

Expected Impacts to Coal
Combustion Product Utilization
(Risks, Landfilling, and Costs)
From Mercury Sorbent Materials

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2001 WE Coal Ash Production

- **Fly Ash** = **569,744 tons**
- **Bottom Ash** = **129,627 tons**
- **Total** = **699,371 tons**

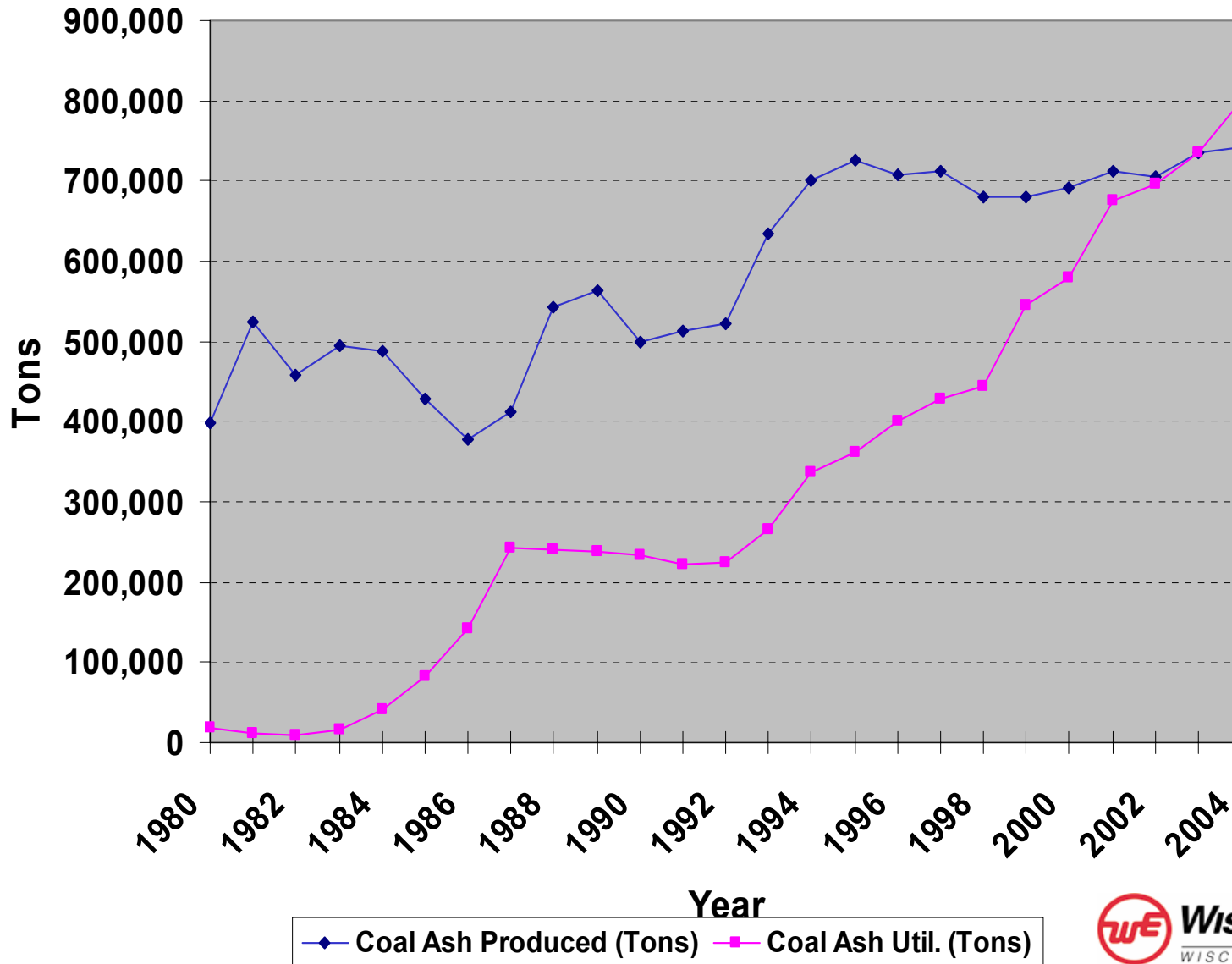


2001 CCP's Utilization (Tons)

| | |
|------------------------------|---------|
| • Concrete | 237,000 |
| • Waste Stabilization | 116,000 |
| • Sub-Base (Btm. Ash) | 76,000 |
| • Supplemental Fuel | 70,000 |
| • Landfill Applications | 37,000 |
| • Cement Raw Feed | 23,000 |
| • CLSM Flowable Fill | 19,000 |
| • Reclaimed Ash Material | 9,000 |
| • Soil/Asphalt Stabilization | 6,000 |
| • Miscellaneous | 1,000 |



WE Coal Ash Production & Utilization



2001 Ash Utilization

- WE Ash Utilization in Wisconsin is 97%
- The National Average is 32%

Effects of Carbon in Fly Ash for Concrete

- Organic Contaminant
- Affects Freeze/Thaw Durability
- Admixture Quantities
- Color
- Water Demand & Strength



Predicted Carbon in Ash

| Injection Concentration (lbs/Mmacf) | Injection Rate (lbs/h) | PAC in Ash (%) |
|------------------------------------------------|-----------------------------------|---------------------------|
| 10 | 340 | 4.3 |
| 5 | 170 | 2.2 |
| 2 | 70 | 0.9 |
| 1.1 | 40 | 0.5 |

American Society of Testing and Materials

ASTM C618

- Puts a 6% limit on carbon content in concrete
- Yet 1% is the real world limit
- The key is consistency - to manage risk and minimize liability

ASTM C618 P4 Results

- LOI Changed from 0.6% to
 - A range of 1.0 to 3.6%
- Strength Activity Changed from 91.3% to
 - A range of 84.1 to 86.8%
- Specific Gravity Changed from 2.58 to
 - 2.56 to 2.49
- No significant change in other parameters

Foam Index Testing Method

- Set amount of cement, fly ash and water or fly ash and water are introduced into a jar, capped and shaken
- Diluted drops of concrete air entraining admixture are added in small increments and shaken after each addition
- Determine how many drops are required to produce a stable foam on the surface
- The number of drops is the foam index

Carbon in Ash Foam Index Results

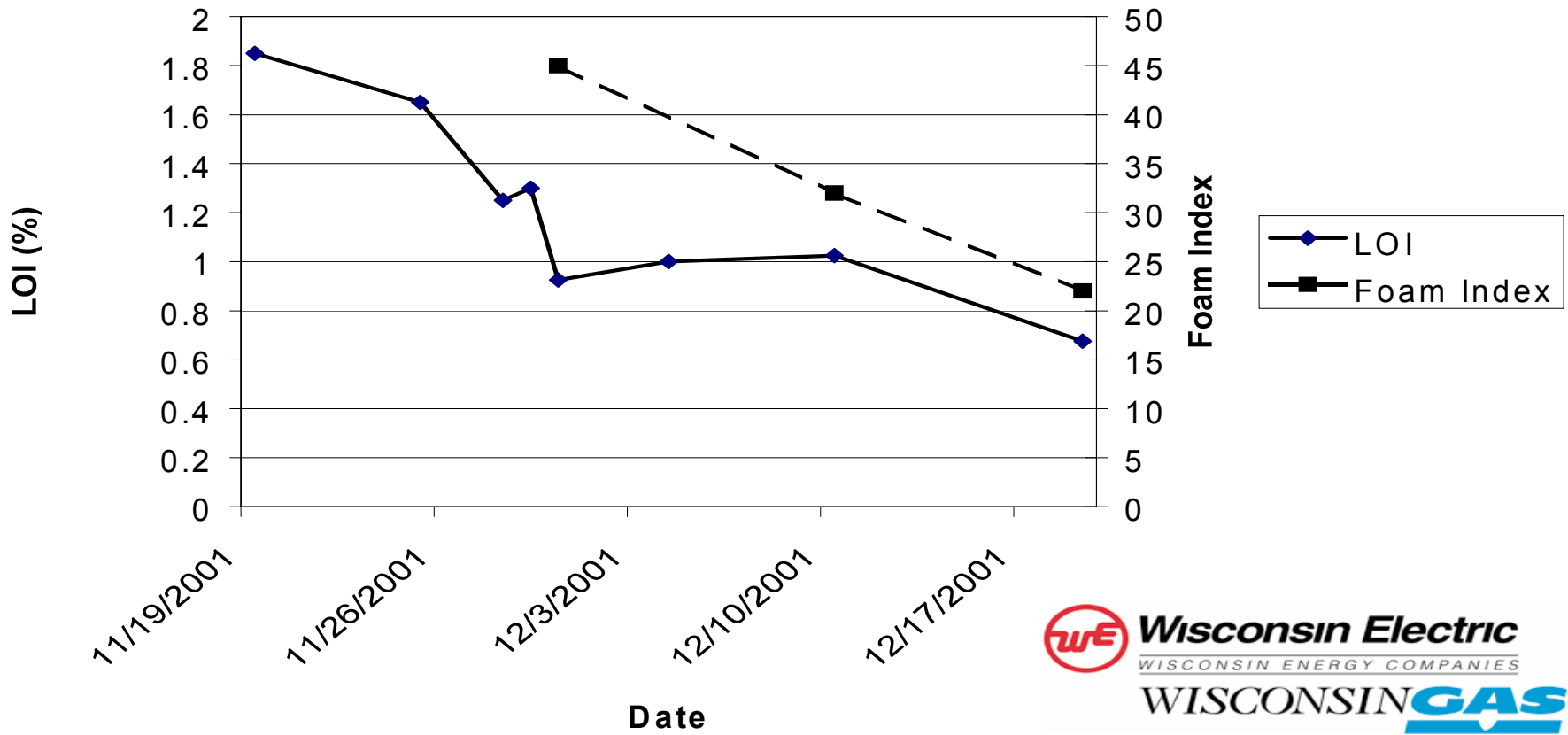
Salable Contract Limit is 25 Drops

| Injection Concentration (lbs/Mmacf) | Unburned Carbon in Ash (%) | Foam Index (Drops) | Comment |
|------------------------------------------------|-------------------------------------------|-------------------------------|------------------|
| 0 | 0.55 | 15 | Normal |
| 1 | 1.1 | >72 | Maxed out |
| 3 | 1.6 | >72 | Maxed out |
| 10 | 3.6 | >72 | Maxed out |

Residual Carbon Effects

Testing Concluded on 11/15/01

P4 Precip #8 LOI & Foam Index



Fly Ash

Mercury Content (Bulk)

- Normal = 0.13 ppm
- Low Sorbent = 0.74 ppm (0.48-0.93)
- Medium Sorbent = 0.85 ppm (0.80-0.91)
- High Sorbent Hg = 0.95 ppm (0.84-1.00)
- NR 538 (Category 1) = Less than 4.7 ppm

Fly Ash

Mercury Content (Leach)

- Normal = Less than 0.000028 mg/l
- Low Sorbent = 0.000033 mg/l
- Medium Sorbent = Less than 0.000028 mg/l
- High Sorbent Hg = Less than 0.000028 mg/l
- NR538 (Categ. 1) = Less than 0.0002 mg/l