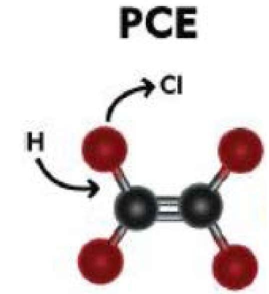
BANDERA ROAD CAG BRIEFING

CHRIS VILLARREAL
OCTOBER 25, 2012

Presentation Outline

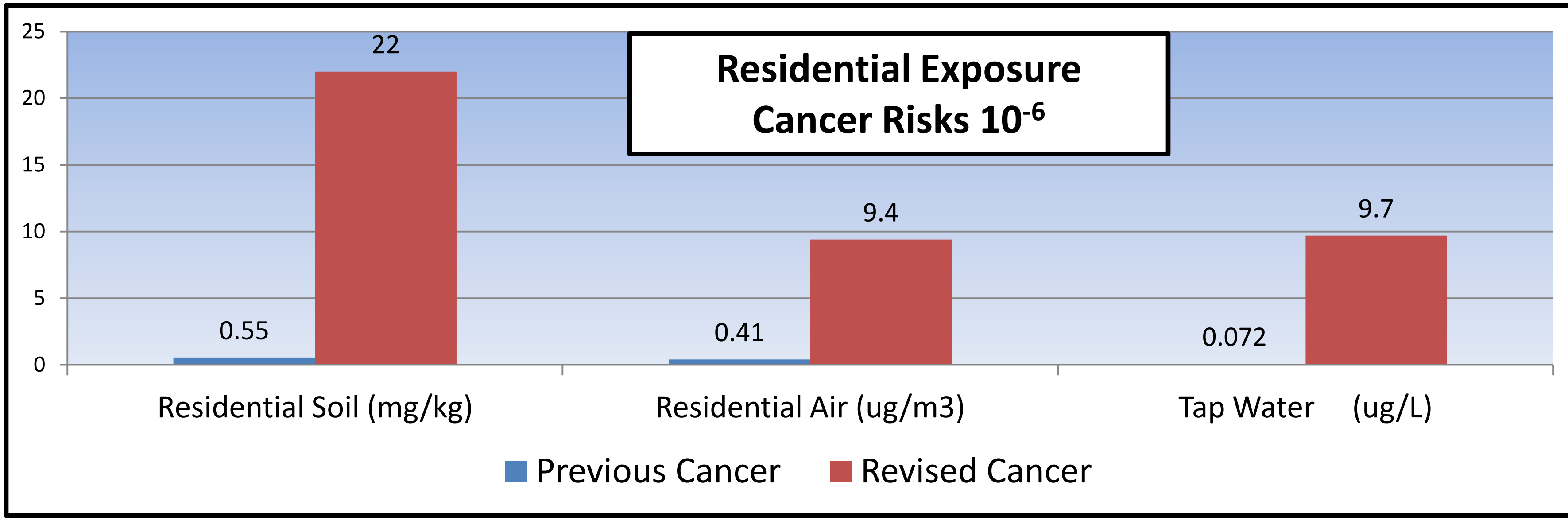
- PCE Toxicity Evaluation
- Soil Vapor and Indoor Air Sampling
  Results from May 2012
- USGS Study - Assessing the
  Vulnerability of Public-Supply Wells
  to Contamination Edwards Aquifer

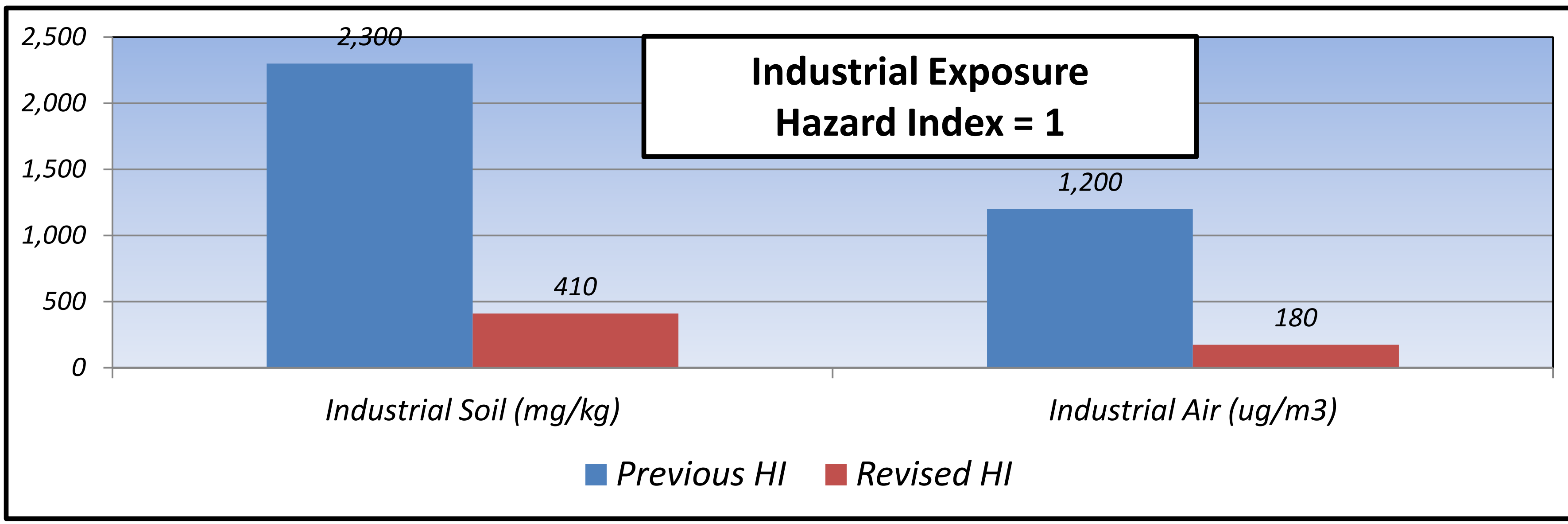
PCE Toxicity Evaluation



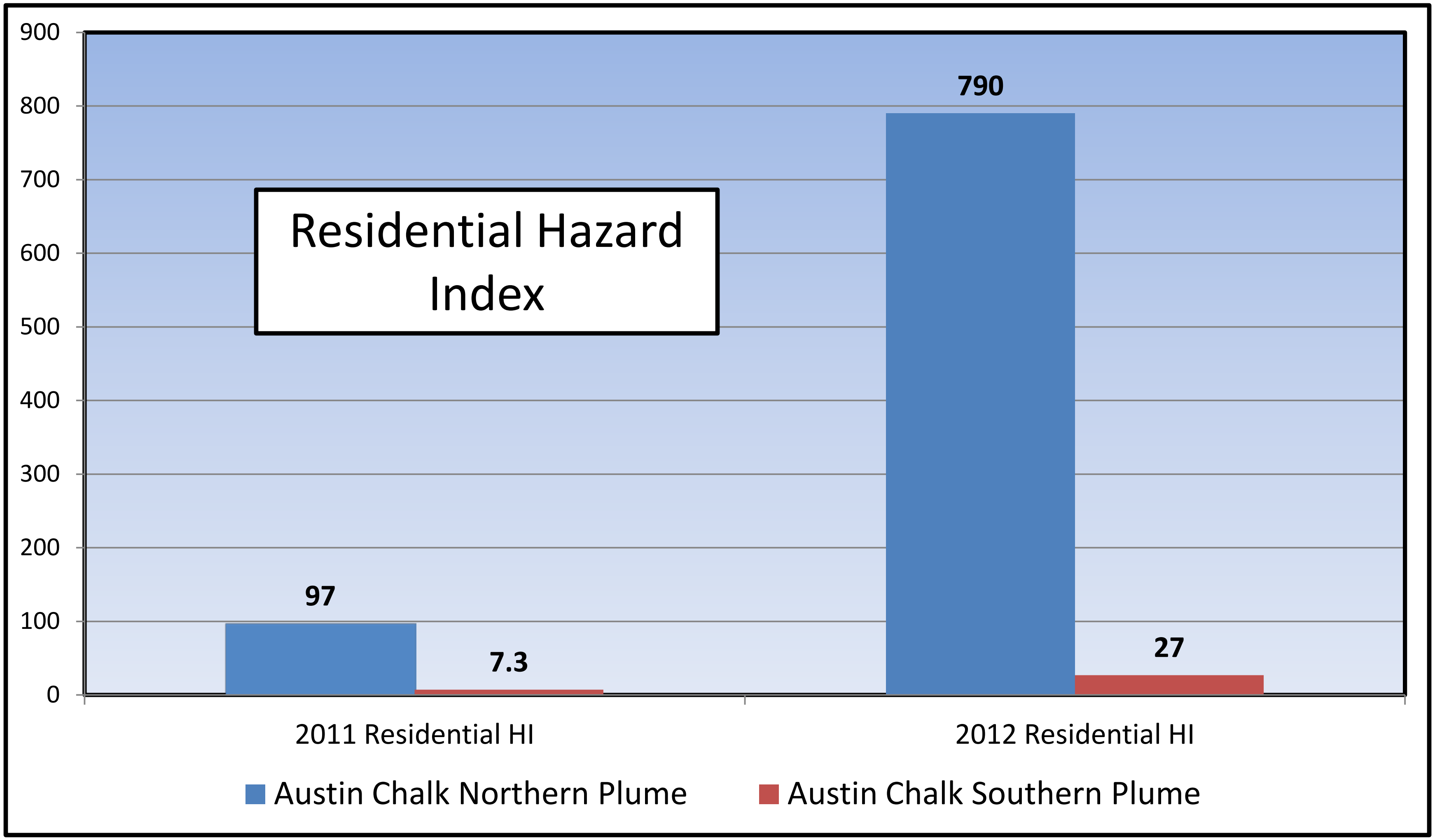
- Final PCE toxicological evaluation posted to IRIS on February 10, 2012.
- Both cancer and non-cancer toxicology values were revised.
- Cancer potency estimates declined significantly (i.e., less conservative).
- Non-cancer reference values decreased - were determined to be more toxic.

PCE SCREENING LEVELS

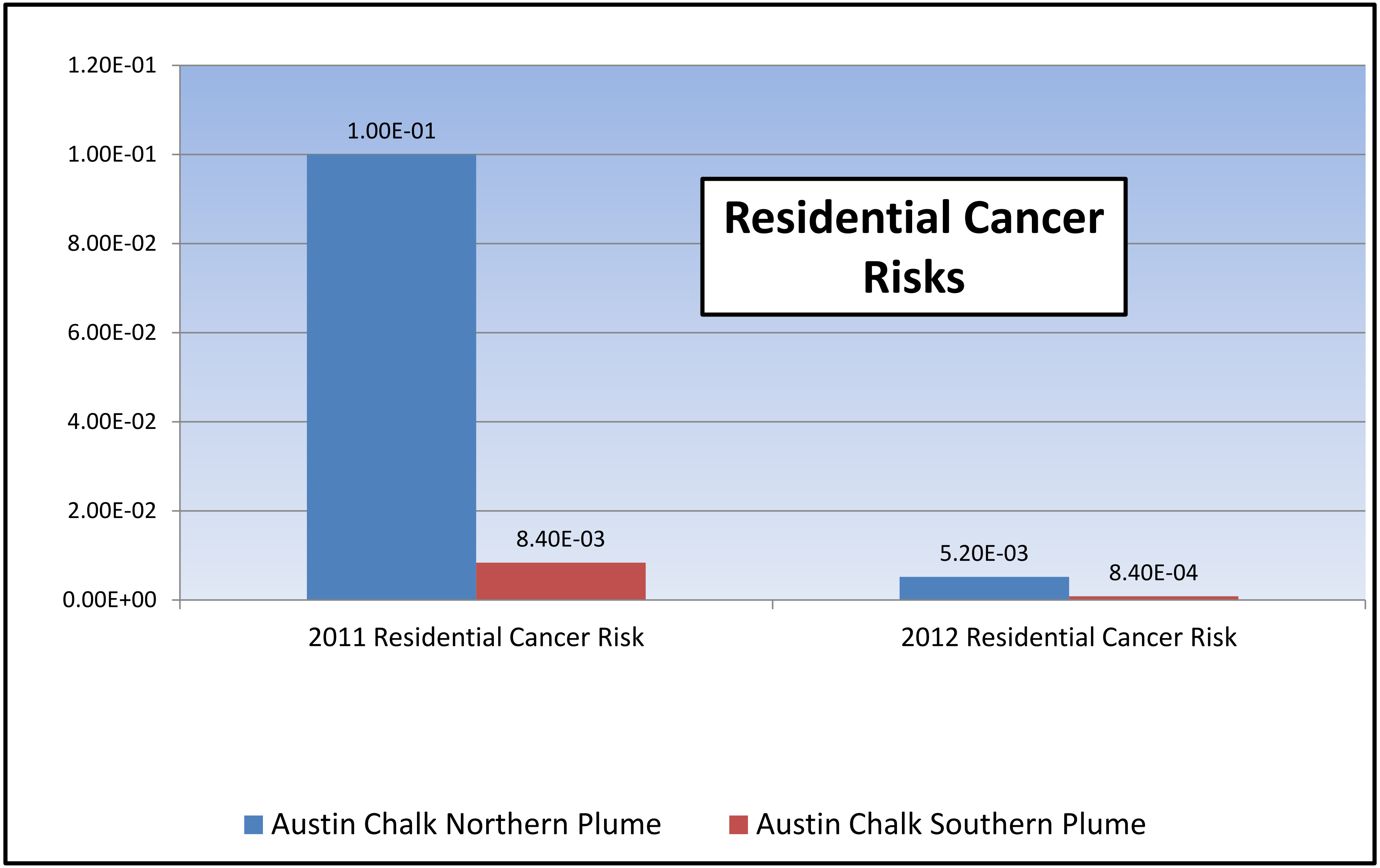




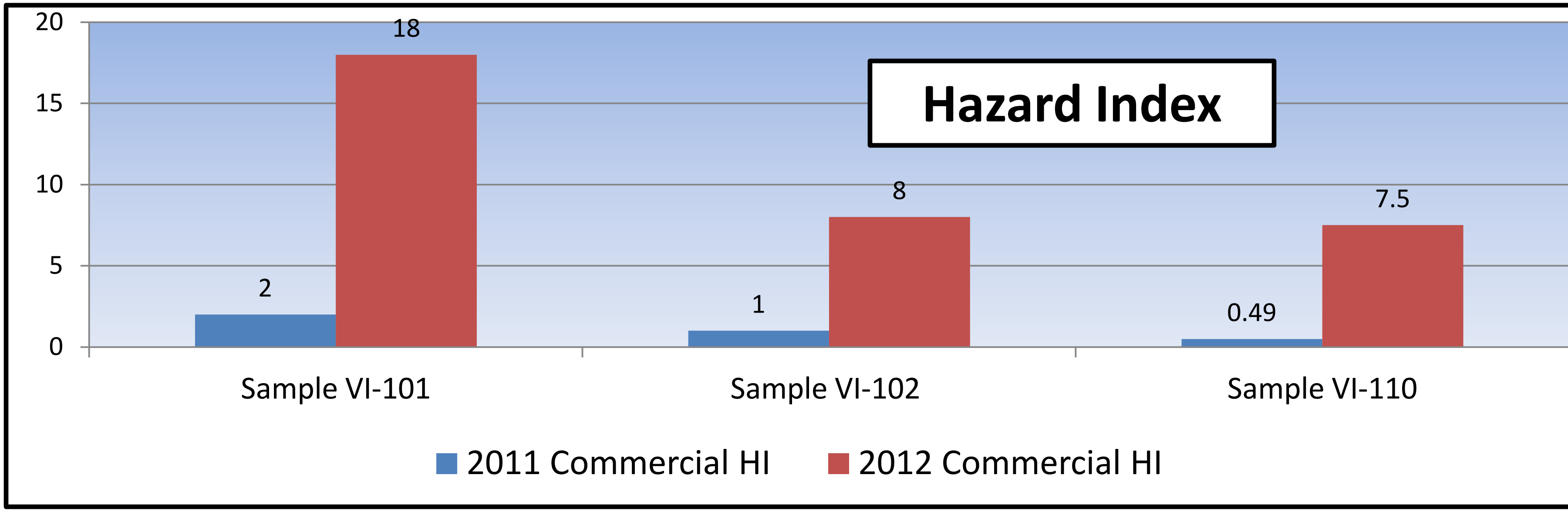
BANDERA ROAD AUSTIN CHALK GROUND WATER
2011 AND 2012 REVISED HAZARD INDEX CALCULATIONS

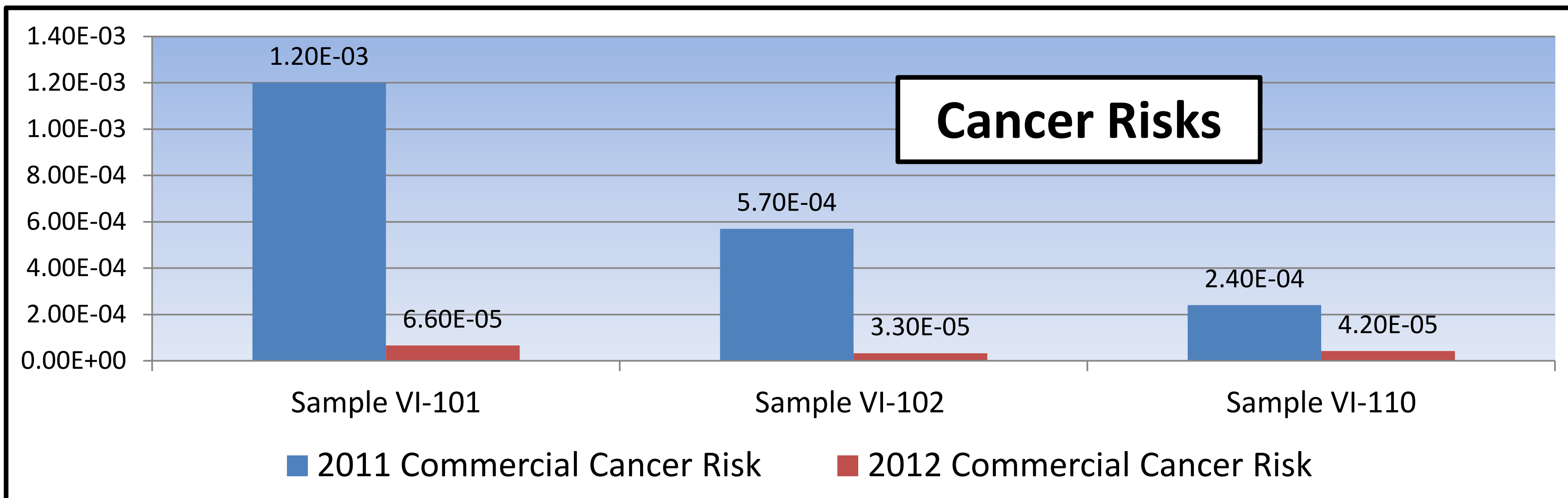


BANDERA ROAD AUSTIN CHALK GROUND WATER
2011 AND 2012 REVISED CANCER RISKS CALCULATIONS



Former Dry Cleaner (Building B1)
Indoor Air Hazard Index (HI) and Cancer Risks

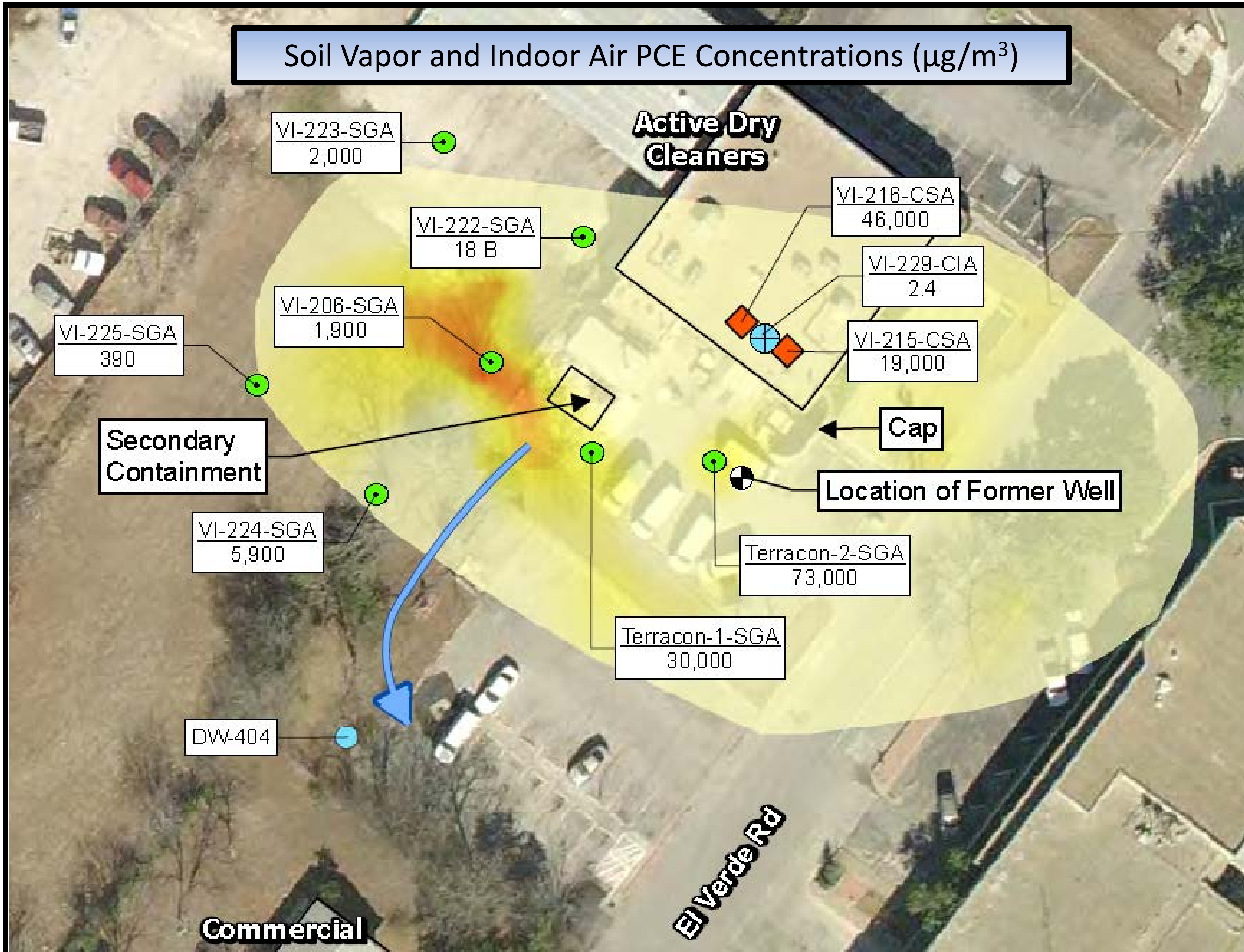




Indoor Air PCE Concentrations (µg/m³)

PCE REGIONAL SCREENING LEVELS – INDOOR AIR		
Indoor Air (µg/m³)	Cancer Risk – 10^{-6}	HI = 1
Residential	9.4	42
Industrial	47	175

Soil Vapor and Indoor Air PCE Concentrations (µg/m^3)



USGS Study

Assessing the Vulnerability of Public-Supply Wells to Contamination

Edwards Aquifer Near San Antonio, Texas

(November 2011)

USGS
science for a changing world

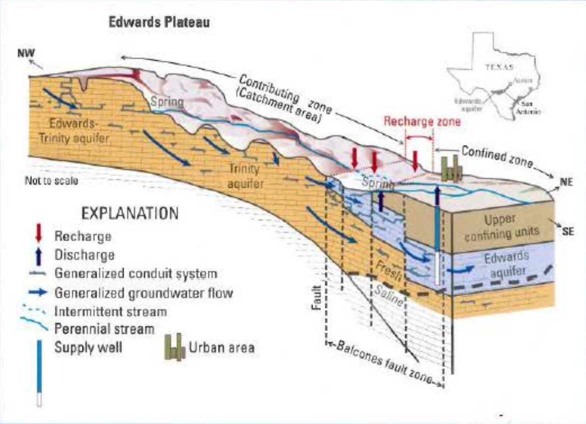
National Water-Quality Assessment, Transport of Anthropogenic and Natural Contaminants (TANC) to Public-Supply Wells

Assessing the Vulnerability of Public-Supply Wells to Contamination: Edwards Aquifer Near San Antonio, Texas

The U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program found, in studies from 1991 to 2001, low levels of mixtures of contaminants in groundwater near the water table in urban areas across the Nation. Contaminants were detected less frequently in deeper groundwater typically developed for public supply (Hamilton and others, 2004). The proximity of contaminant mixtures to underlying public water-supply sources, however, prompted the NAWQA Program to begin intensive studies in 2001 to assess the vulnerability of public-supply wells to contamination. Specifically, pathways and processes by which contaminants reach public-supply wells in nine aquifer systems across the country are being investigated. Scientists are studying the processes that occur below land surface—whereby contaminants are mobilized or attenuated—as well as investigating how human activities can affect the vulnerability of public-supply wells to contamination.

This fact sheet highlights findings from the vulnerability study of a public-supply well field in San Antonio, Texas (Lindgren and others, 2011a; Musgrove and others, 2011). The well field consists of six production wells that tap the Edwards aquifer. Although a single well was initially selected for study, constraints of well-field operation made it necessary for samples to be collected from different wells within the well field for various components of the study. Individual wells have a pumping capacity of

The Edwards aquifer in south-central Texas is composed primarily of limestone and dolostone deposited in a shallow marine environment; it is one of the most productive aquifers in the United States. Most water entering the Edwards aquifer originates from streams that drain the uplifted Edwards Plateau (also called the contributing zone or catchment area) to the west and north of San Antonio. As these streams flow across the Balcones fault zone, where porous rocks of the Edwards aquifer are exposed at land surface, much of the streamflow recharges the aquifer by infiltrating through fractures and karst features (caused by dissolution of bedrock). Precipitation that falls between the streams in the recharge zone also infiltrates into the aquifer, moving rapidly along karst features and faults. A relatively small amount of water flows into the Edwards aquifer from the adjacent and underlying Trinity aquifer.



Once recharge reaches the Edwards aquifer, it typically moves downward and laterally in a southeasterly direction, into the part of the system that is overlain by rocks of the upper confining units. Fine-grained, clay-rich layers in the upper confining units isolate this part of the Edwards aquifer from sources of vertical recharge. Groundwater in the Edwards aquifer encounters high-angle faults as it moves downgradient. Some of these faults might act as an impediment to flow, where layers of less permeable rock have been downdropped and now abut layers of the aquifer, and some faults may act as conduits for flow. Groundwater flow in the confined zone turns to the northeast, toward discharge areas at large springs between San Antonio and Austin. Flow is parallel to the southwest-to-northeast orientation of many of the faults. In some areas, these faults have been widened by dissolution, creating conduits and linear zones of increased permeability through which water can move rapidly.

In addition to natural discharge at springs, discharge from the Edwards aquifer occurs as groundwater withdrawals from wells, primarily for municipal, industrial, and irrigation water supply. Annual discharge by wells more than tripled between 1939 and 2000 in the San Antonio region. Increased pumping has affected springflow at some springs over time, but no long-term declines in groundwater levels have been observed.

Four Primary Findings that affect the movement and fate of contaminants and the vulnerability of the public-supply well field in San Antonio:

1. groundwater age (how long ago water entered, or recharged the aquifer),
2. fast pathways for flow of ground water through features formed or enlarged by dissolution of bedrock,
3. recharge characteristics of the aquifer, and
4. natural geochemical processes within the aquifer.

The vortex in this stream is caused by rapid drainage of water through a 2-foot-diameter karst feature in the streambed. Streams crossing the recharge zone of the Edwards aquifer lose much of their flow as water rapidly infiltrates to the water table along dissolution features such as this one. (Photo by David Johns, City of Austin, used with permission.)

GROUNDWATER AGE

- Groundwater in the well field and about 1.5 miles upgradient is generally young, recently recharged water (<1 to 41 years old) throughout most of the thickness of the aquifer. Unlike most aquifer settings, water age does not increase with depth near the well field.
- Less than 1 percent of the water entering well is 50 or more years old.

GROUNDWATER AGE

Such a large percentage of very young water indicates that :

(a) contaminants entering the aquifer may be transported rapidly to the well,

(b) there is limited time for chemical reactions to occur in the aquifer that may attenuate contaminants.

Karst Features Serve as Fast Pathways for Movement of Contaminants to the Public Supply Well

- Rapid flow of water through dissolution-enlarged pathways was evidenced by fluctuations in ground water chemistry that can be correlated to individual precipitation events. With rain, concentrations of PCE increased (at the selected well field), likely because of accelerated movement of water from an upgradient source to the well. PCE concentrations were generally in the 0.2 to 0.8 parts per billion range.

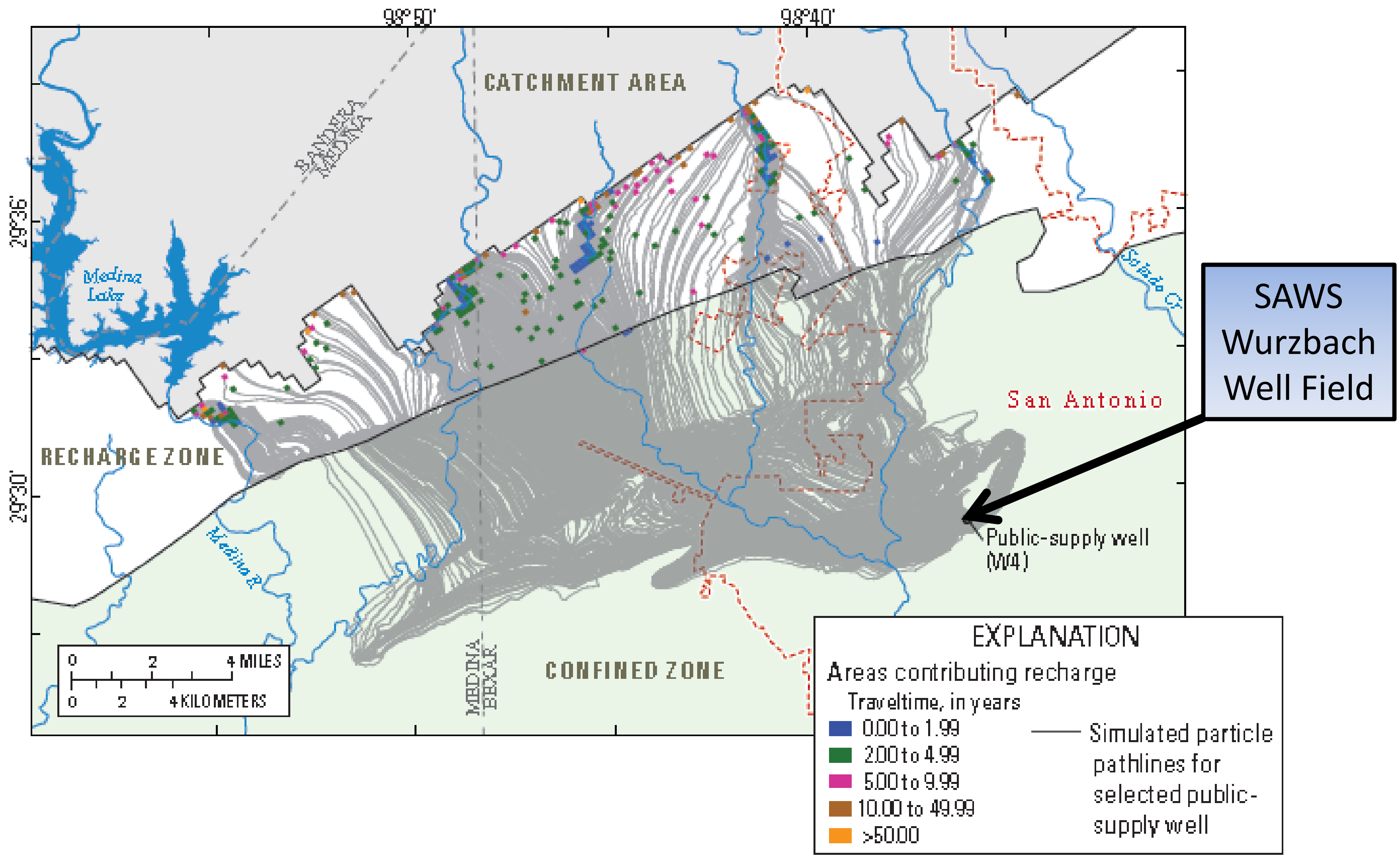
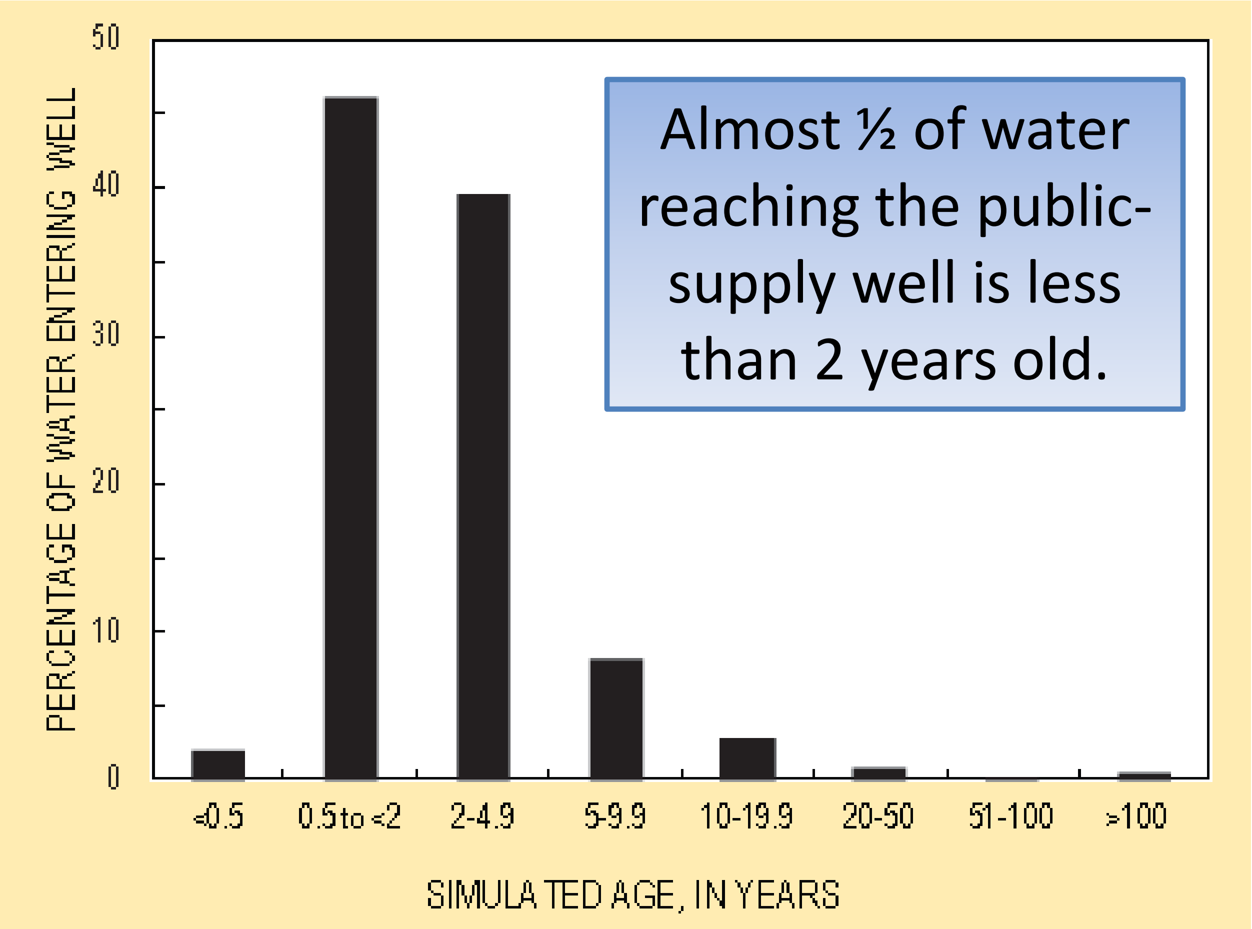


Figure 2. The colored zones on the map show the simulated areas contributing recharge to a public-supply well selected for investigation in San Antonio, Texas. These colored zones indicate where water that eventually reaches the public-supply well enters the groundwater system at the water table.

Karst Features Serve as Fast Pathways for Movement of Contaminants to the Public Supply Well

Simulated recharge to the well originates as far as 16 miles from the well, yet most of the water reaches the well in less than 5 years.



Aquifer Recharge Characteristics Affect Movement of Contaminants to the Public Water Supply

Water samples from shallow, intermediate, and deep zones of the Edwards Aquifer at public water supply well W4 found that the water was notably well mixed. Reasons for this include:

- Recharge enters the Edwards aquifer directly, without infiltrating through overlying, chemically dissimilar rock units or thick soils.
- Recharging water (and any contaminants present in the water) can travel to depths in the aquifer rapidly through preferential flow paths, such as dissolution-enlarged faults, fractures, and bedding planes.
- The large volume of recharge (due to ongoing stream flow contribution with periodic precipitation) and steep hydraulic gradient caused water to flush rapidly through conduits and other dissolution features of the aquifer.

Natural Geochemical Processes in the Aquifer Affect the Fate of Contaminants

Geochemical conditions, such as the oxygen content of ground water, control whether specific contaminants are attenuated or mobilized once they enter the ground water system. In the oxic conditions found throughout the Edwards aquifer (dissolved oxygen concentrations of at least 1 milligram per liter), anthropogenic (man-made) contaminants such as PCE will not degrade and can persist over long distances.

U.S. Department of Interior
U.S. Geological Survey Reports/Professional Paper

Simulations of Groundwater Flow and Particle-Tracking Analysis in the Zone of Contribution to a Public-Supply Well in San Antonio, Texas (Scientific Investigations Report 2011-5149)

Hydrogeology, Chemical Characteristics, and Water Sources and Pathways in the Zone of Contribution of a Public-Supply Well in San Antonio, Texas)Scientific Investigations Report 2011-5146)

Diffuse-Flow Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas (Scientific Investigations Report 2006-5319)

Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas (Scientific Investigations Report 2004-5277)

National Water-Quality Assessment Program
Hydrogeologic Settings and Groundwater-Flow Simulations for Regional Investigations of the Transport of Anthropogenic and National Contaminants to Public-Supply Wells- Investigations Begun in 2004 (Professional Paper 1737-B)

Publications: http://pubs.usgs.gov/

EPA/TCEQ Points of Contact

Chris Villarreal
Remedial Project Manager
U.S. EPA Region 6
214-665-6758
villarreal.chris@epa.gov

Jacob Piehl
EPA Legal Counsel
214-665-2138

Eric Delgado
EPA On Scene Coordinator
U.S. EPA Region 6
214-665-2703

Danielle Sattman
Project Manager
Texas Commission on Environmental Quality
512-239-0158

Courtney Kudla
U.S. EPA Enforcement Officer
214-665-8008

Donn Walters
Community Relations
U. S. EPA Region 6
214-665-6483