Voluntary Aluminum Industrial Partnership

SF_6 and the Environment:
Emission Reduction Strategies
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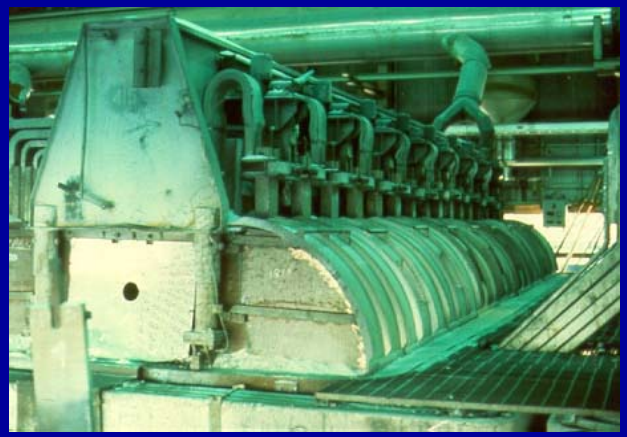
Jerry Y. Marks
J. Marks & Associates
Former Alcoa VAIP Liaison Manager and
Manager of Alcoa Analysis & Testing Services)
312 NE Brockton Dr
Lee's Summit, MO 64064
Email: marks@world-aluminium.org

Discussion Points

- **VAIP background**
- **VAIP agreement structure**
- **Program results**
- **Benefits of VAIP program for producers**
- **Future direction**

Aluminum Electrolysis Operations



Electrolysis cell

Production line

New and consumed anodes

VAIP Background

- Growing awareness of issue in early ’90s
  - ✓ CF_4 and C_2F_6 produced during anode effects
  - ✓ 100 year GWPs of 6500 and 9200
  - ✓ Very stable in atmosphere
- EPA and Aluminum Association dialogue
  - ✓ EPA proposal for voluntary reduction agreement as part of Climate Action Plan
  - ✓ Agreement language developed for reduction from 1990 baseline

VAIP Background

- Individual companies sign voluntary reduction agreements
  - ✓ Company targets established based on technology and capability
- Program officially launched in early 1995

Elements of the VAIP Partnership

- Common agreements and principles
  - ✓Only technically feasible and cost effective sought
  - ✓Acknowledge that factors that influence rate of PFC generation not fully understood
  - ✓Target 30% - 60% reduction in PFC emissions

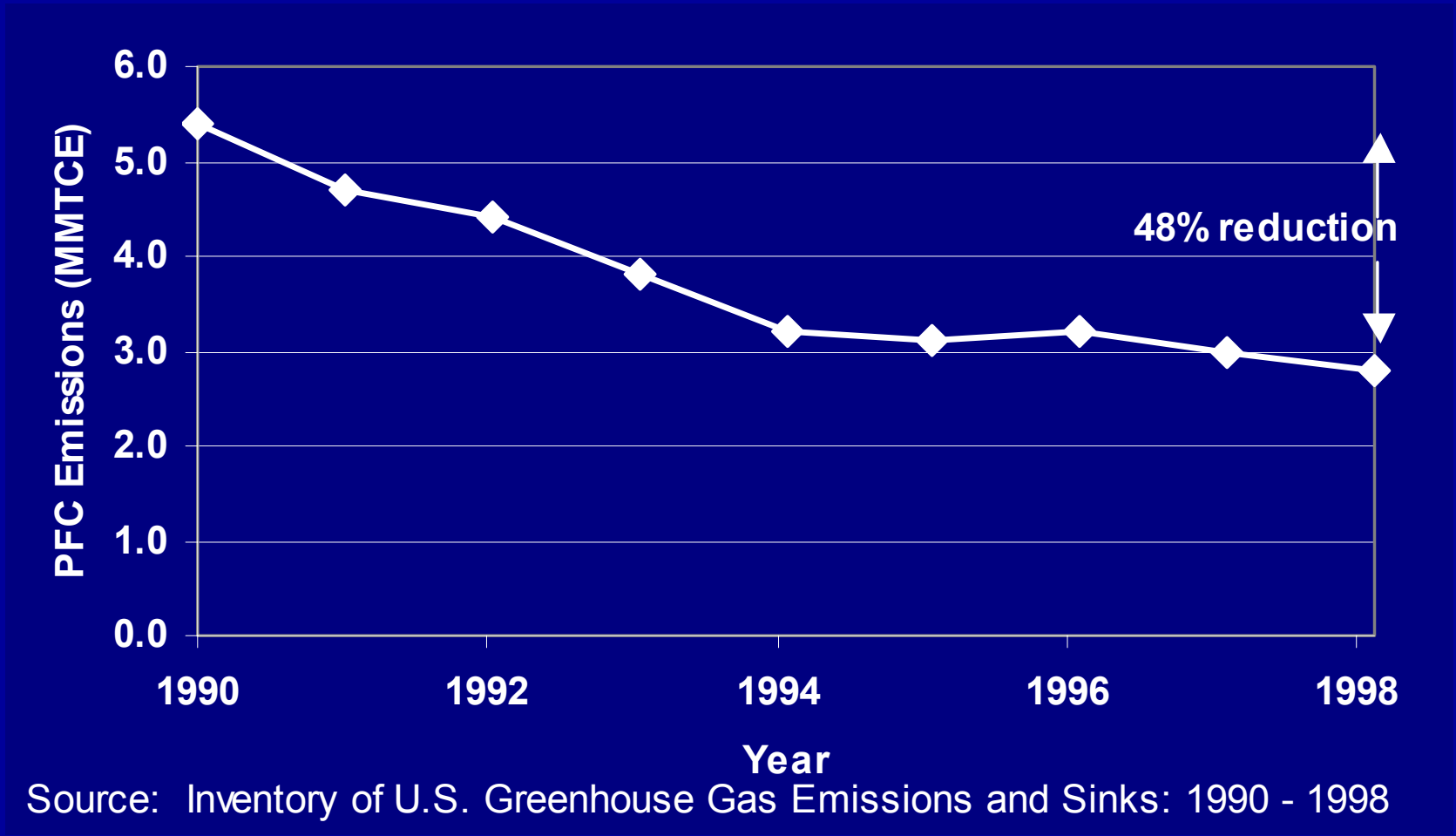
Elements of the VAIP Partnership

- Company responsibilities
  - ✓Provide a liaison person
  - ✓Reduction target based on technology and capability
  - ✓Monitoring and reporting

Elements of the VAIP Partnership

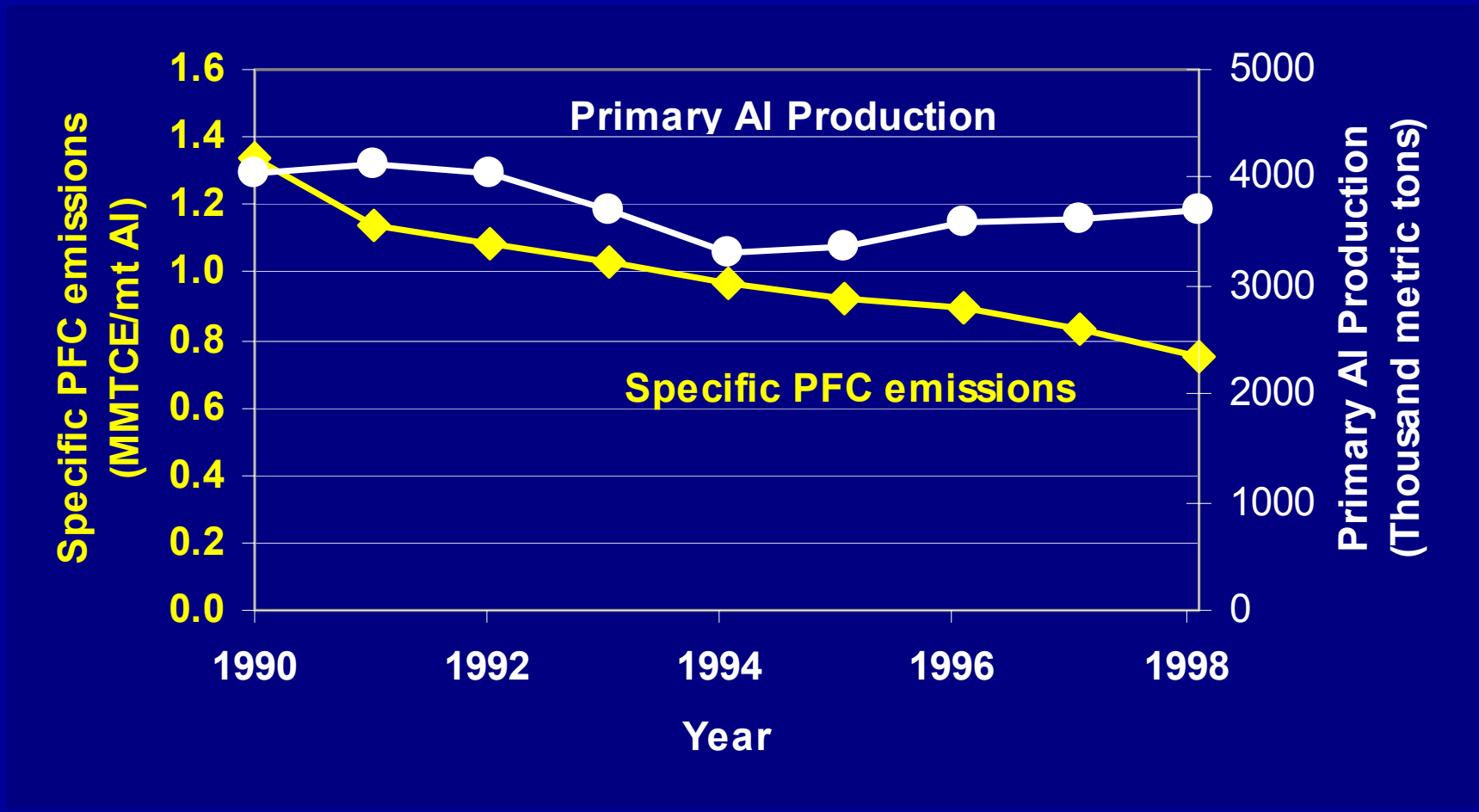
- EPA responsibilities
  - ✓ Provide a single liaison person
  - ✓ Sponsor workshops for information sharing
  - ✓ Communicate on progress of the program

Trends in PFC Emissions From US Primary Aluminum Production



Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 - 1998

Specific PFC Emissions and Trends in US Production



VAIP Program Benefits

- Accelerated reductions in emissions achieved
- Establishes communication channel for dialog on common issues
  - ✓Setting emissions reduction targets
  - ✓International climate change negotiations competitiveness issues
  - ✓Inventory documentation
- Workshops held for information sharing

VAIP Program Benefits

- Measurement programs
  - ✓ Better understanding of PFC generation mechanisms
  - ✓ Standard reference materials developed
  - ✓ Measurement protocols documented
- Fundamental research program at MIT
  - ✓ Improving understanding of basic mechanisms
  - ✓ Interplay with measurements program accelerates knowledge development

Opportunities for the Future

- Further reductions enabled by
  - ✓Incorporation of best practices
    - Improved work practices
    - Better ore control
  - ✓New technology
    - Inert anode materials
    - Process control improvement

Opportunities for the Future

- Reduction in uncertainty in emissions inventory
  - ✓Common reporting templates
  - ✓Use of IPCC Recommended Practices
  - ✓Additional measurements

Summary

VAIP provided an effective forum to bring US aluminum industry and US EPA together to address a common issue and produce superior results through a voluntary effort that could be tailored to each company's needs