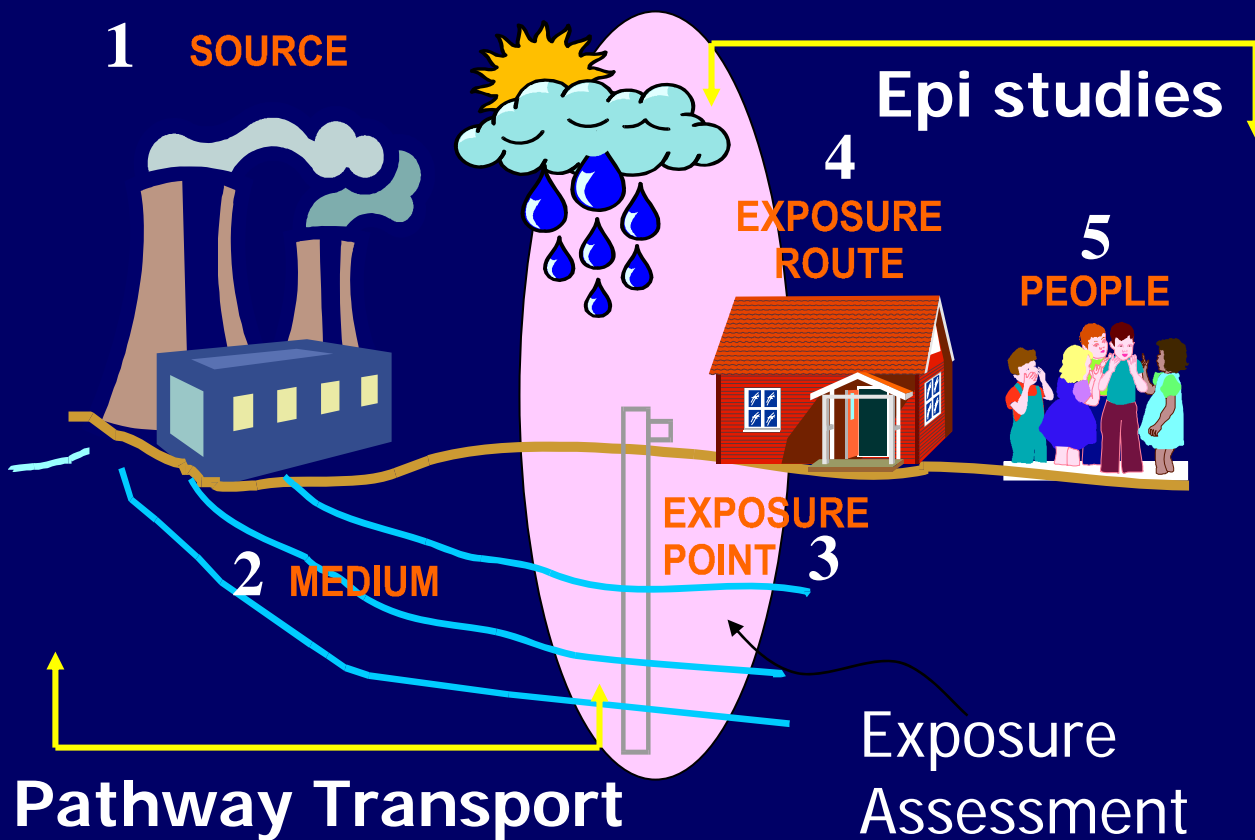
- ❖ US Marine Corps, EMD and PWD
  - ❖ SA Brewer, B Ashton, SR Williams, R Cheng, J Hartsoe, DE Hill
- ❖ US Geological Survey
  - ❖ NC and GA Water Science Center
  - ❖ Enterprise Publishing Network
- ❖ US EPA
  - ❖ Region IV
- ❖ Former Marines and Families



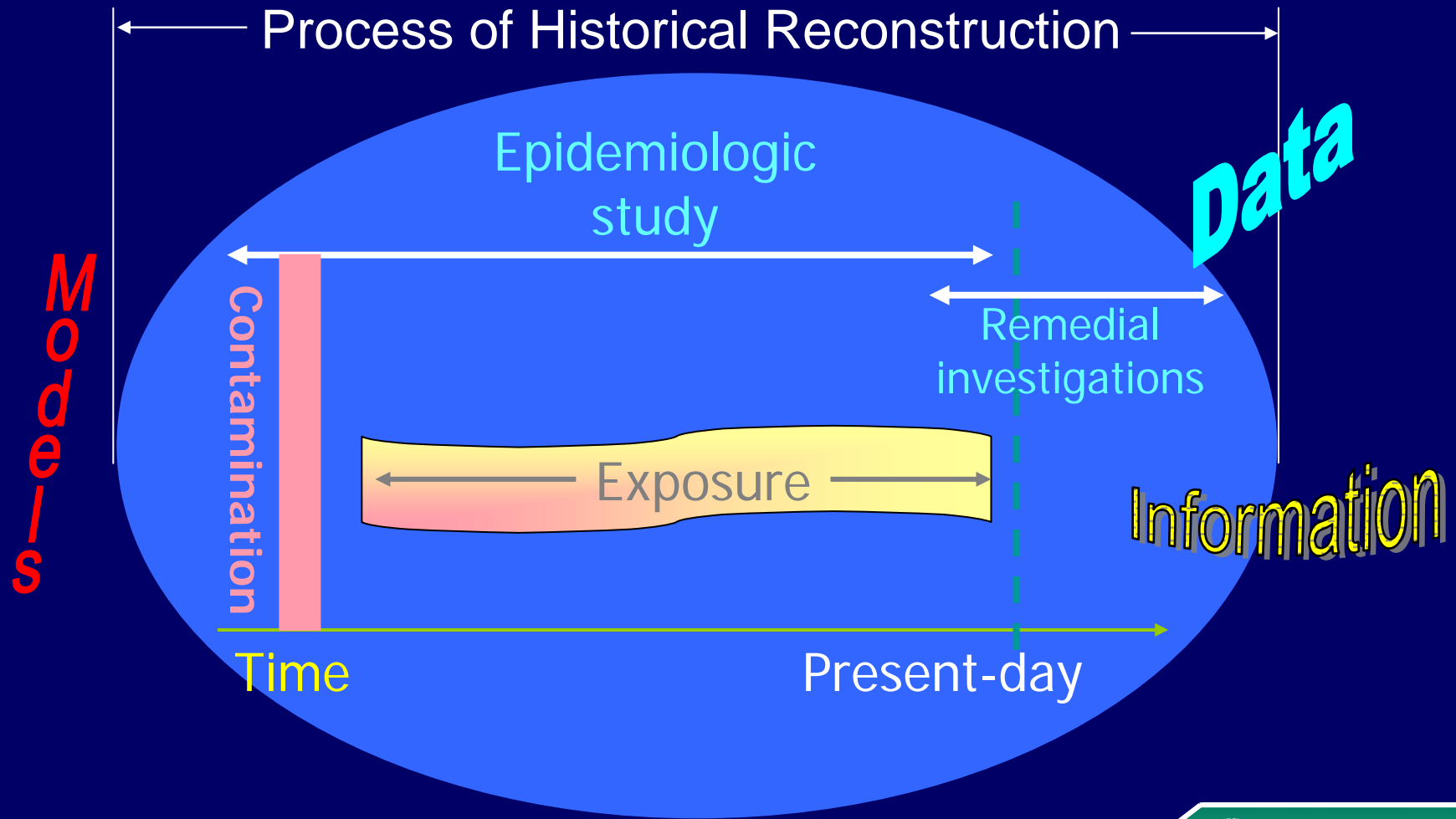
# Environmental pathways, exposure assessment, and modeling concepts



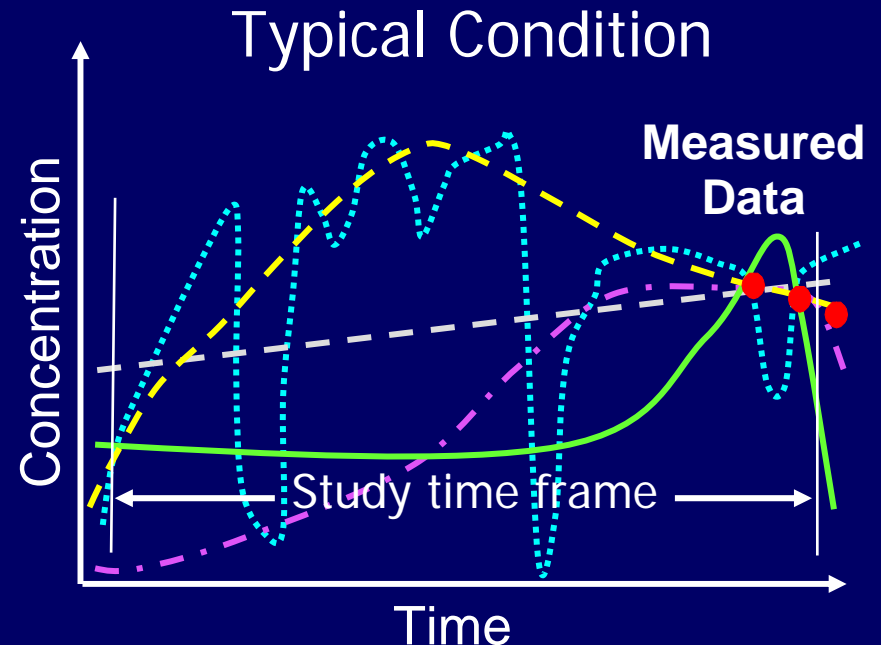
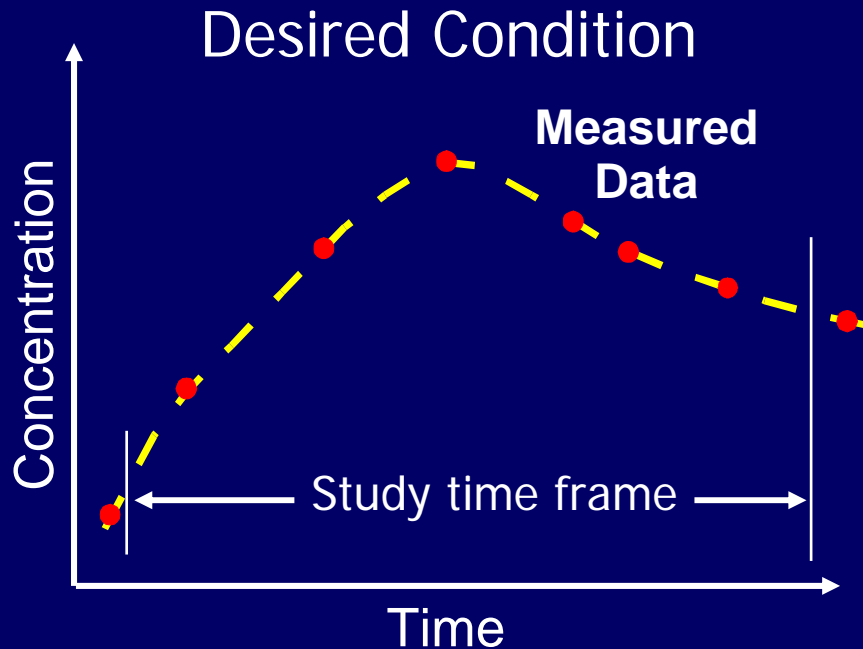
# Environmental health process



# Historical reconstruction



# Why use models to estimate exposure scenarios?



# ATSDR's current health study at U.S. Marine Corps Base Camp Lejeune, North Carolina

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# Exposure to volatile organic compounds in drinking water and specific birth defects and childhood cancers (case-control study)

## ❖ Multi-step process

- ❖ Review scientific literature to identify specific birth defects and childhood cancers associated with drinking water contaminated with chlorinated solvents
- ❖ Conduct telephone survey to ascertain potential cases
- ❖ Obtain medical records to verify diagnoses of reported cases
- ❖ Conduct a case-control study

- ❖ interview parents

 ❖ obtain estimates of exposure from the water modeling component

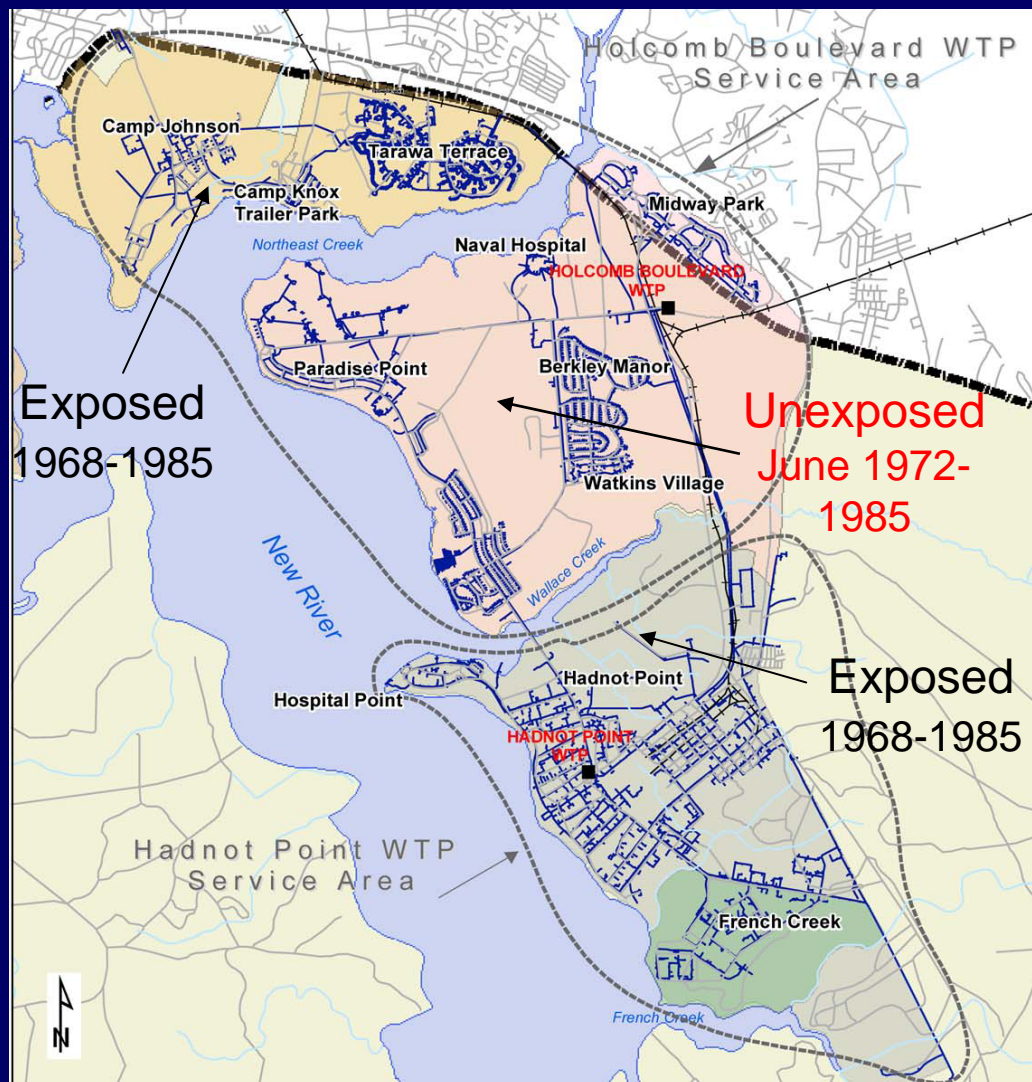


# Goals and objectives of water-modeling activities supporting current health study

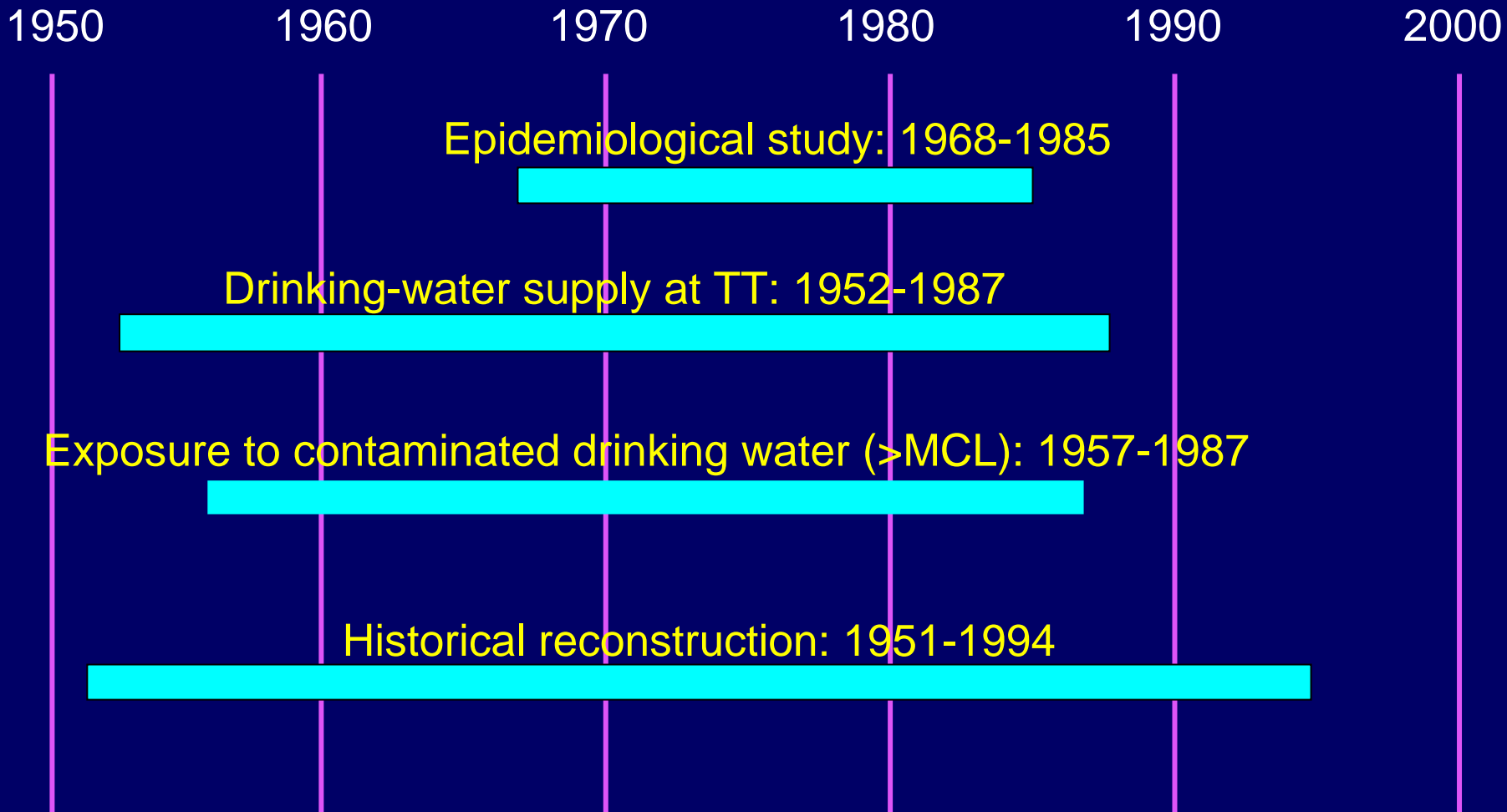
- ❖ Arrival of contaminants at public water-supply wells
- ❖ Distribution of contaminants by housing location
- ❖ Reliability of and confidence in water-modeling results



# Epidemiological study areas



# Study and analysis time frames for Tarawa Terrace



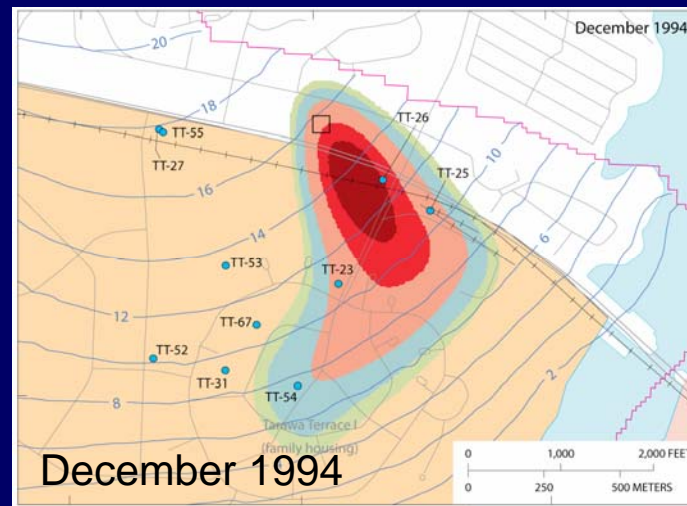
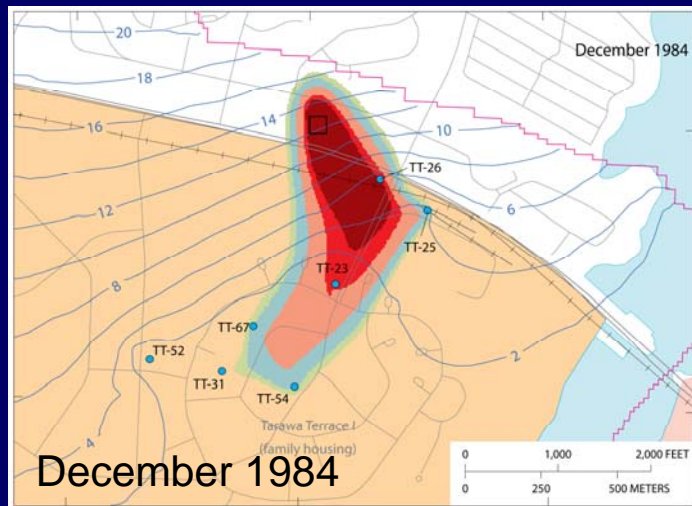
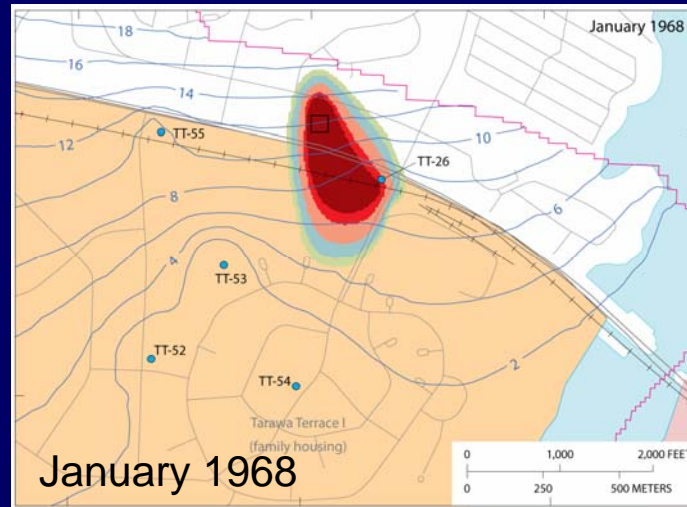
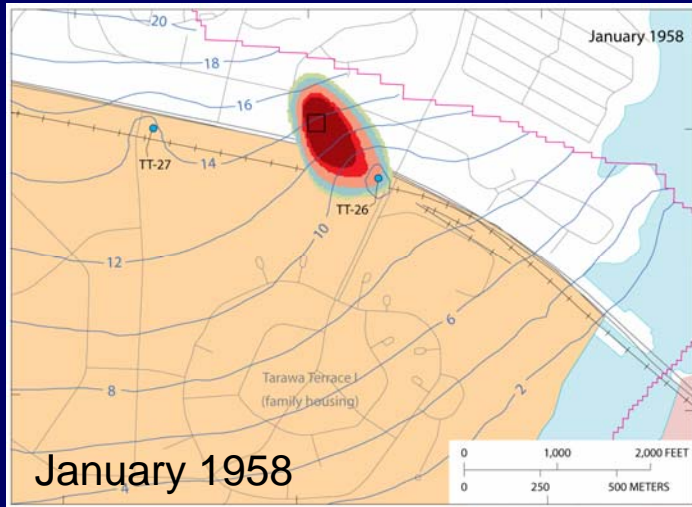
# Final Results for Tarawa Terrace and Vicinity

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# Groundwater fate and transport of PCE



**EXPLANATION**

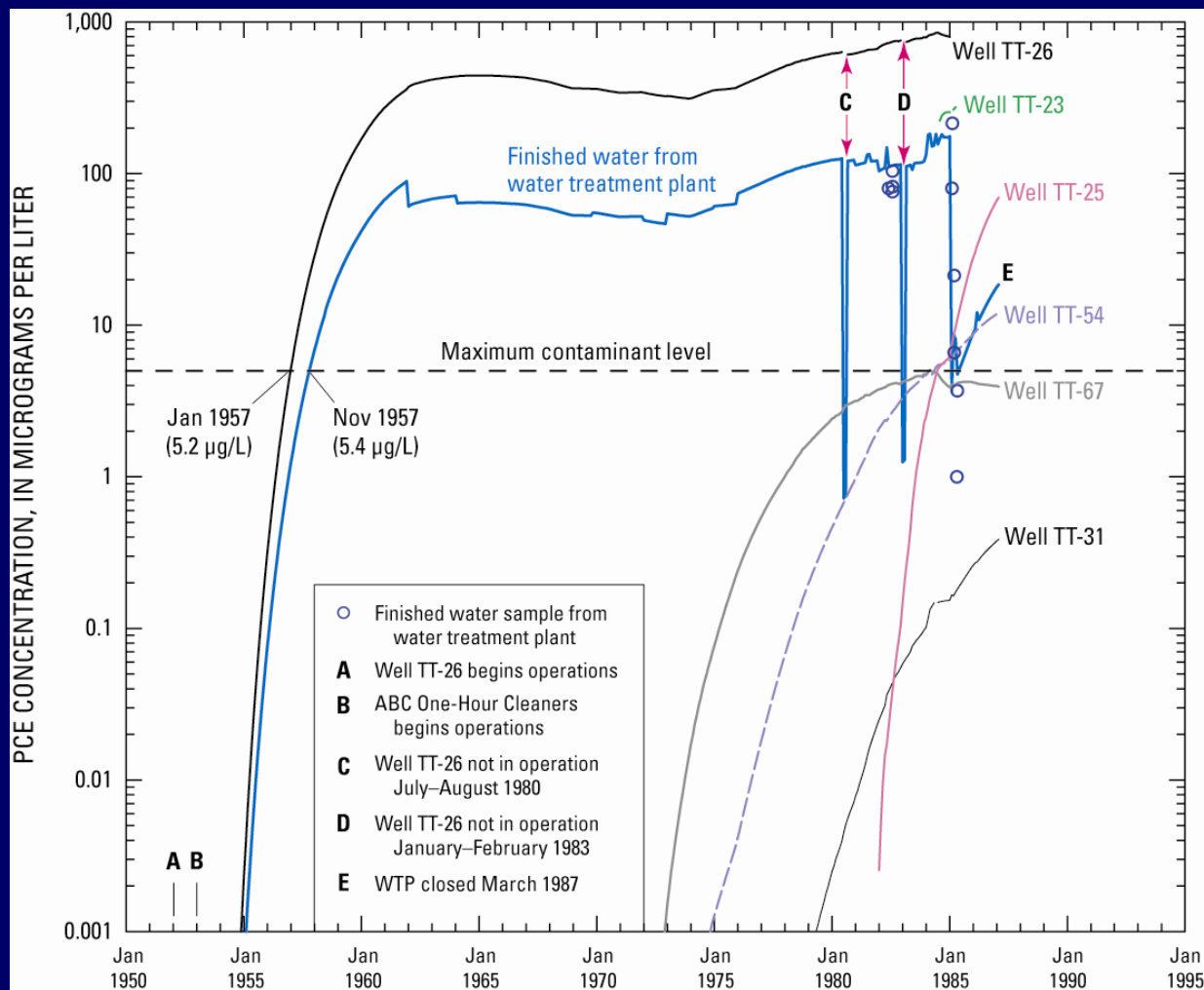
- Historical water-supply area
- Tarawa Terrace
- Holcomb Boulevard
- Model boundary
- Frenchmans Creek
- Simulated potentiometric contour—Shows simulated potentiometric surface during January 1958. Contour interval 2 feet. Datum is National Geodetic Vertical Datum of 1929
- Simulated direction of groundwater flow, January 1958
- ABC One-Hour Cleaners
- TT-26 Pumping water-supply well and identification
- PCE concentration, in micrograms per liter
  - 1 to 5
  - Greater than 5 to 50
  - Greater than 50 to 500
  - Greater than 500 to 1,500
  - Greater than 1,500



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# Concentration of finished water delivered from Tarawa Terrace WTP



# Summary of simulation results

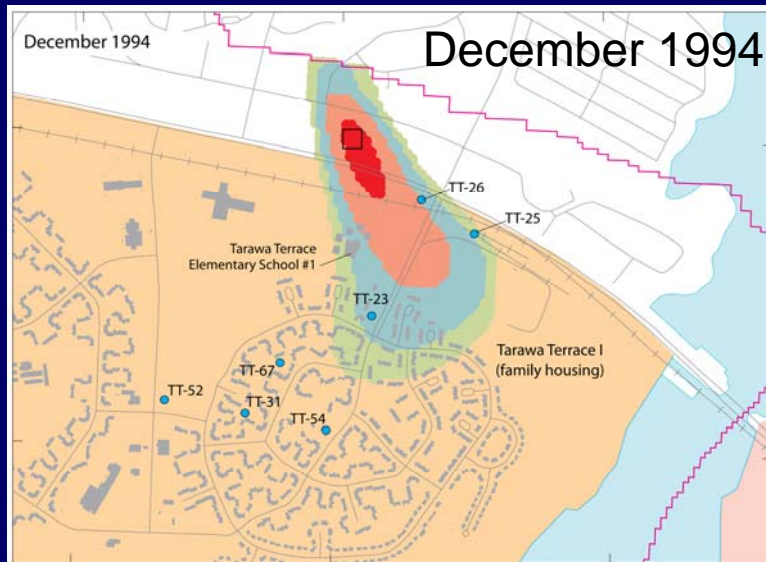
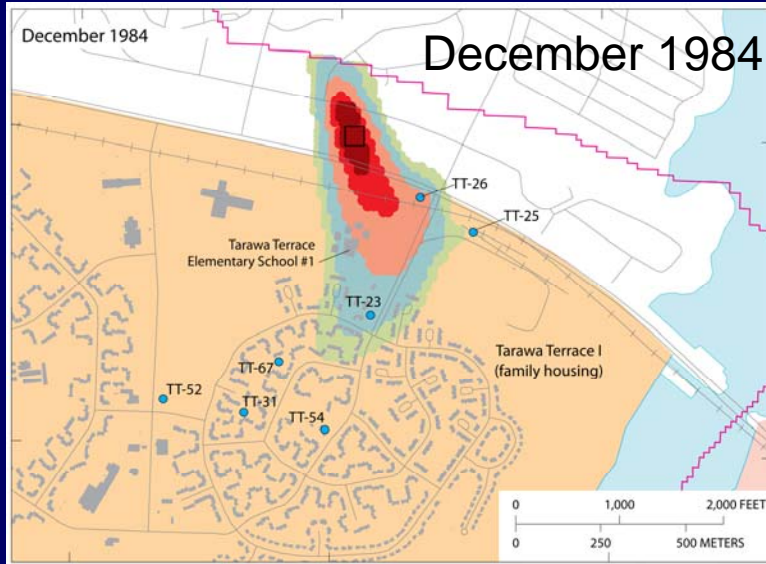
Water supply	Date and duration, in months, MCL exceeded	Maximum PCE concentration, in $\mu\text{g/L}$	Average PCE concentration, in $\mu\text{g/L}^*$
TT-23	Aug 1984–Apr 1985: 8 months	274	252
TT-25	Jul 1984-Feb 1985: 32 months	69	27
TT-26	Jan 1957-Jan 1985: 333 months	851	414
WTP	Nov 1957-Feb 1987: 346 months	183	70

\*Exceeding MCL for PCE of 5  $\mu\text{g/L}$





# PCE in soil gas (depth of 10 ft)



**EXPLANATION**

- Historical water-supply area
- Tarawa Terrace
- Holcomb Boulevard
- Model boundary
- ABC One-Hour Cleaners
- TT-26 Pumping water-supply well and identification

PCE vapor-phase concentration, in micrograms per liter of air

- 1 to 5
- Greater than 5 to 50
- Greater than 50 to 500
- Greater than 500 to 1,500
- Greater than 1,500

# Summary of Findings

- ❖ PCE concentration exceeded the current MCL of 5  $\mu\text{g/L}$  in finished water at the Tarawa Terrace WTP for 346 months
  - ❖ November 1957-February 1987
  - ❖ Maximum modeled value: 183  $\mu\text{g/L}$
  - ❖ Maximum measured value: 215  $\mu\text{g/L}$  (Feb 1985)



# Summary of Findings--continued

- ❖ PCE degradation by-products **TCE** and **1,2-tDCE** in finished water at the Tarawa Terrace WTP:
  - ❖ **Modeled concentrations: 2-15  $\mu\text{g/L}$**
  - ❖ **Measured concentration (TCE): 8  $\mu\text{g/L}$  (Feb 11, 1985)**
  - ❖ **Measured concentration (1,2-tDCE): 12  $\mu\text{g/L}$  (Feb 11, 1985)**



# Summary of Findings--continued

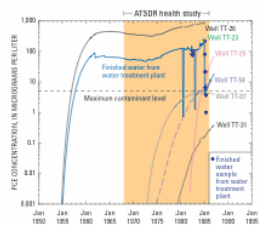
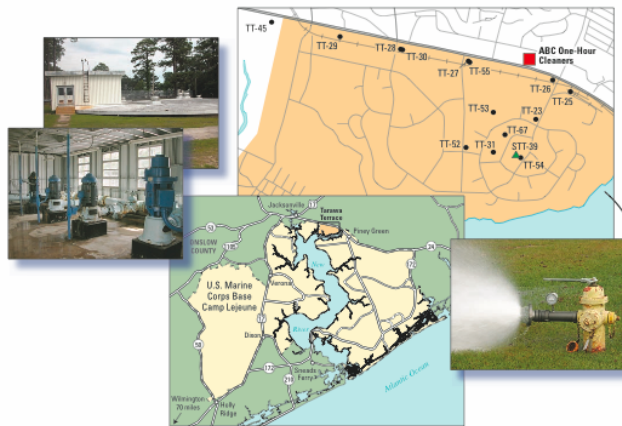
- ❖ Exposure to PCE and PCE degradation by-product contaminated drinking water **ceased after February 1987**
- ❖ Potential for exposure from PCE and PCE degradation by-product vapor in soil (soil gas) at elementary school and in Tarawa Terrace I family housing area simulated through December 1994.



# Tarawa Terrace reports

## Executive Summary

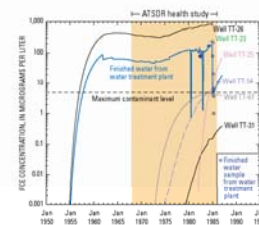
Analyses of Groundwater Flow, Contaminant Fate and Transport, and Distribution of Drinking Water at Tarawa Terrace and Vicinity, U.S. Marine Corps Base Camp Lejeune, North Carolina: Historical Reconstruction and Present-Day Conditions  
**Executive Summary**



Atlanta, Georgia—June 2007

## Summary of Findings

Analyses of Groundwater Flow, Contaminant Fate and Transport, and Distribution of Drinking Water at Tarawa Terrace and Vicinity, U.S. Marine Corps Base Camp Lejeune, North Carolina: Historical Reconstruction and Present-Day Conditions  
**Chapter A: Summary of Findings**



Atlanta, Georgia—July 2007



# Information and results available to public

- ❖ **ATSDR Camp Lejeune web site**
  - ❖ <http://www.atsdr.cdc.gov/sites/lejeune/watermodeling.html>
- ❖ **Web application**
  - ❖ Table listing simulated concentrations of PCE, TCE, 1,2-*t*DCE, and VC by month and year
  - ❖ Graph of simulated concentrations
- ❖ **PDF files for down load**
  - ❖ Peer Review Panel on Water Modeling report
  - ❖ **Executive Summary report**
  - ❖ Table of simulated concentrations vs. time
  - ❖ Graph of simulated concentrations vs. time
  - ❖ **Chapter A – Summary of Findings**



# Thank you for the opportunity to present information on ATSDR's current health study and water- modeling results at Marine Corps Base Camp Lejeune, NC

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