



Future Nutrient Limits (Primarily Due to the Gulf Hypoxia Zone)

Willis Sneed, P.E. – HDR Engineering, Inc.
402/399-1189 willis.sneed@hdrinc.com

- When reissuing the new Effluent Limitations Guidelines (ELGs) for Meat and Poultry in 2002-2004, EPA started with new Total Nitrogen (TN) and Total Phosphorus (TP) limits.
- However EPA quickly dropped the TP limits with little protest.
- TN seemed to be the focus of the EPA's effort because they believed it the cause of the "hypoxia" or dead zone in the Gulf of Mexico.

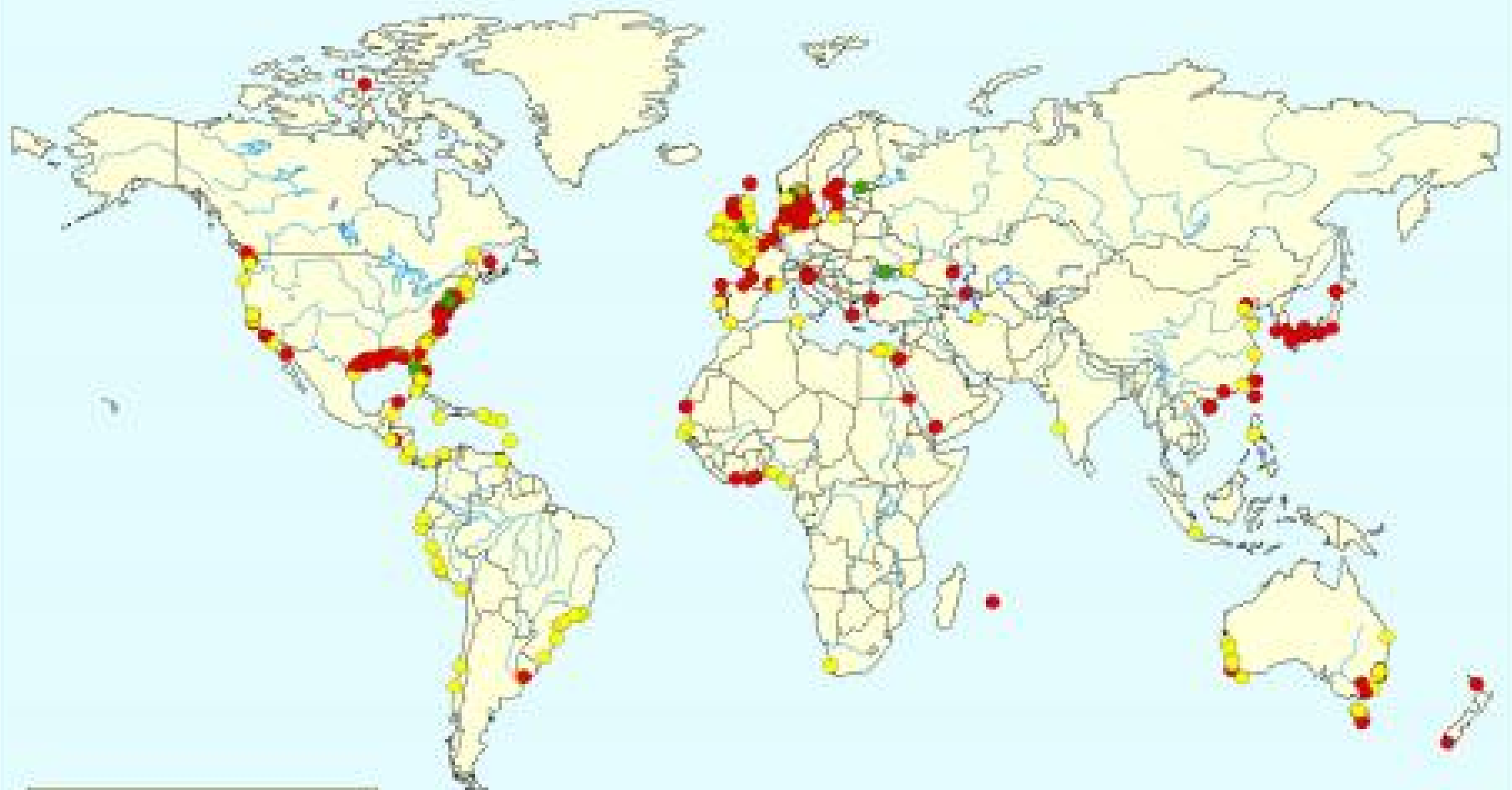
7-24-07 Draft - EPA's Science Advisory Board (SAB) Hypoxia Advisory Report (Noted: Do not cite or quote)

- http://www.epa.gov/sab/pdf/hap_draft_advisory_report_7-24-07.pdf
- Since 1985, scientists have been documenting a “dead zone” in the Northern Gulf of Mexico each summer.
- This area of low D.O. that cannot support marine life, referred to as hypoxia, begins in late spring, peaks in midsummer and disappears in the fall.



The Dead Zone reached a recorded high of 7,728 square miles in 1999.

World Hypoxic and Eutrophic Coastal Areas



- Eutrophic and Hypoxic Areas**
- Areas of Concern
 - Documented Hypoxic Areas
 - Systems in Recovery

Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

What is “Hypoxia”?

- Water with D.O. concentrations \leq 30% of saturation is called **hypoxic**.
- Most fish can't live below 30% D.O. saturation.
- Healthy aquatic environments seldom experience D.O. concentrations less than 80% of saturation.

(from the source of all knowledge – Wikipedia)

TYPES OF AQUATIC ENVIRONMENTS:

AEROBIC – contains dissolved oxygen – may be low (10% of saturation) or high ($\geq 100\%$ of saturation)

HYPOXIC – a subset of AEROBIC @ $\leq 30\%$ of saturation

ANOXIC – contains no dissolved oxygen, but contains oxygen-bearing compounds, such as nitrates and sulfates

ANAEROBIC – contains no dissolved oxygen, nor oxygen-bearing compounds

Hypoxia is the result of a number of factors, including excess nutrients and natural causes :

- Hypoxia is thought to be caused by excess nutrients from the Mississippi River, along with seasonal stratification of Gulf waters.
- Excess nutrients promote algal and associated zooplankton growth.
- Upon dying, this organic matter sinks to the bottom where it decomposes and consumes D.O.
- Stratification of lighter fresh water and denser saline waters prevents oxygen replenishment by mixing of oxygen-rich surface water with oxygen-depleted bottom water.

Goal of the Mississippi River/Gulf of Mexico Task Force Action Plan -- **reduce the hypoxic zone to a 5-year average of 5,000 sq km by 2015.**

- SAB concluded 5,000 sq km remains a reasonable target; however, it may not be possible to achieve this goal by 2015.
- The National Oceanic & Atmospheric Administration predicted 22,015 sq km of dead zone last summer, which would have be the largest hypoxic zone since measurements began in 1985.
- However there are indications there have been hypoxic zones in the Gulf for centuries.

7-24-07 SAB Draft Report Conclusions:

- To reduce the size of the hypoxic zone and improve water quality in the Missouri River Basin, SAB recommended a 45% reduction in TN and a 40% reduction in TP from the average 1980-1996 amounts.
- Most emphasis to be placed on reducing springtime inflow, the time period most correlated with the size of the hypoxic zone.

7-24-07 SAB Draft Report Conclusions - cont.

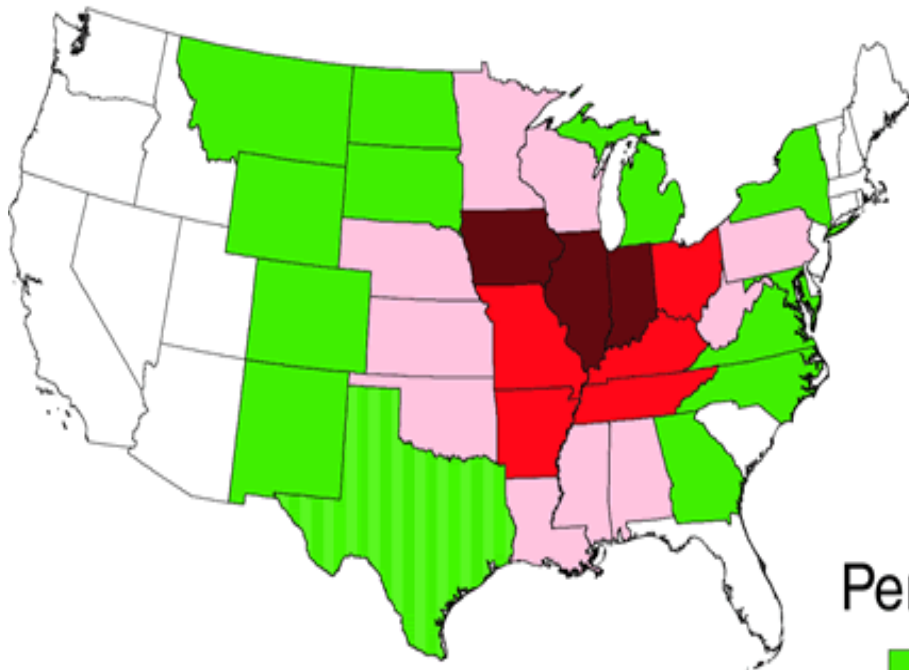
- New information demonstrates the role of TP in determining the size of the hypoxia zone.
- Contrary to conventional wisdom that TN limits algal production in coastal waters, TP is a limiting nutrient during the spring and summer in the Northern Gulf.
- This TP limitation is occurring now because of excessive TN loadings over the past 50 years, which have altered normal N: P ratios.
- Together TN and TP co-limit algal production and the associated hypoxia, so they both need to be reduced to shrink the hypoxia zone.

7-24-07 SAB Draft Report Conclusions - cont.

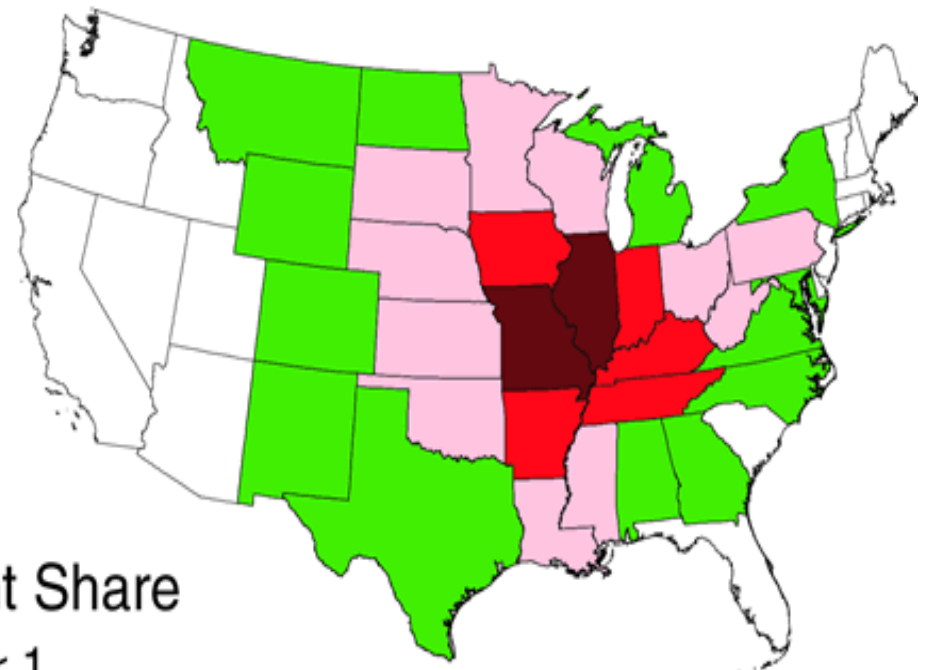
- The inflow of nutrients from April through June, when the Mississippi River flow is high in both TP and TN (especially nitrate), appears to determine the amount of hypoxia.
- April through June TN inflow has declined since the 1980s; but TP inflow shows a 9.5% increase (when compared to the 1980 – 1996 average).
- Point sources represented 22% of TN inflow and 34% of TP during the last five years.

N and P contributions to Gulf by State

Nitrogen



Phosphorus



Percent Share



7-24-07 SAB Draft Report Conclusions - cont.

SAB found the best opportunities for reducing TN and TP in five areas:

1. Alternative cropping (perennials or alternative crop rotation) and promoting environmentally-sustainable management of corn and grain-based biofuel production in targeted areas.
2. Improved management of nutrients to reduce runoff (e.g., reduced fall fertilization). *(CAFOs beware)*
3. Construction and restoration of wetlands.
4. Introduction of tighter TN and TP limits on municipal point sources (also industrial) Note: Even if you discharge to a municipality (POTW), you will be affected by new surcharge rates for TN and TP.
5. Improved drainage water management.

7-24-07 SAB Draft Report Conclusions - cont.

- 22% of annual average TN inflow and 34% of annual average TP to the Gulf comes from point source discharges.
- Tighter limits on TN and TP in wastewater effluents (3 mg/L TN and 0.3 mg/L TP) could achieve an estimated 11% reduction in annual average TN and a 21% reduction in TP to the Gulf.
- Although the exact N and P limits could be debated, clearly there are regulatory opportunities to significantly reduce TN and TP to the Gulf.

Preliminary Opinions Regarding Future TN and TP Limits

- Presently EPA is sorting their priorities to be prepared for either a Democratic or Republican victory, but nutrient are on the “front burner” in either case.
- The focus will be on nutrients in both agricultural runoff and point sources.
- EPA may continue to rely on Numeric Nutrient Criteria and TMDLs to reduce nutrients, but a recent NRDC petition to EPA to impose nutrient limits on POTWs as “secondary treatment” may change that.
- If they continue with Numeric Nutrient Criteria & TMDLs, EPA will try to accelerate States adopting them.

Preliminary Opinions Regarding Future TN and TP Limits – cont.



With high TN (80-300mg/l) and TP (15-35 mg/l) effluent concentrations, the meat and poultry industry is the “low-hanging fruit” to regulators!

Preliminary Opinions Regarding Future TN and TP Limits:

- Nutrient limits will probably be concentration based, not mass limits.
- It is questionable whether EPA will establish different TN and TP limits for POTWs and industry.
- EPA may be willing to raise the proposed 3.0 mg/l TN and 0.3 mg/l TP limits upward, but 8-15 mg/l TN and 1 mg/l TP limits may be as good as we get.

Preliminary Opinions Regarding Future TN and TP Limits – cont.

- In the past, EPA has imposed these types of limits more rapidly on industry than on POTWs.
- In a “worst case” scenario, new nutrient limits might be imposed on industries around 2013, to show positive movement toward meeting the 2015 goal of reducing the dead zone to 5,000 sq km.

What do we do? What do we do?

- Determine whether industry should lobby EPA/States for higher nutrient concentrations than those for POTWs, or join with POTWs in trying to “guide” EPA/States regarding nutrient limits.
- Since “The inflow of nutrients from April through June, when the Mississippi River flow is high in both TP and TN (especially nitrate), appears to determine the amount of hypoxia.” all point-source dischargers (industry and POTWs) should lobby States/EPA for nutrient limits only during that time period.
- Industry and POTWs should lobby States/EPA for only monthly, or even seasonal, nutrient limits from April through June – no daily or weekly limits.

Questions?