

Appendix C: Nitrate Legacy and Drinking Water Access Subcommittee Meeting Materials

Attachment 1

Members List

<i>NITRATE LEGACY AND DRINKING WATER ACCESS</i>
Brian Bruckner
Tom Downey
Matt Manning
Dean Settje
Marty Stange
Annette Sudbeck

Attachment 2

Meeting Schedule

DATE	LOCATION
July 14, 2025	Kearney
August 20, 2025	Kearney
September 24, 2025	Kearney
October 23, 2025	Virtual
November 21, 2025	Kearney
December 16, 2025	Norfolk

Attachment 3
Presentation Materials

Beneath the Plains: *Nitrate in Groundwater and Our Health*

Jesse E. Bell, PhD.

Claire M. Hubbard Professor of Water, Climate and Health

Director, Water, Climate and Health Program at UNMC

Director, Water, Climate and Health at Daugherty Water for Food Global Institute

UNMC College of Public Health

UNL School of Natural Resources





Public Health is the science of protecting and improving the health of people and their communities





Water Quality & Health

Water Quality & Health in Nebraska



WATER QUALITY

Nebraska's nitrate problem is growing worse and it's likely harming our kids

Yanqi Xu Flatwater Free Press Oct 28, 2022 Updated Dec 5, 2022 8

Nebraska's nitrate problem is serious, experts say. Can we solve it?

Matthew Hansen and Yanqi Xu Flatwater Free Press Dec 31, 2022 Updated Jun 5, 2023 1

EDITOR'S PICK TOPICAL TOP STORY

FIGHTING NITRATES

Clean water doesn't come cheap: Nebraska towns are shelling out millions to treat nitrate-laced drinking water

YANQI XU Flatwater Free Press Dec 15, 2022 Updated Jan 20, 2023 3

Omaha World-Herald Search Omaha World-Herald

E-edition News Obituaries Opinion Huskers Entertainment Lifestyles Jobs 64° Sunny

Researchers detect insecticides in water, home near troubled Nebraska ethanol plant

Nancy Gaarder Jun 16, 2022 Updated Aug 24, 2022 3

Nitrates A Costly, Persistent Problem For Small Towns

by Grant Gerlock, NET News/harvest Public Media



Cover crops like this rye grass growing in a harvested field of corn can allow farmers to use less fertilizer. (Photo by Grant Gerlock, NET News/harvest Public Media)



October 23, 2015 - 6:45am

Nitrogen fertilizer on farm fields helps crops grow. But if there's too much left over in the soil, it can pollute water supplies as nitrates. A big city lawsuit in Iowa over nitrates has grabbed headlines, but many small towns have the same problem.

Earlier this year, Des Moines, Iowa, [made news](#) when the city announced it would sue farmers in a legal battle over fertilizer. The city's water supply from the Des Moines and Raccoon Rivers often surpasses the [legal limit for nitrates](#) (10 mg/L), which commonly appear in water contaminated by runoff from farm fields.

Too many nitrates are a health hazard, particularly for infants whose blood can lose its ability to absorb oxygen. So nitrates must be reduced or removed, but cleaning nitrates from the city's water is a huge expense. When nitrate levels rise above the safe drinking water limit, Des Moines fires up a [filtering system](#) that costs thousands of dollars to operate each day.

Des Moines is unusual, though. In most cases, nitrate pollution is not a big city problem. It's most often a small town problem, says [Bruce Dvorak](#), professor of environmental engineering at the University of Nebraska-Lincoln.



Creighton, Nebraska water operator, Kevin Scrimshaw, stands before the \$1.3

"Nitrates in drinking water is the most common source water problem in the region," Dvorak said. "And for many small towns this is a very major cost issue. It may mean water rates, if they're lucky, only double. And some cases it may go up by eight to ten times."

That's the case in Creighton, a small town in northeast Nebraska. Creighton installed a \$1.3 million water filtering system in 1993 to reduce nitrate levels in town's drinking water. It has been running ever since, pulling nitrates out of about 300,000 gallons of water per day.

Omaha World-Herald
MIDLANDS
SUNDAY, MAY 3, 2009
SECTION 8



Water from this spring had eight times standards in downtown Omaha, according to Wang. It's a problem, she says, because she says residents 10 up water pipe from the spring every day. Omaha City, with a population of 58, has been under a state order to find a clean water source since 2007.

Nebraska towns pay more for water

Communities are collectively paying millions of dollars to fight nitrate contamination as they watch their bills increase

By Jason A. Francis-Watson

Residents in Nebraska towns as big as Hartsgate and as small as Oliver have one thing in common these days: higher water bills.

That's because a growing number of communities, most of them small, are spending collectively millions of dollars to build water pipelines to other towns or drill test wells to determine whether to invest in water treatment that cleans their water supply to drink under federal standards.

In one of many examples, Edgar, with a population of about 80, is building a water line to Fairfield, about 17 miles

away, at a cost of \$2.99 million. While building ground and have money to covering the costs, residents face higher water bills.

Nearly 30,000 Nebraskans are affected by nitrates in their drinking water. Nitrates are seen as a public health danger because excessive amounts can cause blue baby syndrome, which reduces the amount of oxygen in the blood.

Some researchers believe nitrates in the groundwater also have a link to some types of cancer. Nebraska's age-adjusted prostate cancer rate is the highest in the Midwest and seventh-highest in the country.

See Nitrates: Page 2

NITRATE-N CONCENTRATIONS IN NEBRASKA

Most recent recorded concentrations of 18,299 wells from 1999-2018.

Nitrate Levels: 0-10 mg/L, 11-19 mg/L, 20-29 mg/L, 30-39 mg/L, 40-49 mg/L, 50-59 mg/L, 60-69 mg/L, 70-79 mg/L, 80-89 mg/L, 90-99 mg/L, 100-109 mg/L, 110-119 mg/L, 120-129 mg/L, 130-139 mg/L, 140-149 mg/L, 150-159 mg/L, 160-169 mg/L, 170-179 mg/L, 180-189 mg/L, 190-199 mg/L, 200-209 mg/L, 210-219 mg/L, 220-229 mg/L, 230-239 mg/L, 240-249 mg/L, 250-259 mg/L, 260-269 mg/L, 270-279 mg/L, 280-289 mg/L, 290-299 mg/L, 300-309 mg/L, 310-319 mg/L, 320-329 mg/L, 330-339 mg/L, 340-349 mg/L, 350-359 mg/L, 360-369 mg/L, 370-379 mg/L, 380-389 mg/L, 390-399 mg/L, 400-409 mg/L, 410-419 mg/L, 420-429 mg/L, 430-439 mg/L, 440-449 mg/L, 450-459 mg/L, 460-469 mg/L, 470-479 mg/L, 480-489 mg/L, 490-499 mg/L, 500-509 mg/L, 510-519 mg/L, 520-529 mg/L, 530-539 mg/L, 540-549 mg/L, 550-559 mg/L, 560-569 mg/L, 570-579 mg/L, 580-589 mg/L, 590-599 mg/L, 600-609 mg/L, 610-619 mg/L, 620-629 mg/L, 630-639 mg/L, 640-649 mg/L, 650-659 mg/L, 660-669 mg/L, 670-679 mg/L, 680-689 mg/L, 690-699 mg/L, 700-709 mg/L, 710-719 mg/L, 720-729 mg/L, 730-739 mg/L, 740-749 mg/L, 750-759 mg/L, 760-769 mg/L, 770-779 mg/L, 780-789 mg/L, 790-799 mg/L, 800-809 mg/L, 810-819 mg/L, 820-829 mg/L, 830-839 mg/L, 840-849 mg/L, 850-859 mg/L, 860-869 mg/L, 870-879 mg/L, 880-889 mg/L, 890-899 mg/L, 900-909 mg/L, 910-919 mg/L, 920-929 mg/L, 930-939 mg/L, 940-949 mg/L, 950-959 mg/L, 960-969 mg/L, 970-979 mg/L, 980-989 mg/L, 990-999 mg/L, 1000-1009 mg/L, 1010-1019 mg/L, 1020-1029 mg/L, 1030-1039 mg/L, 1040-1049 mg/L, 1050-1059 mg/L, 1060-1069 mg/L, 1070-1079 mg/L, 1080-1089 mg/L, 1090-1099 mg/L, 1100-1109 mg/L, 1110-1119 mg/L, 1120-1129 mg/L, 1130-1139 mg/L, 1140-1149 mg/L, 1150-1159 mg/L, 1160-1169 mg/L, 1170-1179 mg/L, 1180-1189 mg/L, 1190-1199 mg/L, 1200-1209 mg/L, 1210-1219 mg/L, 1220-1229 mg/L, 1230-1239 mg/L, 1240-1249 mg/L, 1250-1259 mg/L, 1260-1269 mg/L, 1270-1279 mg/L, 1280-1289 mg/L, 1290-1299 mg/L, 1300-1309 mg/L, 1310-1319 mg/L, 1320-1329 mg/L, 1330-1339 mg/L, 1340-1349 mg/L, 1350-1359 mg/L, 1360-1369 mg/L, 1370-1379 mg/L, 1380-1389 mg/L, 1390-1399 mg/L, 1400-1409 mg/L, 1410-1419 mg/L, 1420-1429 mg/L, 1430-1439 mg/L, 1440-1449 mg/L, 1450-1459 mg/L, 1460-1469 mg/L, 1470-1479 mg/L, 1480-1489 mg/L, 1490-1499 mg/L, 1500-1509 mg/L, 1510-1519 mg/L, 1520-1529 mg/L, 1530-1539 mg/L, 1540-1549 mg/L, 1550-1559 mg/L, 1560-1569 mg/L, 1570-1579 mg/L, 1580-1589 mg/L, 1590-1599 mg/L, 1600-1609 mg/L, 1610-1619 mg/L, 1620-1629 mg/L, 1630-1639 mg/L, 1640-1649 mg/L, 1650-1659 mg/L, 1660-1669 mg/L, 1670-1679 mg/L, 1680-1689 mg/L, 1690-1699 mg/L, 1700-1709 mg/L, 1710-1719 mg/L, 1720-1729 mg/L, 1730-1739 mg/L, 1740-1749 mg/L, 1750-1759 mg/L, 1760-1769 mg/L, 1770-1779 mg/L, 1780-1789 mg/L, 1790-1799 mg/L, 1800-1809 mg/L, 1810-1819 mg/L, 1820-1829 mg/L, 1830-1839 mg/L, 1840-1849 mg/L, 1850-1859 mg/L, 1860-1869 mg/L, 1870-1879 mg/L, 1880-1889 mg/L, 1890-1899 mg/L, 1900-1909 mg/L, 1910-1919 mg/L, 1920-1929 mg/L, 1930-1939 mg/L, 1940-1949 mg/L, 1950-1959 mg/L, 1960-1969 mg/L, 1970-1979 mg/L, 1980-1989 mg/L, 1990-1999 mg/L, 2000-2009 mg/L, 2010-2019 mg/L, 2020-2029 mg/L, 2030-2039 mg/L, 2040-2049 mg/L, 2050-2059 mg/L, 2060-2069 mg/L, 2070-2079 mg/L, 2080-2089 mg/L, 2090-2099 mg/L, 2100-2109 mg/L, 2110-2119 mg/L, 2120-2129 mg/L, 2130-2139 mg/L, 2140-2149 mg/L, 2150-2159 mg/L, 2160-2169 mg/L, 2170-2179 mg/L, 2180-2189 mg/L, 2190-2199 mg/L, 2200-2209 mg/L, 2210-2219 mg/L, 2220-2229 mg/L, 2230-2239 mg/L, 2240-2249 mg/L, 2250-2259 mg/L, 2260-2269 mg/L, 2270-2279 mg/L, 2280-2289 mg/L, 2290-2299 mg/L, 2300-2309 mg/L, 2310-2319 mg/L, 2320-2329 mg/L, 2330-2339 mg/L, 2340-2349 mg/L, 2350-2359 mg/L, 2360-2369 mg/L, 2370-2379 mg/L, 2380-2389 mg/L, 2390-2399 mg/L, 2400-2409 mg/L, 2410-2419 mg/L, 2420-2429 mg/L, 2430-2439 mg/L, 2440-2449 mg/L, 2450-2459 mg/L, 2460-2469 mg/L, 2470-2479 mg/L, 2480-2489 mg/L, 2490-2499 mg/L, 2500-2509 mg/L, 2510-2519 mg/L, 2520-2529 mg/L, 2530-2539 mg/L, 2540-2549 mg/L, 2550-2559 mg/L, 2560-2569 mg/L, 2570-2579 mg/L, 2580-2589 mg/L, 2590-2599 mg/L, 2600-2609 mg/L, 2610-2619 mg/L, 2620-2629 mg/L, 2630-2639 mg/L, 2640-2649 mg/L, 2650-2659 mg/L, 2660-2669 mg/L, 2670-2679 mg/L, 2680-2689 mg/L, 2690-2699 mg/L, 2700-2709 mg/L, 2710-2719 mg/L, 2720-2729 mg/L, 2730-2739 mg/L, 2740-2749 mg/L, 2750-2759 mg/L, 2760-2769 mg/L, 2770-2779 mg/L, 2780-2789 mg/L, 2790-2799 mg/L, 2800-2809 mg/L, 2810-2819 mg/L, 2820-2829 mg/L, 2830-2839 mg/L, 2840-2849 mg/L, 2850-2859 mg/L, 2860-2869 mg/L, 2870-2879 mg/L, 2880-2889 mg/L, 2890-2899 mg/L, 2900-2909 mg/L, 2910-2919 mg/L, 2920-2929 mg/L, 2930-2939 mg/L, 2940-2949 mg/L, 2950-2959 mg/L, 2960-2969 mg/L, 2970-2979 mg/L, 2980-2989 mg/L, 2990-2999 mg/L, 3000-3009 mg/L, 3010-3019 mg/L, 3020-3029 mg/L, 3030-3039 mg/L, 3040-3049 mg/L, 3050-3059 mg/L, 3060-3069 mg/L, 3070-3079 mg/L, 3080-3089 mg/L, 3090-3099 mg/L, 3100-3109 mg/L, 3110-3119 mg/L, 3120-3129 mg/L, 3130-3139 mg/L, 3140-3149 mg/L, 3150-3159 mg/L, 3160-3169 mg/L, 3170-3179 mg/L, 3180-3189 mg/L, 3190-3199 mg/L, 3200-3209 mg/L, 3210-3219 mg/L, 3220-3229 mg/L, 3230-3239 mg/L, 3240-3249 mg/L, 3250-3259 mg/L, 3260-3269 mg/L, 3270-3279 mg/L, 3280-3289 mg/L, 3290-3299 mg/L, 3300-3309 mg/L, 3310-3319 mg/L, 3320-3329 mg/L, 3330-3339 mg/L, 3340-3349 mg/L, 3350-3359 mg/L, 3360-3369 mg/L, 3370-3379 mg/L, 3380-3389 mg/L, 3390-3399 mg/L, 3400-3409 mg/L, 3410-3419 mg/L, 3420-3429 mg/L, 3430-3439 mg/L, 3440-3449 mg/L, 3450-3459 mg/L, 3460-3469 mg/L, 3470-3479 mg/L, 3480-3489 mg/L, 3490-3499 mg/L, 3500-3509 mg/L, 3510-3519 mg/L, 3520-3529 mg/L, 3530-3539 mg/L, 3540-3549 mg/L, 3550-3559 mg/L, 3560-3569 mg/L, 3570-3579 mg/L, 3580-3589 mg/L, 3590-3599 mg/L, 3600-3609 mg/L, 3610-3619 mg/L, 3620-3629 mg/L, 3630-3639 mg/L, 3640-3649 mg/L, 3650-3659 mg/L, 3660-3669 mg/L, 3670-3679 mg/L, 3680-3689 mg/L, 3690-3699 mg/L, 3700-3709 mg/L, 3710-3719 mg/L, 3720-3729 mg/L, 3730-3739 mg/L, 3740-3749 mg/L, 3750-3759 mg/L, 3760-3769 mg/L, 3770-3779 mg/L, 3780-3789 mg/L, 3790-3799 mg/L, 3800-3809 mg/L, 3810-3819 mg/L, 3820-3829 mg/L, 3830-3839 mg/L, 3840-3849 mg/L, 3850-3859 mg/L, 3860-3869 mg/L, 3870-3879 mg/L, 3880-3889 mg/L, 3890-3899 mg/L, 3900-3909 mg/L, 3910-3919 mg/L, 3920-3929 mg/L, 3930-3939 mg/L, 3940-3949 mg/L, 3950-3959 mg/L, 3960-3969 mg/L, 3970-3979 mg/L, 3980-3989 mg/L, 3990-3999 mg/L, 4000-4009 mg/L, 4010-4019 mg/L, 4020-4029 mg/L, 4030-4039 mg/L, 4040-4049 mg/L, 4050-4059 mg/L, 4060-4069 mg/L, 4070-4079 mg/L, 4080-4089 mg/L, 4090-4099 mg/L, 4100-4109 mg/L, 4110-4119 mg/L, 4120-4129 mg/L, 4130-4139 mg/L, 4140-4149 mg/L, 4150-4159 mg/L, 4160-4169 mg/L, 4170-4179 mg/L, 4180-4189 mg/L, 4190-4199 mg/L, 4200-4209 mg/L, 4210-4219 mg/L, 4220-4229 mg/L, 4230-4239 mg/L, 4240-4249 mg/L, 4250-4259 mg/L, 4260-4269 mg/L, 4270-4279 mg/L, 4280-4289 mg/L, 4290-4299 mg/L, 4300-4309 mg/L, 4310-4319 mg/L, 4320-4329 mg/L, 4330-4339 mg/L, 4340-4349 mg/L, 4350-4359 mg/L, 4360-4369 mg/L, 4370-4379 mg/L, 4380-4389 mg/L, 4390-4399 mg/L, 4400-4409 mg/L, 4410-4419 mg/L, 4420-4429 mg/L, 4430-4439 mg/L, 4440-4449 mg/L, 4450-4459 mg/L, 4460-4469 mg/L, 4470-4479 mg/L, 4480-4489 mg/L, 4490-4499 mg/L, 4500-4509 mg/L, 4510-4519 mg/L, 4520-4529 mg/L, 4530-4539 mg/L, 4540-4549 mg/L, 4550-4559 mg/L, 4560-4569 mg/L, 4570-4579 mg/L, 4580-4589 mg/L, 4590-4599 mg/L, 4600-4609 mg/L, 4610-4619 mg/L, 4620-4629 mg/L, 4630-4639 mg/L, 4640-4649 mg/L, 4650-4659 mg/L, 4660-4669 mg/L, 4670-4679 mg/L, 4680-4689 mg/L, 4690-4699 mg/L, 4700-4709 mg/L, 4710-4719 mg/L, 4720-4729 mg/L, 4730-4739 mg/L, 4740-4749 mg/L, 4750-4759 mg/L, 4760-4769 mg/L, 4770-4779 mg/L, 4780-4789 mg/L, 4790-4799 mg/L, 4800-4809 mg/L, 4810-4819 mg/L, 4820-4829 mg/L, 4830-4839 mg/L, 4840-4849 mg/L, 4850-4859 mg/L, 4860-4869 mg/L, 4870-4879 mg/L, 4880-4889 mg/L, 4890-4899 mg/L, 4900-4909 mg/L, 4910-4919 mg/L, 4920-4929 mg/L, 4930-4939 mg/L, 4940-4949 mg/L, 4950-4959 mg/L, 4960-4969 mg/L, 4970-4979 mg/L, 4980-4989 mg/L, 4990-4999 mg/L, 5000-5009 mg/L, 5010-5019 mg/L, 5020-5029 mg/L, 5030-5039 mg/L, 5040-5049 mg/L, 5050-5059 mg/L, 5060-5069 mg/L, 5070-5079 mg/L, 5080-5089 mg/L, 5090-5099 mg/L, 5100-5109 mg/L, 5110-5119 mg/L, 5120-5129 mg/L, 5130-5139 mg/L, 5140-5149 mg/L, 5150-5159 mg/L, 5160-5169 mg/L, 5170-5179 mg/L, 5180-5189 mg/L, 5190-5199 mg/L, 5200-5209 mg/L, 5210-5219 mg/L, 5220-5229 mg/L, 5230-5239 mg/L, 5240-5249 mg/L, 5250-5259 mg/L, 5260-5269 mg/L, 5270-5279 mg/L, 5280-5289 mg/L, 5290-5299 mg/L, 5300-5309 mg/L, 5310-5319 mg/L, 5320-5329 mg/L, 5330-5339 mg/L, 5340-5349 mg/L, 5350-5359 mg/L, 5360-5369 mg/L, 5370-5379 mg/L, 5380-5389 mg/L, 5390-5399 mg/L, 5400-5409 mg/L, 5410-5419 mg/L, 5420-5429 mg/L, 5430-5439 mg/L, 5440-5449 mg/L, 5450-5459 mg/L, 5460-5469 mg/L, 5470-5479 mg/L, 5480-5489 mg/L, 5490-5499 mg/L, 5500-5509 mg/L, 5510-5519 mg/L, 5520-5529 mg/L, 5530-5539 mg/L, 5540-5549 mg/L, 5550-5559 mg/L, 5560-5569 mg/L, 5570-5579 mg/L, 5580-5589 mg/L, 5590-5599 mg/L, 5600-5609 mg/L, 5610-5619 mg/L, 5620-5629 mg/L, 5630-5639 mg/L, 5640-5649 mg/L, 5650-5659 mg/L, 5660-5669 mg/L, 5670-5679 mg/L, 5680-5689 mg/L, 5690-5699 mg/L, 5700-5709 mg/L, 5710-5719 mg/L, 5720-5729 mg/L, 5730-5739 mg/L, 5740-5749 mg/L, 5750-5759 mg/L, 5760-5769 mg/L, 5770-5779 mg/L, 5780-5789 mg/L, 5790-5799 mg/L, 5800-5809 mg/L, 5810-5819 mg/L, 5820-5829 mg/L, 5830-5839 mg/L, 5840-5849 mg/L, 5850-5859 mg/L, 5860-5869 mg/L, 5870-5879 mg/L, 5880-5889 mg/L, 5890-5899 mg/L, 5900-5909 mg/L, 5910-5919 mg/L, 5920-5929 mg/L, 5930-5939 mg/L, 5940-5949 mg/L, 5950-5959 mg/L, 5960-5969 mg/L, 5970-5979 mg/L, 5980-5989 mg/L, 5990-5999 mg/L, 6000-6009 mg/L, 6010-6019 mg/L, 6020-6029 mg/L, 6030-6039 mg/L, 6040-6049 mg/L, 6050-6059 mg/L, 6060-6069 mg/L, 6070-6079 mg/L, 6080-6089 mg/L, 6090-6099 mg/L, 6100-6109 mg/L, 6110-6119 mg/L, 6120-6129 mg/L, 6130-6139 mg/L, 6140-6149 mg/L, 6150-6159 mg/L, 6160-6169 mg/L, 6170-6179 mg/L, 6180-6189 mg/L, 6190-6199 mg/L, 6200-6209 mg/L, 6210-6219 mg/L, 6220-6229 mg/L, 6230-6239 mg/L, 6240-6249 mg/L, 6250-6259 mg/L, 6260-6269 mg/L, 6270-6279 mg/L, 6280-6289 mg/L, 6290-6299 mg/L, 6300-6309 mg/L, 6310-6319 mg/L, 6320-6329 mg/L, 6330-6339 mg/L, 6340-6349 mg/L, 6350-6359 mg/L, 6360-6369 mg/L, 6370-6379 mg/L, 6380-6389 mg/L, 6390-6399 mg/L, 6400-6409 mg/L, 6410-6419 mg/L, 6420-6429 mg/L, 6430-6439 mg/L, 6440-6449 mg/L, 6450-6459 mg/L, 6460-6469 mg/L, 6470-6479 mg/L, 6480-6489 mg/L, 6490-6499 mg/L, 6500-6509 mg/L, 6510-6519 mg/L, 6520-6529 mg/L, 6530-6539 mg/L, 6540-6549 mg/L, 6550-6559 mg/L, 6560-6569 mg/L, 6570-6579 mg/L, 6580-6589 mg/L, 6590-6599 mg/L, 6600-6609 mg/L, 6610-6619 mg/L, 6620-6629 mg/L, 6630-6639 mg/L, 6640-6649 mg/L, 6650-6659 mg/L, 6660-6669 mg/L, 6670-6679 mg/L, 6680-6689 mg/L, 6690-6699 mg/L, 6700-6709 mg/L, 6710-6719 mg/L, 6720-6729 mg/L, 6730-6739 mg/L, 6740-6749 mg/L, 6750-6759 mg/L, 6760-6769 mg/L, 6770-6779 mg/L, 6780-6789 mg/L, 6790-6799 mg/L, 6800-6809 mg/L, 6810-6819 mg/L, 6820-6829 mg/L, 6830-6839 mg/L, 6840-6849 mg/L, 6850-6859 mg/L, 6860-6869 mg/L, 6870-6879 mg/L, 6880-6889 mg/L, 6890-6899 mg/L, 6900-6909 mg/L, 6910-6919 mg/L, 6920-6929 mg/L, 6930-6939 mg/L, 6940-6949 mg/L, 6950-6959 mg/L, 6960-6969 mg/L, 6970-6979 mg/L, 6980-6989 mg/L, 6990-6999 mg/L, 7000-7009 mg/L, 7010-7019 mg/L, 7020-7029 mg/L, 7030-7039 mg/L, 7040-7049 mg/L, 7050-7059 mg/L, 7060-7069 mg/L, 7070-7079 mg/L, 7080-7089 mg/L, 7090-7099 mg/L, 7100-7109 mg/L, 7110-7119 mg/L, 7120-7129 mg/L, 7130-7139 mg/L, 7140-7149 mg/L, 7150-7159 mg/L, 7160-7169 mg/L, 7170-7179 mg/L, 7180-7189 mg/L, 7190-7199 mg/L, 7200-7209 mg/L, 7210-7219 mg/L, 7220-7229 mg/L, 7230-7239 mg/L, 7240-7249 mg/L, 7250-7259 mg/L, 7260-7269 mg/L, 7270-7279 mg/L, 7280-7289 mg/L, 7290-7299 mg/L, 7300-7309 mg/L, 7310-7319 mg/L, 7320-7329 mg/L, 7330-7339 mg/L, 7340-7349 mg/L, 7350-7359 mg/L, 7360-7369 mg/L, 7370-7379 mg/L, 7380-7389 mg/L, 7390-7399 mg/L, 7400-7409 mg/L, 7410-7419 mg/L, 7420-7429 mg/L, 7430-7439 mg/L, 7440-7449 mg/L, 7450

Nitrate & Drinking Water

85% get their home water from groundwater

Over 360,000 residents get their water from private wells

Sources: Nitrogen fertilizers, animal and human waste

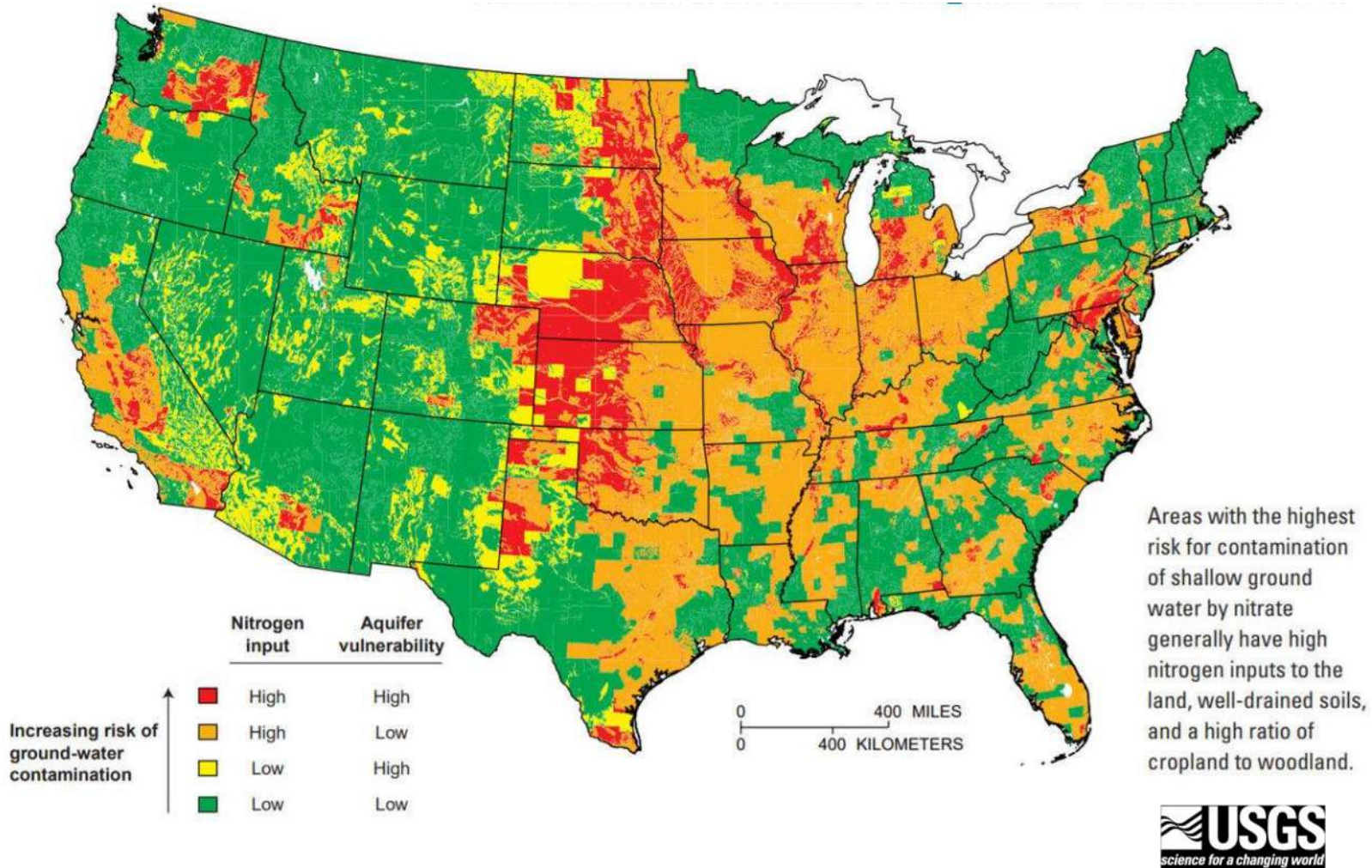
Regulatory limit: 10 mg/L as NO₂-N (USA)

Greatest exposure

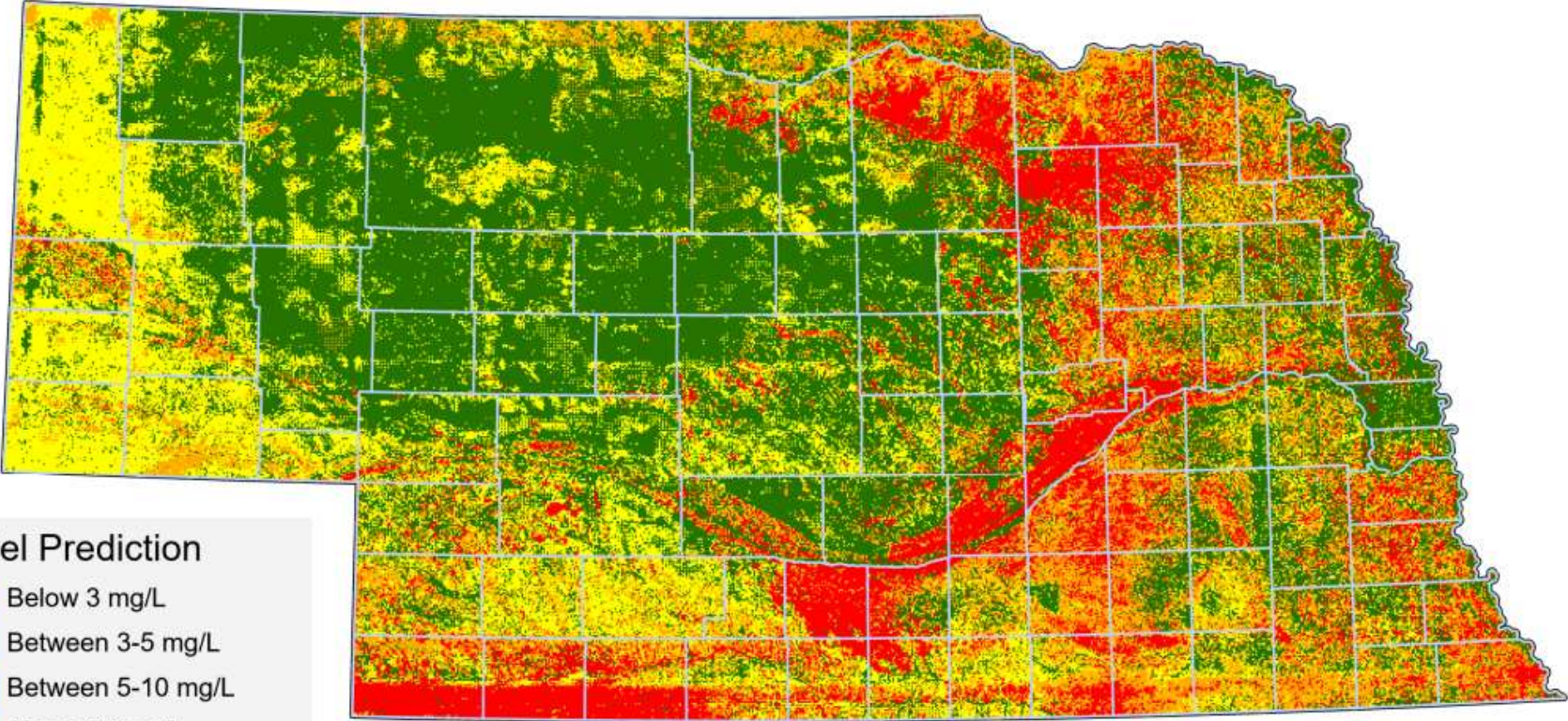
- Agricultural areas
- Private wells
 - Not regulated
 - Sparse measurements



Areas of Highest Risk of Nitrate Contamination



Nitrate impacts most of Nebraska



Model Prediction

- Below 3 mg/L
- Between 3-5 mg/L
- Between 5-10 mg/L
- Above 10 mg/L

Credits: NDEE Drinking Water and Groundwater Division
Spatial Reference: NAD 1983 State Plane
Nebraska FIPS 2,600 Feet
Projection: Lambert Conformal Conic



2025



Nitrate & Human Health



Regulatory limits of nitrate in drinking water are set for infant development of methemoglobinemia, not for other health outcomes

Numerous scientific studies have looked at the relationship of nitrate in drinking water on human health

High concentration of nitrate in drinking water has been linked to adverse health outcomes

Strongest links:

- Minor health ailments
- Methemoglobinemia
- Preterm birth issues
- Birth defects
- Pediatric cancers
- Adult cancers



N-nitroso compound (NOC) formation from ingested nitrate (drinking water & diet)



Oral bacteria: Nitrate → nitrite

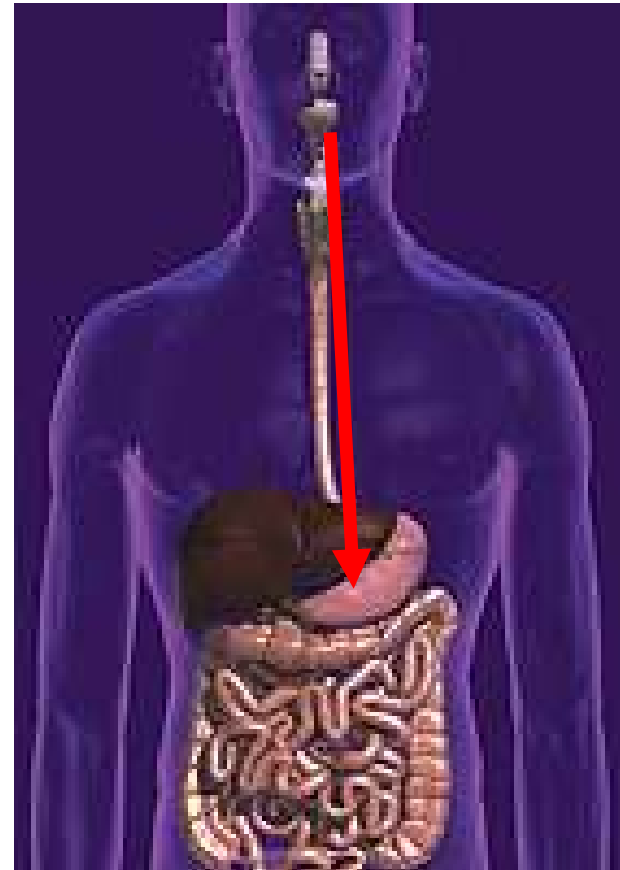
Nitrite + stomach acid

N_2O_3 +
amines/amides

NOC

↑
Heme iron
(red meat)
Thiocyanate
(smoking)

↓
Antioxidants
(vitamin C)



Increased heart rate, nausea, headaches, and abdominal cramps

Cancers

Colorectal cancer (5 studies; 4 positive)

Thyroid disease (3 positive studies)

- Increase risk of thyroid cancer (5 mg/L)

Kidney cancer (2 studies; 2 positive)

Bladder cancer (4 studies; 2 positive)

Non-Hodgkin lymphoma (3 studies; 1 positive)



Alzheimer's, Diabetes And Parkinson's Disease

Ward et al. 2018

Research in Iowa



- Long-term ingestion of elevated nitrate in drinking water was associated with an increased risk of bladder cancer among postmenopausal women. *Jones et al. 2016*
- High nitrate levels in public drinking water and private well use may increase ovarian cancer risk among postmenopausal women. *Inoue-Choi et al. 2015*
- Exposure to total trihalomethanes in drinking water is associated with the risk of rectal cancer. Nitrate in drinking water was not associated with risk of colon or rectal cancers. *Jones et al. 2019*
- Positive association between a relatively low dietary intake of nitrite from processed meats and stomach cancer risk in postmenopausal women. No association between long-term exposure to nitrate or TTHM levels in public water supplies and the risk of these digestive system cancers. *Buller et al. 2021*

Multiple health issues have been identified in children

- Methemoglobinemia (Infants less than 6 months)
- Pediatric brain cancers (2 studies; 2 positive)
- Non-Hodgkin Lymphoma (3 studies; 1 positive)
- Non-Hodgkin Lymphoma had a three-fold increase in risk with nitrates and atrazine in Nebraska study (Rhoades et al 2013)



Maternal & Fetal Health Issues



CDC report 1996 showed a cluster of spontaneous abortions (miscarriages) in rural Indiana
Private wells 19-26 mg/L

California study found an increase in spontaneous preterm births with drinking water nitrate of 5 to 10 mg/L (Sherris et al. 2021)

Fetal growth restriction with exposure of high nitrate in drinking water (Coffman et al. 2021)

Fetal hemoglobin is particularly susceptible to oxidation

Study shows elevated methemoglobin cord blood with exposure to nitrate during pregnancy (Tabacova et al. 1998)

Central Nervous System (CNS) Malformations

5 of 6 studies found a positive association with nitrate
4 of the studies had concentrations less than 10mg/L





Which groups are
susceptible to negative
health impacts of nitrate?



Populations of Concern

Pregnant people and their fetus

Young infants (< 6 months of age)

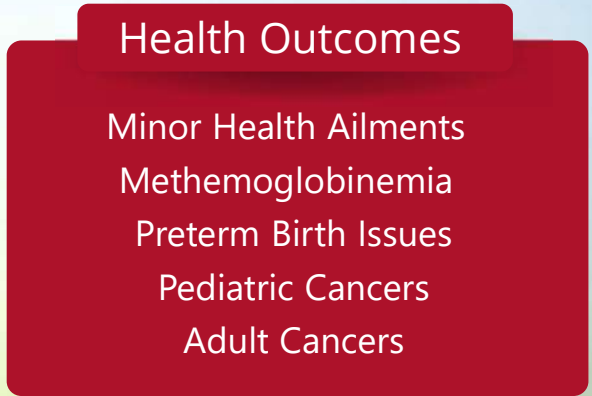
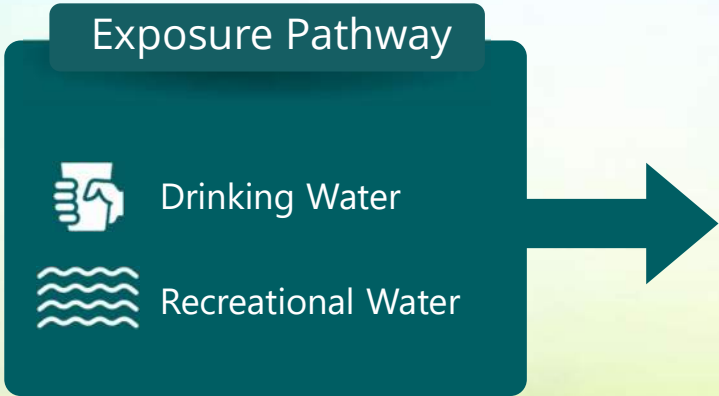
Children

People with oxygen transport or delivery conditions like anemia, cardiovascular disease, lung disease, sepsis and presence of other structural hemoglobin variants

People with high nitrate in their well water

- Diet also plays a role

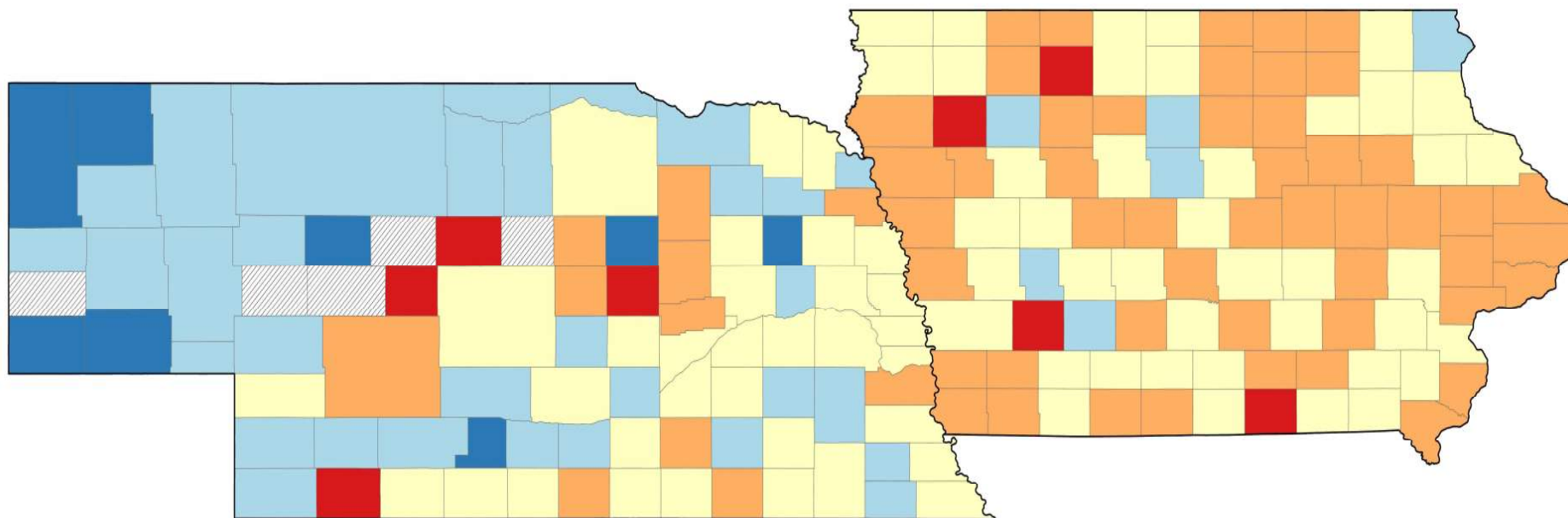






Health Concerns in
Nebraska

Iowa & Nebraska have 5 of the Top 25



Incidence Rates

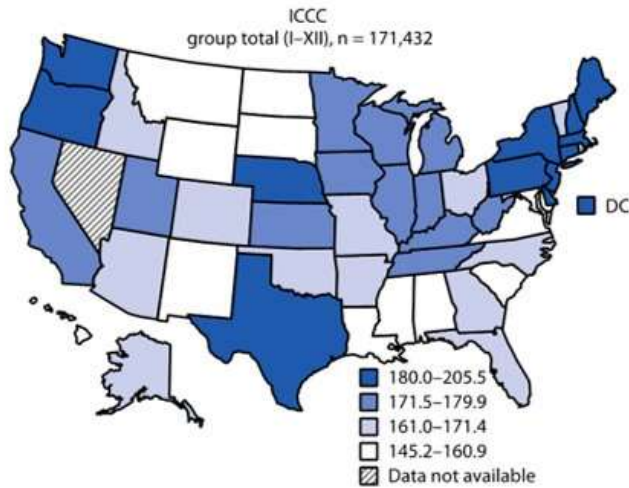


3 in the Top 10

Centers for Disease Control & Prevention



Data from 2003 – 2014 and reported as age-adjusted incidence rates of childhood cancer per 1 million:



United States	173.7
New Hampshire	205.5
New Jersey	192.3
Maine	190.5
New York	190
Pennsylvania	186.6
Connecticut	185.8
Nebraska	183.2
Texas	183.2
Oregon	182.6
Massachusetts	181.5

ICCC: International Classification of Childhood Cancer

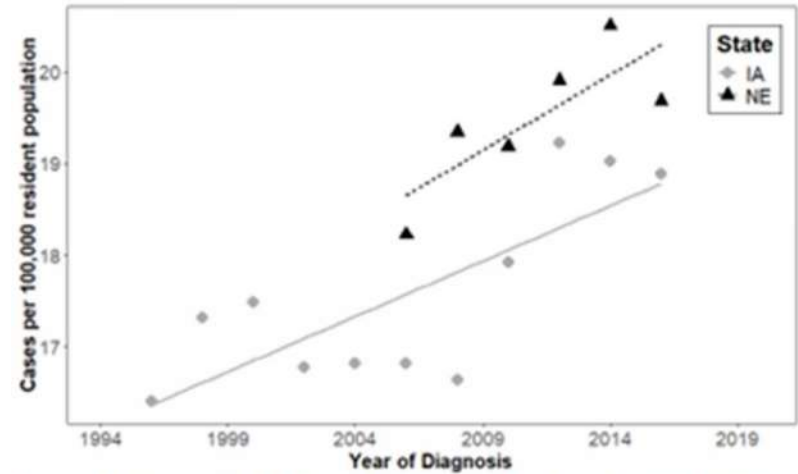


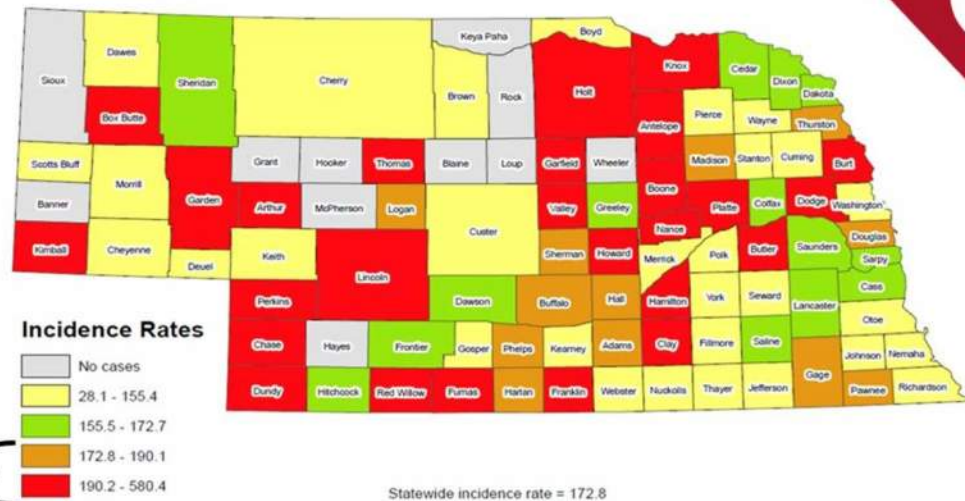
Figure 2. Change in PC Rates in Iowa and Nebraska (1994-2019)

Siegel et al. Geographic Variation in Pediatric Cancer Incidence - US, 2003–2014. *MMWR*, 2018

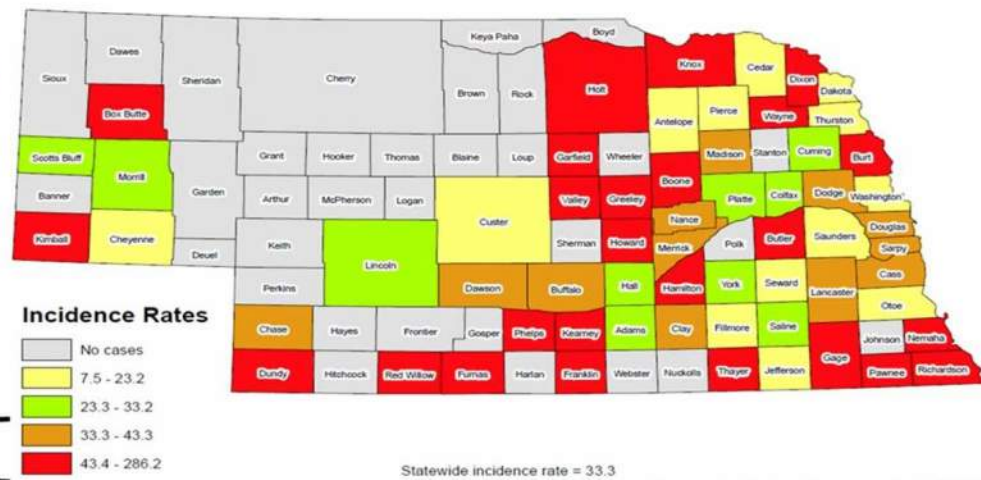
Courtesy of Don Coulter, MD



All Pediatric Cancer



Pediatric Brain Tumors



Farazi, et al. *Cancer Epi*, 2018

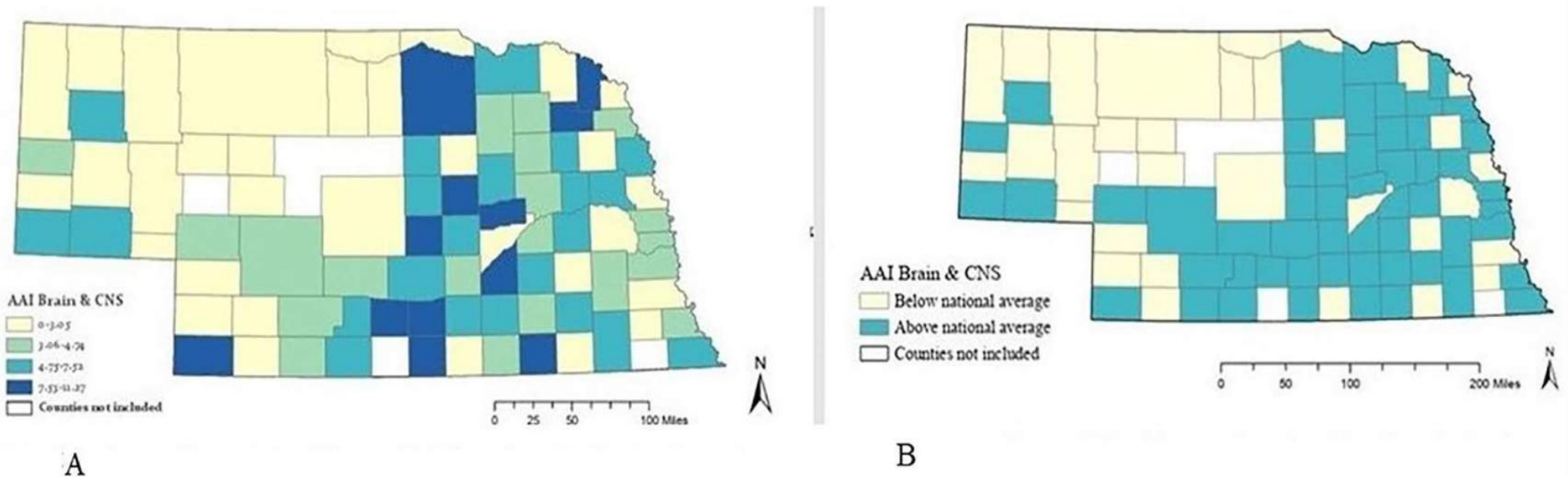
Incidence of pediatric cancers in Nebraska is among the **five highest** in the United States (Farazi et al., 2018).

Courtesy of Don Coulter, MD

Pediatric Brain & other CNS Cancers 1987- 2016



Nebraska counties with elevated atrazine or nitrate levels reported more childhood cancers than counties with lower levels of these chemicals.



Relative to the national average, the age-adjusted incidence of pediatric brain and other CNS cancers is higher in 63% (54/86) of the Nebraska counties.

Unexpected Costs

Moving

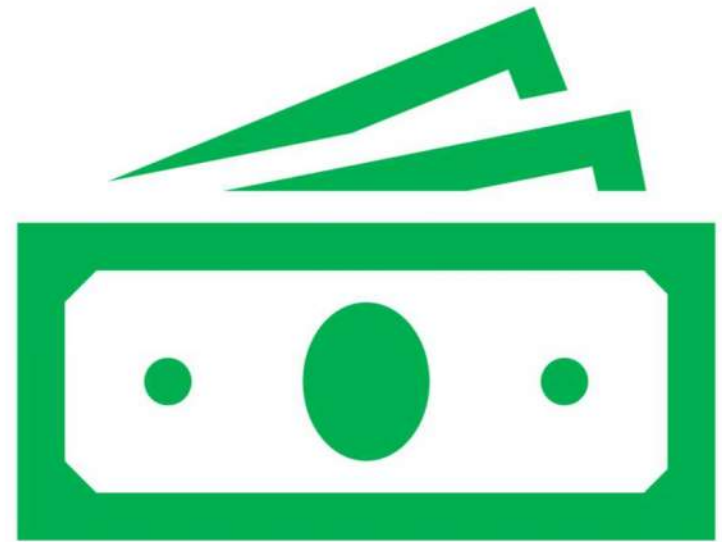
Financial burden

Higher rates of bankruptcy

Wisconsin study:

\$250,000-\$1.5 billion in medical
expenditures

\$1.3-\$6.5 billion lost in productivity



Goals for Addressing Water Quality



Identify at-risk areas and people



Encourage water testing



Find low-cost to no-cost solutions




Maintain these water systems



EXIT

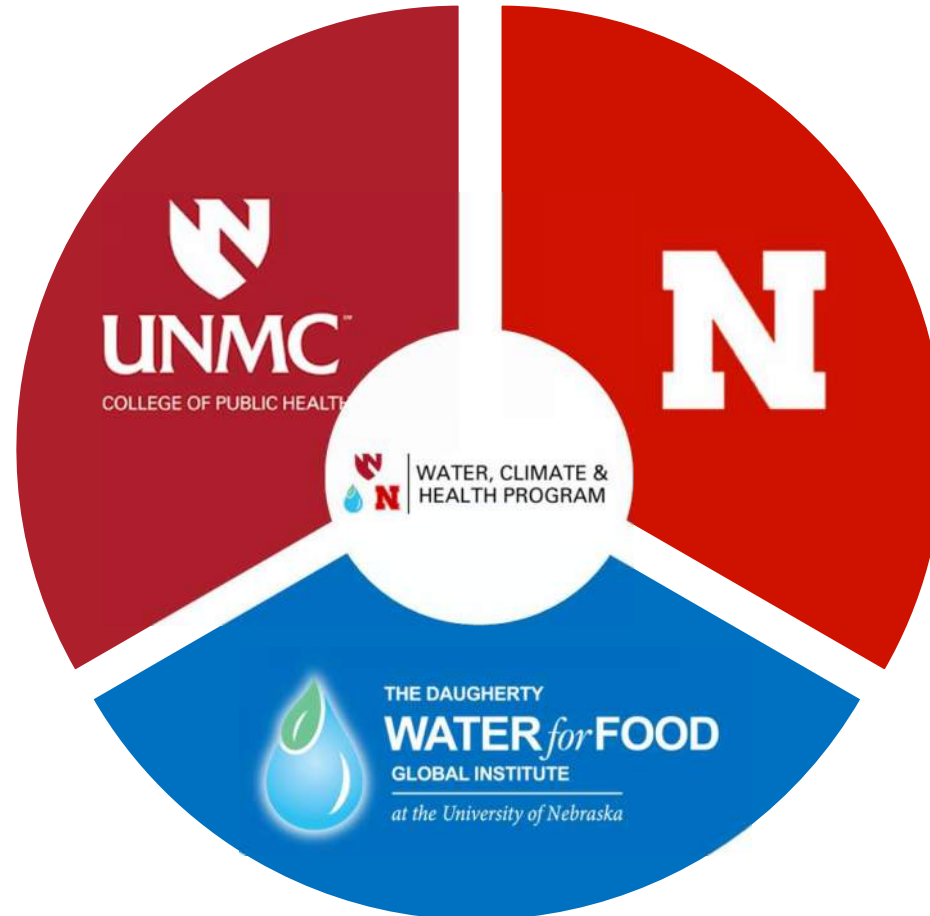
A group of nine people, eight women and one man, are standing in a well-lit hallway. They are dressed in professional attire, including blazers, sweaters, and trousers. Behind them are several informational posters. One poster on the left is titled 'Nebraska Tornado Early Warnings' and 'Community Impact'. Another poster in the center is titled 'Needs Assessment' and 'After Day Tornado'. A poster on the right is titled 'Preparedness for Disaster'. The hallway has large windows on the right side and a white pillar on the left. A red banner with white text is overlaid across the middle of the image.

Engagement and Outreach



The Water, Climate and Health Program pioneers interdisciplinary research, education, and collaborative solutions to public health challenges associated with water and climate in Nebraska and around the world.

A Multi-Institution Initiative



Our Foundational Commitments



Research



Education

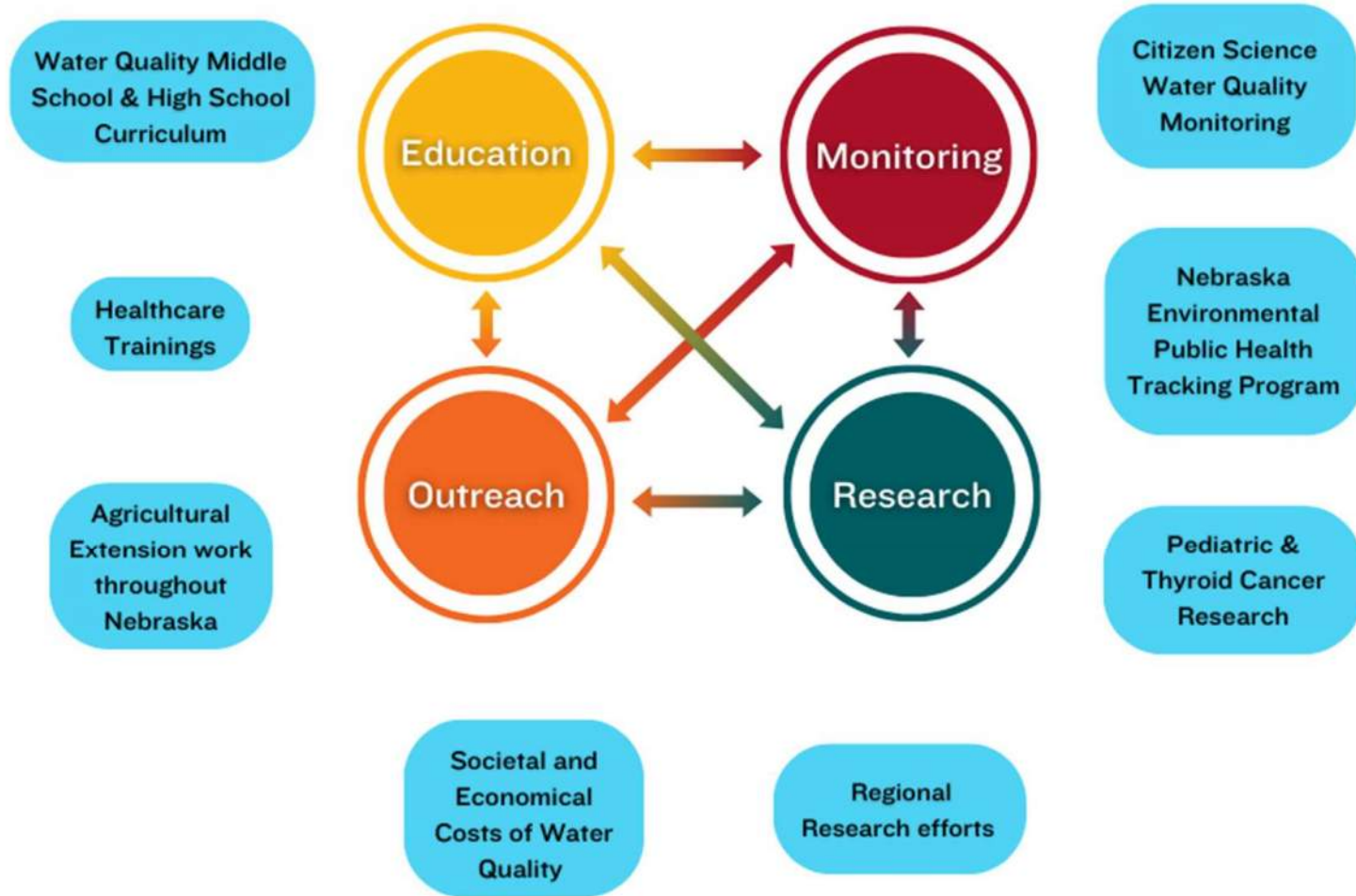


Engagement



Policy Development

Water Quality at the WCHP



Communication: Diverse Opportunities



***689**

Healthcare providers
(HCPs) surveyed

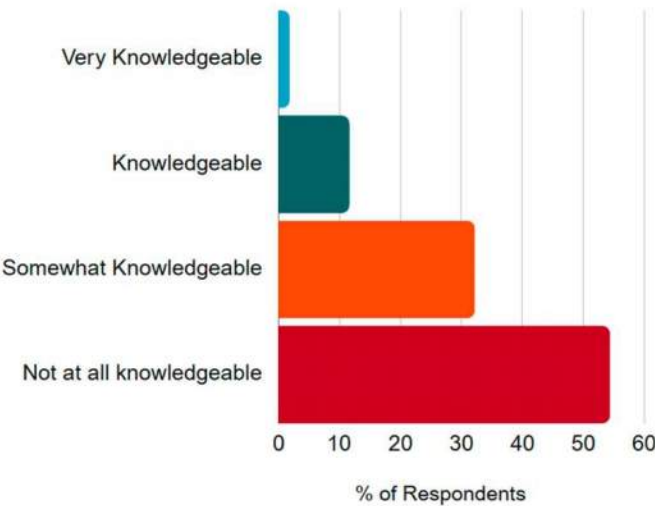


22

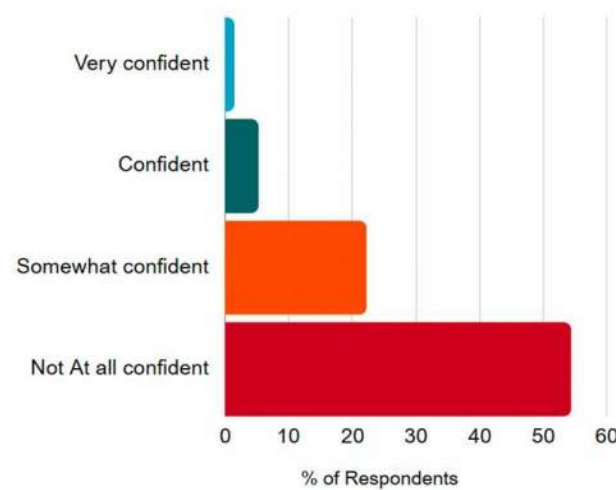
Natural Resource District
employees (NRDs)
surveyed



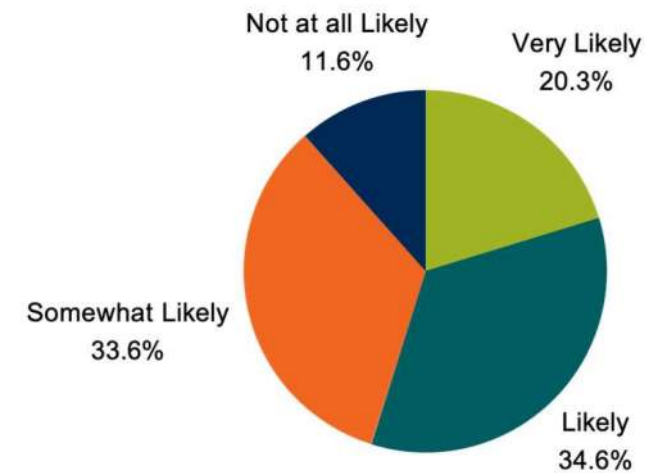
HCPs Self-Rated Knowledge of the Health Impacts of Nitrate Contaminated Drinking Water (n=655)



HCPs Self-Rated Confidence that They Can Advise Patients About the Health Impacts of Nitrate Contaminated Drinking Water (n=655)



HCPs Self-Rated Likeliness to Distribute Educational Products to Patients if they were Available (n=596)



Water Quality Education & Engagement



NE **Nebraskans Can Treat Their Drinking Water for Free!**

If your drinking water has high concentrations of nitrate, the Nebraska Department of Environment and Energy (NDEE) is offering an opportunity for you to treat it for free with the Reverse Osmosis System rebate program.

Application opens: January 1st, 2023
Application closes: June 23, 2024

Eligibility Requirements:

1. This program is open to anyone with a private well.
2. The private well must be registered.
3. Applicants will need to submit water quality data from the State laboratory, with testing results dated no earlier than January 1, 2022.
4. Only wells with samples above 10 ppm nitrate will be eligible for this program.

Why Apply?

Treating your drinking water helps protect the health of you and your loved ones.

There are known health impacts for drinking nitrate contaminated water. The strongest linked are:

- Blue baby syndrome
- preterm birth issues
- birth defects
- pediatric cancers
- adult cancers

Application for R.O. rebate program
<https://go.unl.edu/roapp>

Order your lab kit for
<https://go.unl.edu/waterkits>

Check if your well is registered
<https://go.unl.edu/checkwell>

How to register your well
<https://go.unl.edu/registerwell>

More program details
<https://go.unl.edu/roappdetails>

Get up to \$4,000 reimbursed!



NITRATE AND HEALTH

PROTECT THE HEALTH OF YOU AND YOUR LOVED ONES BY KNOWING WHAT IS IN YOUR DRINKING WATER!

WHERE AND WHAT IS NITRATE?

Nitrate is a form of nitrogen that can sometimes be found in our drinking water. Nitrogen fertilizers used for growing crops are the largest contributor to nitrate in our drinking water. Therefore, if you live in an area where there is a lot of agricultural production, you are at risk of drinking nitrate-contaminated water!

WHAT CAN I DO TO PROTECT MYSELF AND MY FAMILY?

If you drink water from a private well, it is up to you to ensure you are drinking safe water. There are no requirements for private well owners to test or treat their water. Nitrate is colorless, odorless and tasteless. The only way to know if you have nitrate in your drinking water is to test it.

Private well users should test their drinking water regularly. You can order a test kit from a certified laboratory or do-it-yourself test kits are available on-line. The do-it-yourself kits should be used as a screening tool only. An analysis by an approved lab is recommended for the most accurate, reliable and precise measurement.

If you find nitrate above the safe drinking water level (10 ppm) in your water, the quickest and easiest solution is to install a reverse osmosis water filtration system in your house. For more information, go to <https://water.unl.edu/>

HOW CAN CONSUMING NITRATE IMPACT HUMAN HEALTH?

Children and Infants

- A result in infants consuming nitrate-contaminated water is methemoglobinemia (blue baby syndrome), sometimes fatal within under six months old are at the highest risk. This illness can cause the skin to turn a bluish color and cause serious illness or death.
- There are studies suggesting potential linkages between nitrate consumption and pediatric cancers. Nebraska has the highest rate of pancreatic cancer in the Midwest and 7th highest in the entire United States. More research needs to be conducted before we can draw any conclusions.

Pregnant Women

- During pregnancy, it is common for a woman's methemoglobin levels to increase from breast feeding. Therefore, pregnant women are particularly susceptible to methemoglobinemia as well.
- Pregnant women exposed to too much nitrate are at general risk of giving birth prematurely.
- Elevated exposure to nitrate through drinking water has been linked to birth defects. Nebraska has double the national average rate of birth defects.

Other Adults

- The University of Nebraska Medical Center, along with researchers across the globe, continue to study linkages between consuming nitrate and human health impacts.
- A growing body of studies indicate potential associations between nitrate and:
- increased blood cell counts, leukemias, thyroid disease, and other endocrine-related conditions, kidney, prostate and testicular cancer, and
- increased risk of stroke if you are consuming one of these substances.

UNMC

Keep Your Baby Safe: Nitrates in Drinking Water from Wells Can Be Harmful

The only way to know if your well water is safe to drink is to test it.

What are Nitrates?

Nitrates are chemicals that can get into private drinking water wells from:

- Farm fertilizers
- Animal manure
- Septic systems

How can Drinking Nitrates be Harmful?

During Pregnancy

High nitrates can increase the risk of:

- Early birth
- Low birth weight
- Pregnancy problems

Breastfeeding is safer: nitrates do not pass into breast milk.

Babies

High nitrates can increase the risk of "Blue Baby Syndrome" (Methemoglobinemia) which can cause:

- Blue or Purple skin
- Trouble Breathing
- Low oxygen in the blood and even death

! Babies under 6 months are especially vulnerable to nitrates. Drinking formula mixed with nitrate-contaminated well water can cause serious health problems and, in severe cases, may be life-threatening. Do not make formula with water that tests above 10 mg/L of nitrate.

Why might we develop middle school and high school curriculum and train teachers to focus on water quality and citizenship skills?

Citizen Science and Environmental Education Showcase: Empowering Youth, Inspiring Civic Action

Water Quality & Health Toolkit

Water Quality & Health Communications Resource
For Public Health & Health Professionals In Nebraska

University of Nebraska Medical Center

Drinking Water and Health

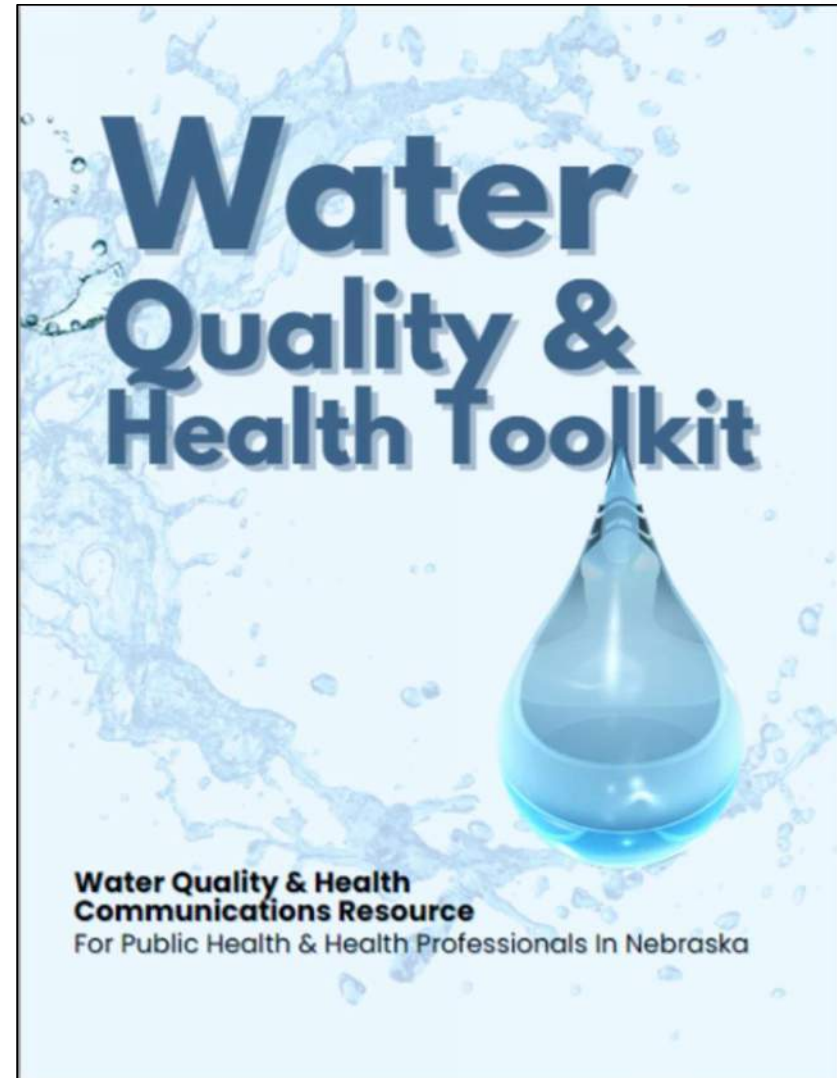
- 1. Drinking Water in Nebraska**
Did you know, water from private wells is not required to be tested or treated? Therefore, the only way to know if your water is safe to drink is to test to find out for yourself!
- 2. Common Water Contaminants**
Throughout much of Nebraska, water monitoring shows several harmful contaminants. The most common contaminant is nitrate-related to nitrogen fertilizer use.
- 3. Lifetime Health Impacts**
There are known health impacts for drinking nitrate contaminated water. The strongest linked are: blue baby syndrome, preterm birth issues, birth defects, pediatric cancers and adult cancers.
- 4. Who is the Most at Risk?**
The most vulnerable populations are pregnant women and their fetuses, young infants, children, and people with oxygen transport/delivery conditions.
- 5. Test Your Well Water!**
The only way to be sure of what is in your drinking water is to test it! The recommended way to test is to order a testing kit from an official Nebraska lab. After knowing what's in your water, you can begin building a treatment plan if necessary.

For more information:
Laura Reaggost
lreaggost@unmc.edu OR scan here

NEBRASKA
made by nebraskans with heart

Water Quality Communications for Public Health

1. The Basics of Water Quality
2. Water Quality and Health
3. Testing and Treating Your Water
4. Stakeholder Checklist
5. Water Quality Communication
6. Appendix/Resources



Protecting Nebraska's Waters Curriculum

Taylor Hamblin,
PhD at the
WCHP's
Research Seminar
Series in Spring
2023



Citizen Science and Environmental Education Showcase: *Empowering Youth, Inspiring Civic Action*



Middle and High School Curriculum that engages students with water quality issues.

Developed by WCHP's Taylor Hamblin, PhD

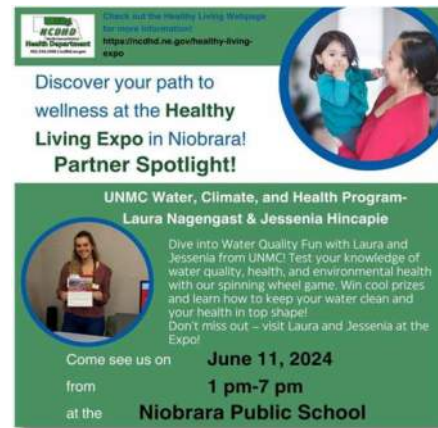
Connections and engagement throughout the state



WCHP In the Community & Beyond



“Flatwater Free Press Forum on Nitrates in Nebraska’s Water” in Norfolk, NE in March 2023.



Opportunities for Moving Forward



Partnerships to educate and do outreach



Improve testing of private wells



Continue to research these issues – **it would be great to expand our studies to include Kansas**



Create education materials for stakeholders





The Water, Climate and Health Program is made possible through generous support provided by:



Our Key Partners:

Kristina Kintziger, PhD
Yeongjin Gwon, PhD
Elli Rogan, PhD
Mounika Kudary, MPH
Thomas Barnett, MPH
Jabeen Taiba, PhD
Kelli Gribben, PhD

Summer Woolsey, MPH
Krista Brown, PhD, MBA, MPH
Siddhi Munde, MS
Arianna Li, MS
Julie Petersen, PhD, MPH
Renata Rimšaitė, PhD
Kaycie Lane, PhD

Taylor Hamblin, PhD
Harshanee Jayasekera, PhD
Babak Fard, PhD
Lisa Willard

Special Thanks

Don Coulter, MD
Ann Anderson-Berry, MD, PhD



Get Involved



Learn More



Sign Up for
Our
Newsletter



Donate



go.unmc.edu/waterclimatehealth



jesse.bell@unmc.edu



wchp@unmc.edu



[@UNMC_WCHP](https://twitter.com/UNMC_WCHP)

