

Educating Schoolkids About Water

Where drinking water comes from

- rain
- it's nearly perfect water, but we can't collect enough of it reliably and consistently
- talk about: what size of tarp would be required to capture enough rain for 100 gpd per person in town
- streams, rivers, and lakes
- groundwater
- in Nebraska, most of the *people* drink water from rivers, but the largest number of *towns* get water from deep wells
- most water must be treated somehow before it's drinkable
- disinfection
- contaminant removal
- desalination (where not freshwater)
- fluoridation (where used)

All water is recycled

- it's used in infinite loops
- you may be drinking dinosaur water
- that's why we have to be careful with it
- that's also why we have to clean it before putting it back into nature
- follow the Platte River: how many towns does it pass through? how many have to share the same water?
- the water cycle from well field or surface water source
- astronauts live on a closed-loop water cycle when they're in space

Why water tastes different in different places

- water picks up the features of what it passes through
- rain water is very "soft"
- water that percolates through rocks and minerals becomes "hard"
- those minerals affect how you bathe
- soap bubbles well in soft water, but forms soap scum in hard water
- in many places, the water used in Nebraska comes from more than 300 feet below ground
- <http://ne.water.usgs.gov/ogw/hpwlms/hydsett.html>

Those minerals also affect the land

- most of the water used in Nebraska is for irrigation
- the minerals that come with the water are left behind when the irrigation water evaporates or goes into plants

What's the difference between tap water and bottled water?

- What is bottled water and where does it come from?
- What is tap water and where does it come from?
- What does bottled water cost per gallon?
- What does tap water cost per gallon, on average?
- What is the environmental cost of bottled water, ie: oil to make bottles, waste disposal etc

What is water used to do?

- people
- plants (including lawns)
- example: oranges
- animals (including livestock)
- food
- examples: bread, Hershey's Kisses

- manufacturing
- example: cars

Do we have enough water?

- how much water is in the entire world?
- water use changes with the seasons
- we need runoff from snowfall in the mountains
- we also need rain
- the challenge is more about getting water to the *right* places when it's needed
- as the population concentrates into urban areas, it can strain local resources
- Omaha and Lincoln have two big water plants just a few miles apart along the same part of the Platte River

What does it take to get water from nature to the tap?

- collection
- treatment
- filtration
- fluoridation
- chlorination
- swimming pools
- drinking water
- chlorine bleach
- softening
- removal of contaminants
- Nebraska issues: nitrates
- Nebraska issues: uranium
- Nebraska issues: radium
- Nebraska issues: arsenic
- general issues: viruses
- general issues: bacteria
- general issues: residual chemicals and pharmaceuticals
- general issues: petroleum and byproducts
- pressure
- pump stations
- water towers

How did we get to modern water treatment?

- many years of trial and error
- modern treatment era starts with the Broad Street Pump Handle
- chlorination in the United States started about 100 years ago
- dramatically reduced deaths and illnesses
- still not at our standards in developing countries
- cross-contamination from bathwater to laundry to sanitary use to drinking use
- 1 in 6 don't have safe drinking water
- 1 in 5 don't have basic sanitation
- 12 million deaths per year
- 4,000 children per day under the age of 5 die of waterborne diseases

What can harm us in the water?

- waterborne diseases
- giardiasis
- gastroenteritis
- cryptosporidiosis
- cholera
- typhoid fever

- microorganisms: bacteria, protozoa, and viruses
- bacteria are tiny cells that are found everywhere, but mostly aren't harmful
- E. coli
- excreted in waste and then find their way into untreated water
- protozoa
- water-borne single-celled organisms
- parasitic
- viruses
- smallest of all
- how small would your filter have to be to trap them?
- contamination
- garden hoses can pull contaminants into the water

What would life be like without clean water?

- not imaginary; it's reality for many in the developing world
- illnesses from untreated water
- effort required to obtain safe water
- how heavy is water? (about 8.3 lbs per gallon)
- can you carry a bucket?
- how many gallons per bucket?
- do you know how many gallons you use per day? (about 100 gallons)
- how many buckets would that be?
- twenty 5-gallon buckets per day
- each bucket weighs 41.5 pounds
- that's 830 pounds of water you'd have to carry per day -- often for several miles each way
- if you had to carry that many buckets, could you still go to school?
- women and children in many developing countries spend all day fetching water
- opportunity cost/wasted potential: if you're fetching water, you aren't doing other useful things

How are Americans helping people in those countries?

- fundraising
- awareness campaigns
- service trips
- knowledge transfer

Who works in the water industry?

- operators
- laboratory scientists
- regulators
- engineers
- managers
- manufacturers/product representatives