“Documenting and understanding natural variability is a vexing topic in almost every environmental problem: How do we recognize and understand changes in natural systems if we don’t understand the range of baseline levels?”

Zoback, GSA Today, December 2001

USGS

According to Chemical Abstracts Service Registry Number and Substance Count, as of 3 March 2006, there are:

27,439,410 organic and inorganic substances
8,456,221 commercially available chemicals
239,392 inventoried/regulated substances
Approximately 4,000 new substances added daily

http://www.cas.org/cgi-bin/regreport.pl

USGS

According to Chemical Abstracts Service Registry Number and Substance Count, as of 9 November 2007, there are:

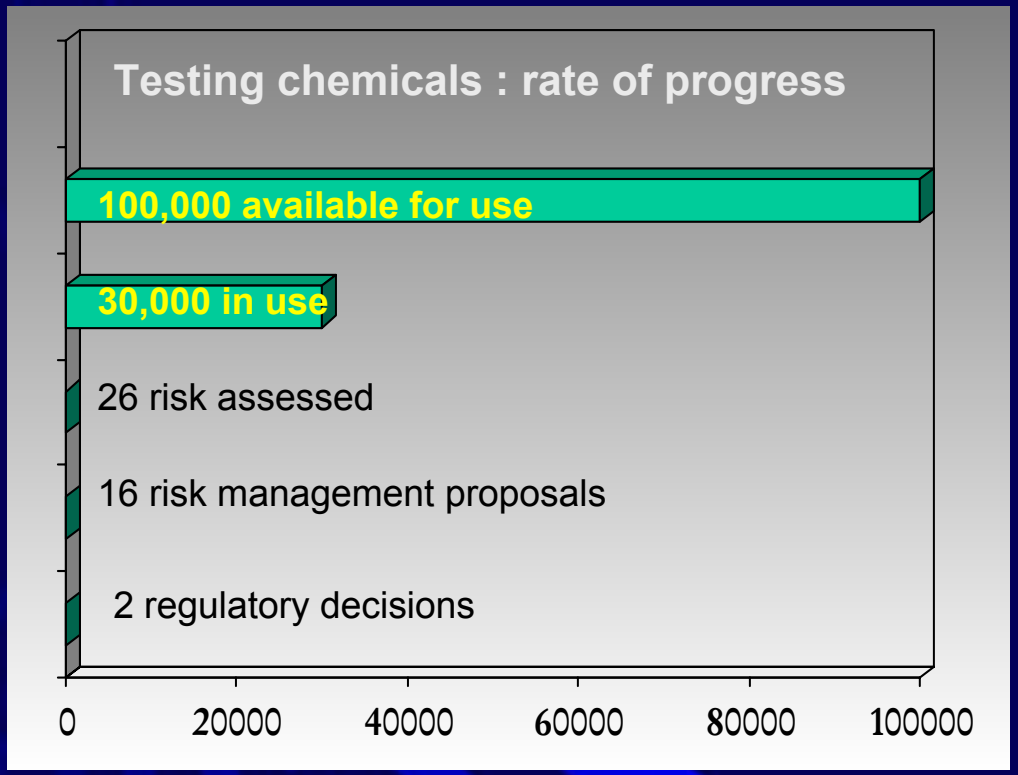
32,911,316 organic and inorganic substances
(increase of 5,471,906)
16,008,298 commercially available chemicals
(increase of 7,552,077)
246,083 inventoried/regulated substances
(increase of 6,691)

http://www.cas.org/cgi-bin/regreport.pl

USGS

How much do we know?

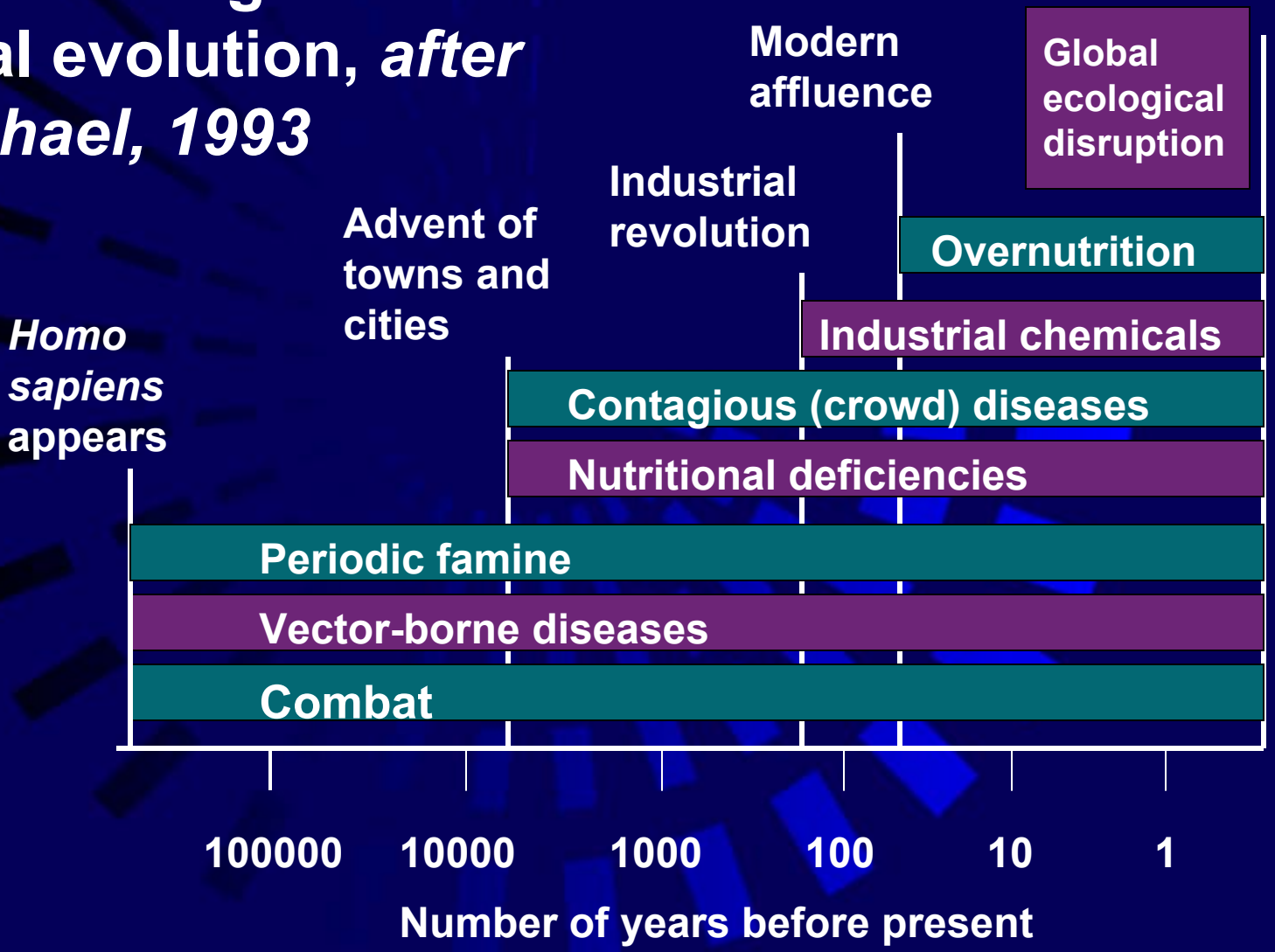
- Large number of chemicals – very few tested
- Complex supply chains
- Limitations of test methods



“. . .ignorance outweighs knowledge at every point in the risk assessment process. ”

Source RCEP 2003

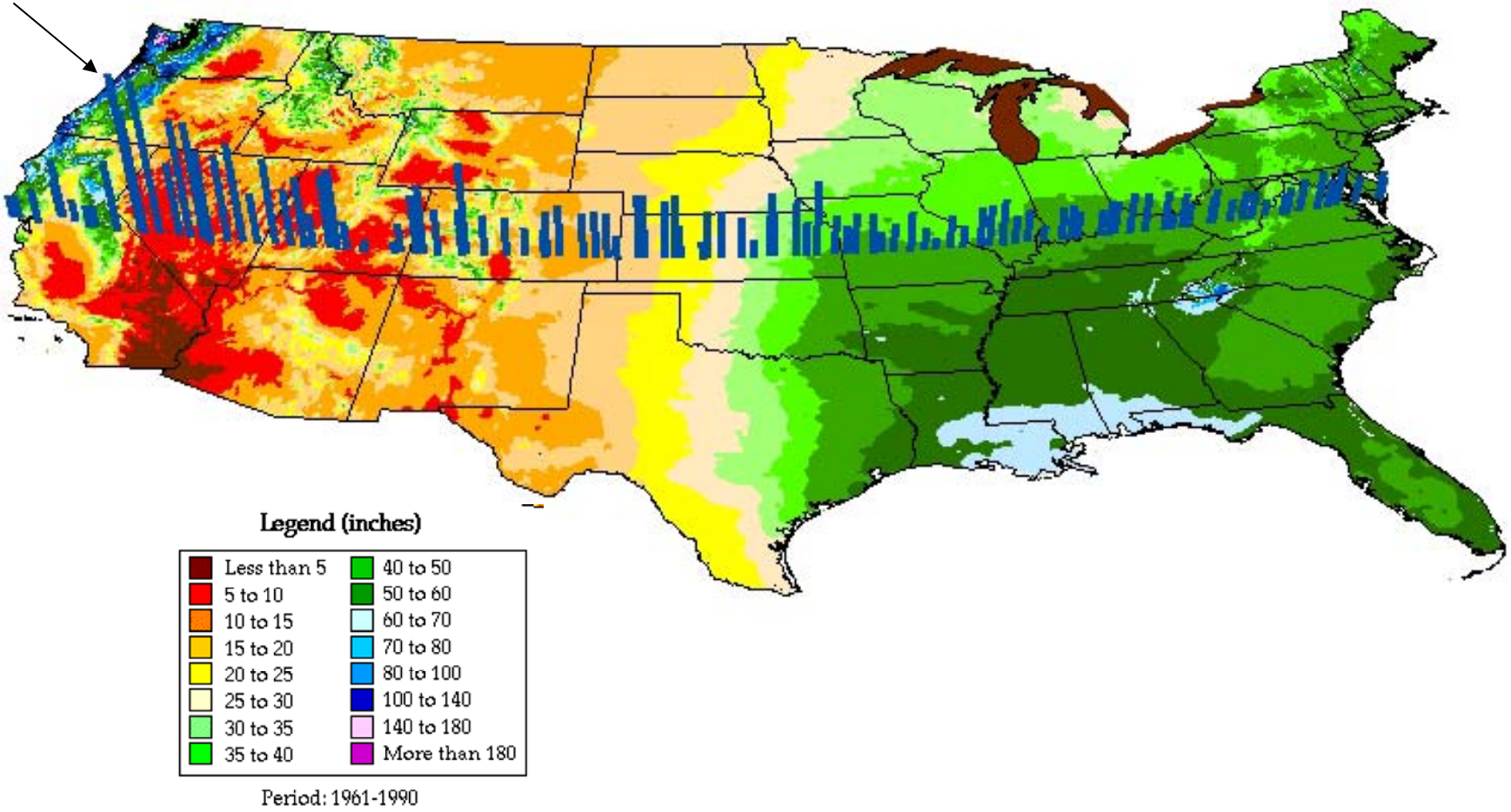
Major categories of population health hazards during human cultural evolution, *after McMichael, 1993*



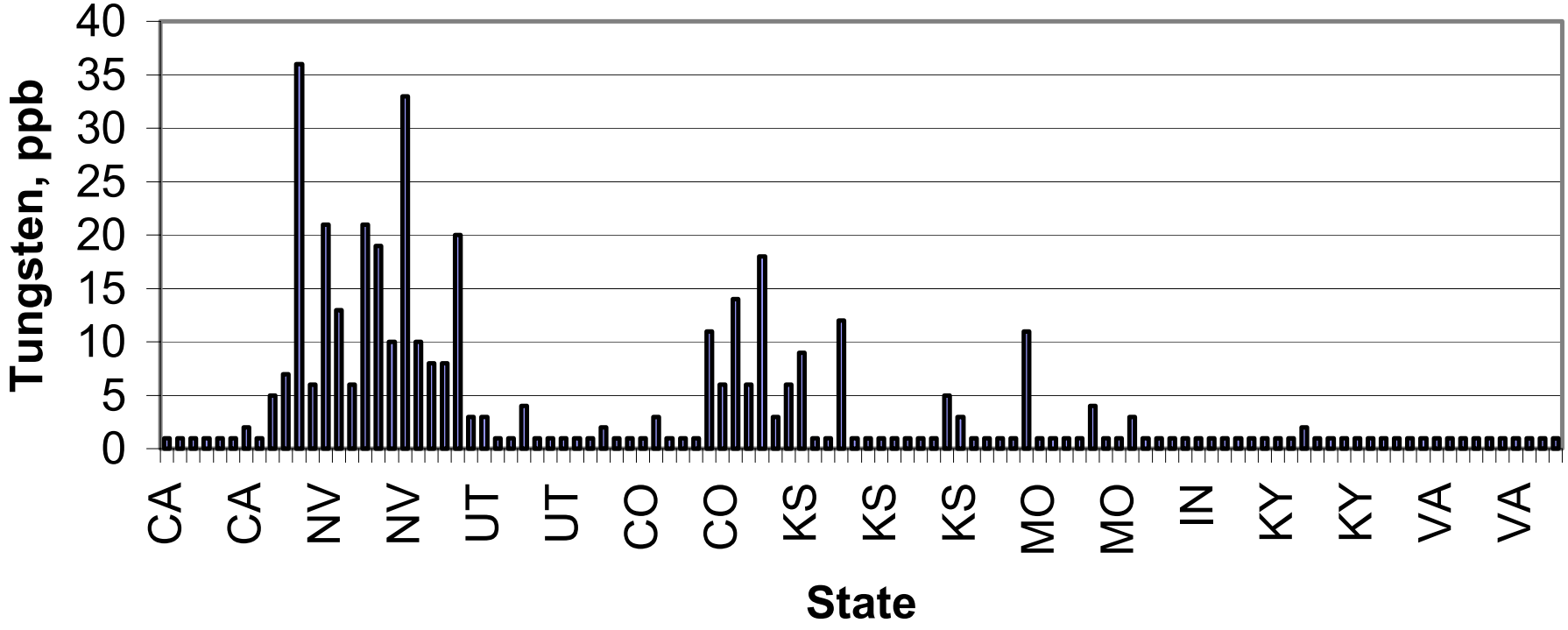
USGS

Tungsten in A-horizon soils of the E-W transect plotted on a backdrop of average annual precipitation

2.7 ppm



Tungsten in water extracts of A-horizon soils of the E-W transect



Fallon, NV Cancer Cluster

- Between 1997-2002, 16 children in Churchill County, NV diagnosed with acute leukemia
- Considering county population and statewide cancer rate, <2 cases expected
- Elevated W found in urine of both affected and unaffected children

USGS

Table 2: Geometric mean tungsten levels for urine and water samples

Location	Geometric mean tungsten level (95% confidence interval)			
	Urine (µg/L)			Tap Water (µg/L)
	Adults	Children	Total	
Lovelock	0.38 (0.33-0.45)	0.62 (0.50-0.76)	0.48 (0.34-0.68)	0.11 (0.07-0.19)
Pahrump	0.4 (0.38 - 0.53)	0.56 (0.48 – 0.66)	0.51 (0.37-0.69)	0.04 (0.02-0.06)
Yerington	1.04 (0.84-1.30)	1.18 (1.00-1.39)	1.11 (0.97-1.27)	3.32 (1.82-6.04)
Churchill County	0.81 (0.56 - 1.16)	2.31 (1.66 - 3.22)	1.19 (0.89-1.59)	4.66 (2.98-7.30)
National average*	>20 yrs 0.07 (0.07-0.08)	6–11 yrs 0.15 (0.12-0.18) 12-19 yrs 0.10 (0.09-0.12)	0.08 (0.07-0.09)	N/A

* From the *Second National Report on Human Exposure to Environmental Chemicals*[6], based on an NHANES reference population.

From report submitted to NV State Health Division by CDC, June 2003

National soil clean-up standards in mg/kg (residential land use)

	As	Pb	Cd	Ni	Hg	Zn
Slovakia	30	150	5	100	2	500
Canada	12	140	10	50	6.6	200
Sweden	15	80	0.4	35	1	350
France	37	400	20	140	7	9000
Belgium	110	700	6	470	15	1000