A Frank Appraisal of Using WTE Ash Outside landfills

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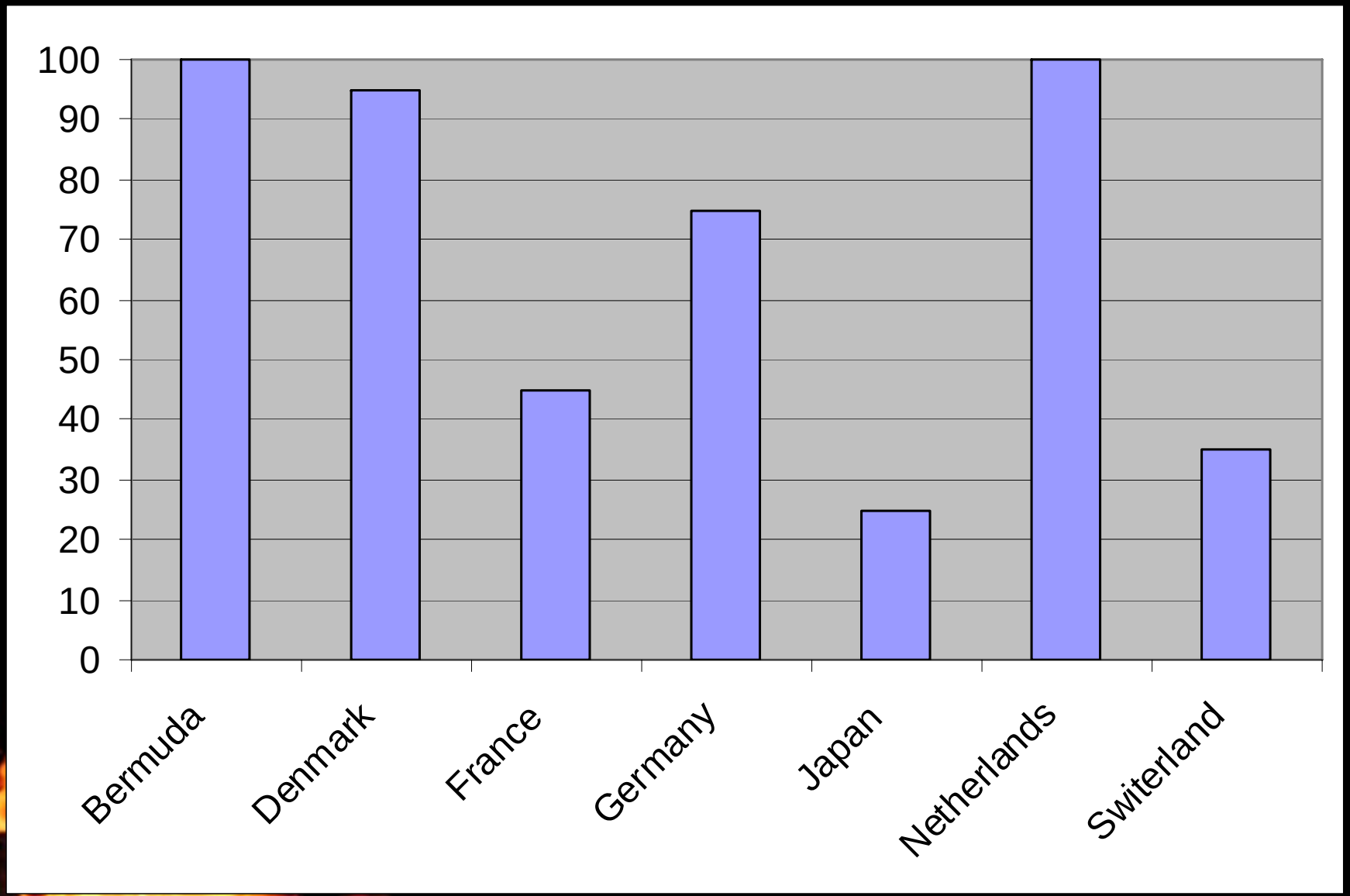
Ash from combustion of as-received MSW (Mass-burn)

- **Bottom ash**: 85-90% of total ash; low in volatile metals and chlorides
- Ash collected in Air Pollution Control system (**APC ash**): 10-15% of total; high in volatile metals, chlorides and calcium compounds
- **Combined ash**: Mixture of bottom and APC ash (practiced in the U.S.)

Utilization of Bottom Ash Abroad



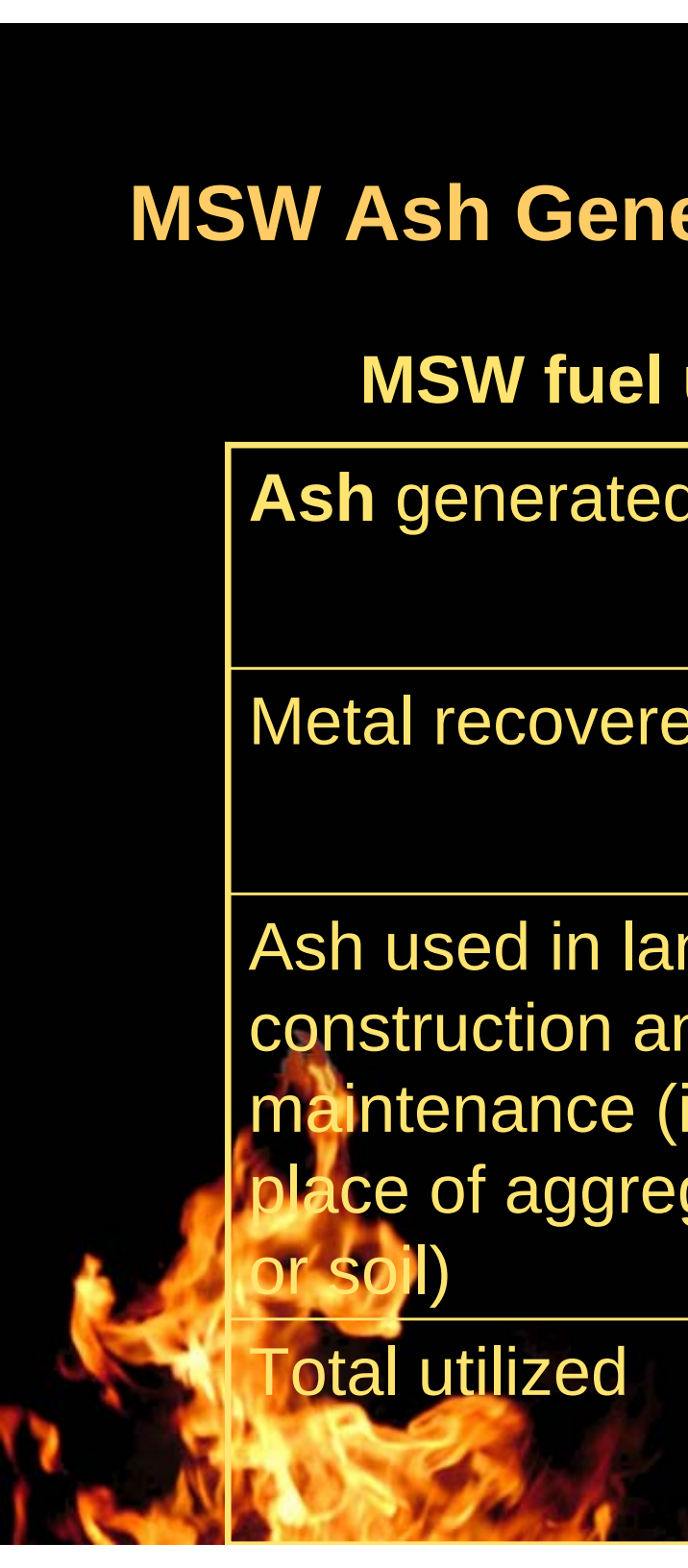
Main Quality Parameters for Using Bottom Ash as Secondary Material

- Total Organic Carbon of less than 1%
- Low concentration of soluble salts (NaCl, etc.)
- Leachability of heavy metals (lead, etc.)

MSW Ash Generation and Utilization in the U.S.

MSW fuel used in WTEs: 29 million tons

Ash generated	8 million tons	100%
Metal recovered	0.8 million tons	10%
Ash used in landfill construction and maintenance (in place of aggregate or soil)	Up to 3 million tons	Up to 38%
Total utilized	3.8 million tons	48%

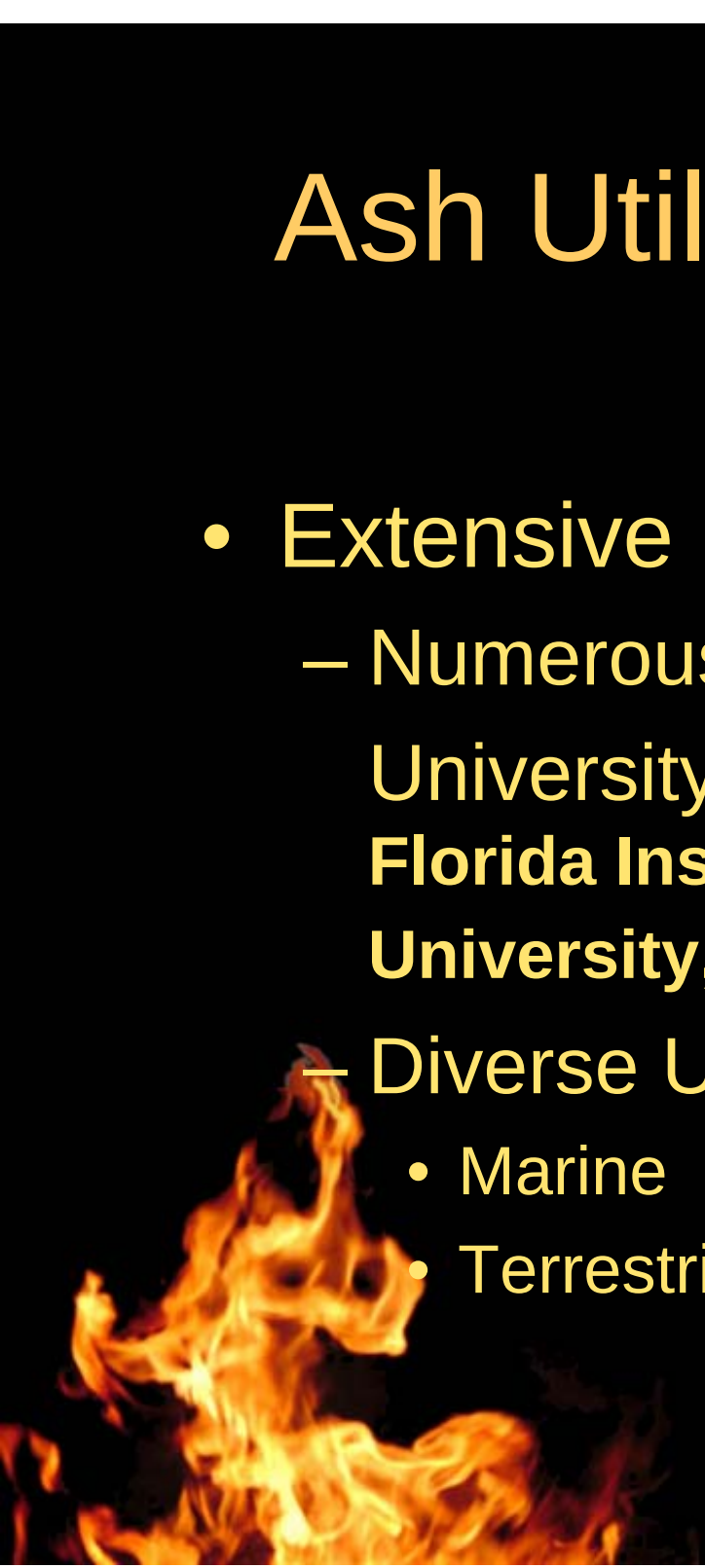


At least 52% of the U.S. WTE ash is landfilled. Can it be used beneficially?

Ash Utilization R&D in U.S.

- Extensive Bench-scale and Field Activities
  - Numerous Research Groups

    University University of New Hampshire, **Florida Institute of Technology, Stony Brook University, Columbia University**, etc.
  - Diverse Utilization Applications
    - Marine
    - Terrestrial



Selected Marine Opportunities

Cement blocks to create new land (Bermuda) or prevent erosion

Embankment (Rivetment) along James River, VA

Construction Opportunities

(Boathouse, Stony Brook; Aircraft hangar, Brookhaven)

Construction Opportunities (cont.)

Taxiway, Brookhaven; Parking lot, Farmingville, NY

Large Scale Applications

- Structural Fill (roads, embankments)
- Land reclamation (abandoned mines, brownfields)

Stream contamination near old coal mines

Large Scale Application of MSW Ash:

Reclamation of Old Strip Mine (from WTERT analysis (M. Hyland) of Bark Camp, PA, test using 300,000 tons of ARF Essex County (NJ) combined WTE ash

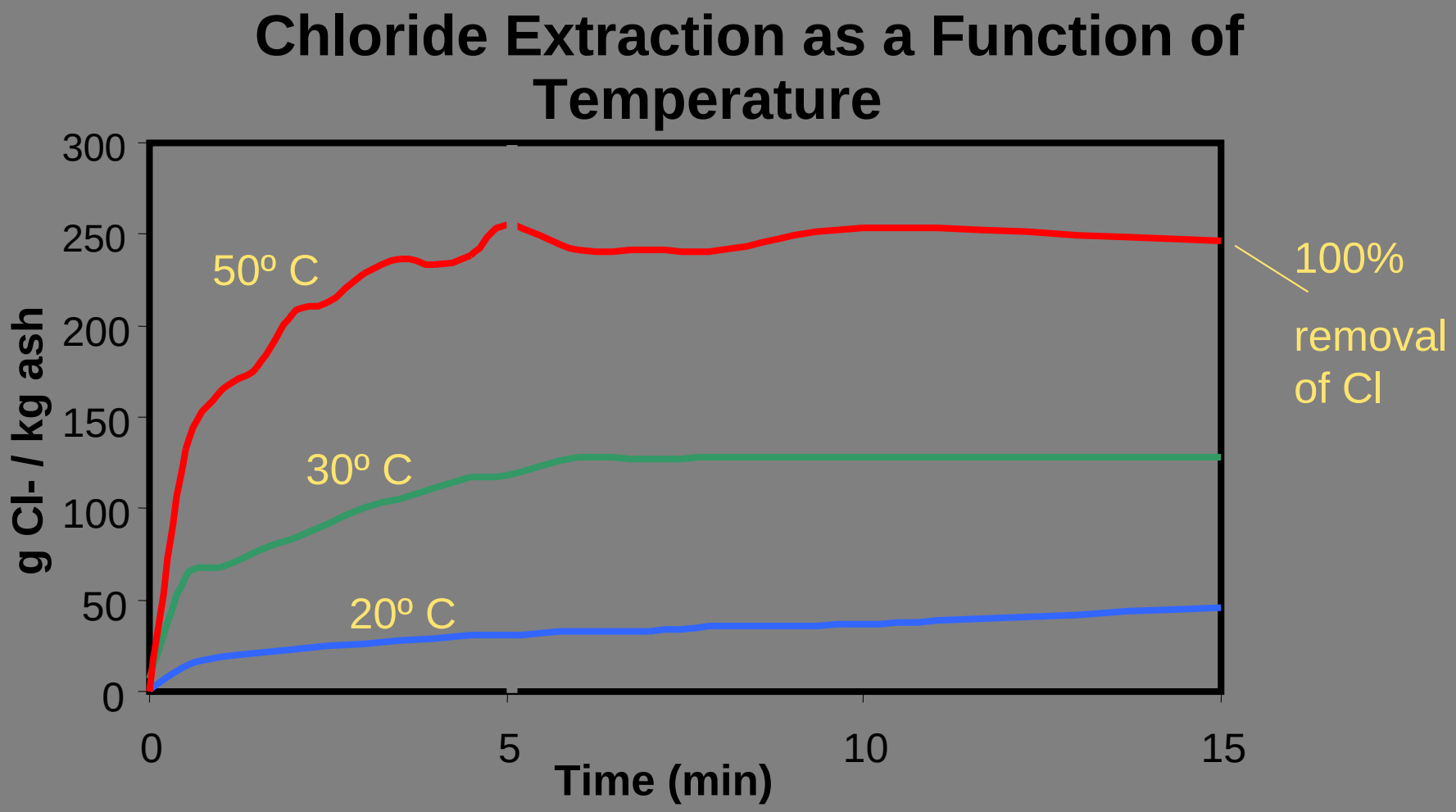
Large Scale Applications:

Reclamation of Old Strip Mines (cont.)

- The only thing that stopped this, otherwise very successful, test was the increase of salt (NaCl) concentration in adjacent surface waters.
- The salt was due to the APC ash contained in the combined ash used.

From **WTER**T Study of Bark Camp, PA, test using 300,000 tons of Essex (NJ) WTE ash (M. Hyland)

WTERT tests with APC ash (A. Penque)



- **50 C found to be optimal temp for Chloride extraction.**
- **All extractions: Chloride removal peaked after ~5 min.**

Large Scale Application:
Reclamation of Old Strip Mines(cont.)

- **WTERT and others have found that NaCl can be removed very easily from APC ash (see next slide)**
- **OR: APC ash should not be mixed with bottom ash**

In any case: This is an application that should be pursued by the WTE industry actively

Consistent Utilization of WTE Ash in the U.S. outside landfills

Impediments to developing new uses for WTE ash

- Landfilling used to be inexpensive
- Cheap aggregate sources
- **Present ash management strategy of combining bottom and APC ash**

Combining bottom and APC ash makes sense when ash is destined to landfills:

- Calcium compounds in APC ash act as a stabilizing agent to form a material that is much less likely to leach out than the raw MSW in landfills
- The use of combined ash in landfill construction and maintenance is beneficial because it reduces the use of soil and stone aggregate in landfills

Recommendations: For uses **outside** landfills, bottom ash should **not** be combined with APC ash

- Ash Separation at selected locations:
  - Bottom Ash used outside landfills
  - APC Ash treated within the WTE Facility and then landfilled
- Design for separate ash collection at
  - New WTEs in the U.S.
  - Expansion of existing facilities
- Additional benefit to communities: Less landfill space required for ash management

WTERT Analysis shows that:

- When WTE ash passes the TCLP (Toxic Leaching Contaminant Procedure) of EPA, it is suitable for landfill disposal
- If APC (Fly) ash is treated so that it passes the TCLP test, then it is suitable for landfill disposal
- A low-cost treating process is needed that can be installed and operated within a WTE site for treating APC ash.

WTERT Research in 2006-2007

- TCLP tests on APC ash have shown that leachate can exceed the EPA limits.

- There are existing technologies for stabilizing APC ash to render it acceptable for landfill disposal (Phosphate stabilization; CO2 absorption-aging; cement-based stabilization; asphalt-based encapsulation)

WTERT Research in 2006-2007 (cont.)

- Optimize the most promising APC ash stabilization technologies
  - Leachate characteristics
  - Optimize financial benefits (e.g., reagent use)
  - Equipment and infrastructure requirements

- Develop a model for assessing the long-term economic implications of changing the current ash management strategy (combined ash disposal) to APC treatment and bottom ash utilization for a selected region.