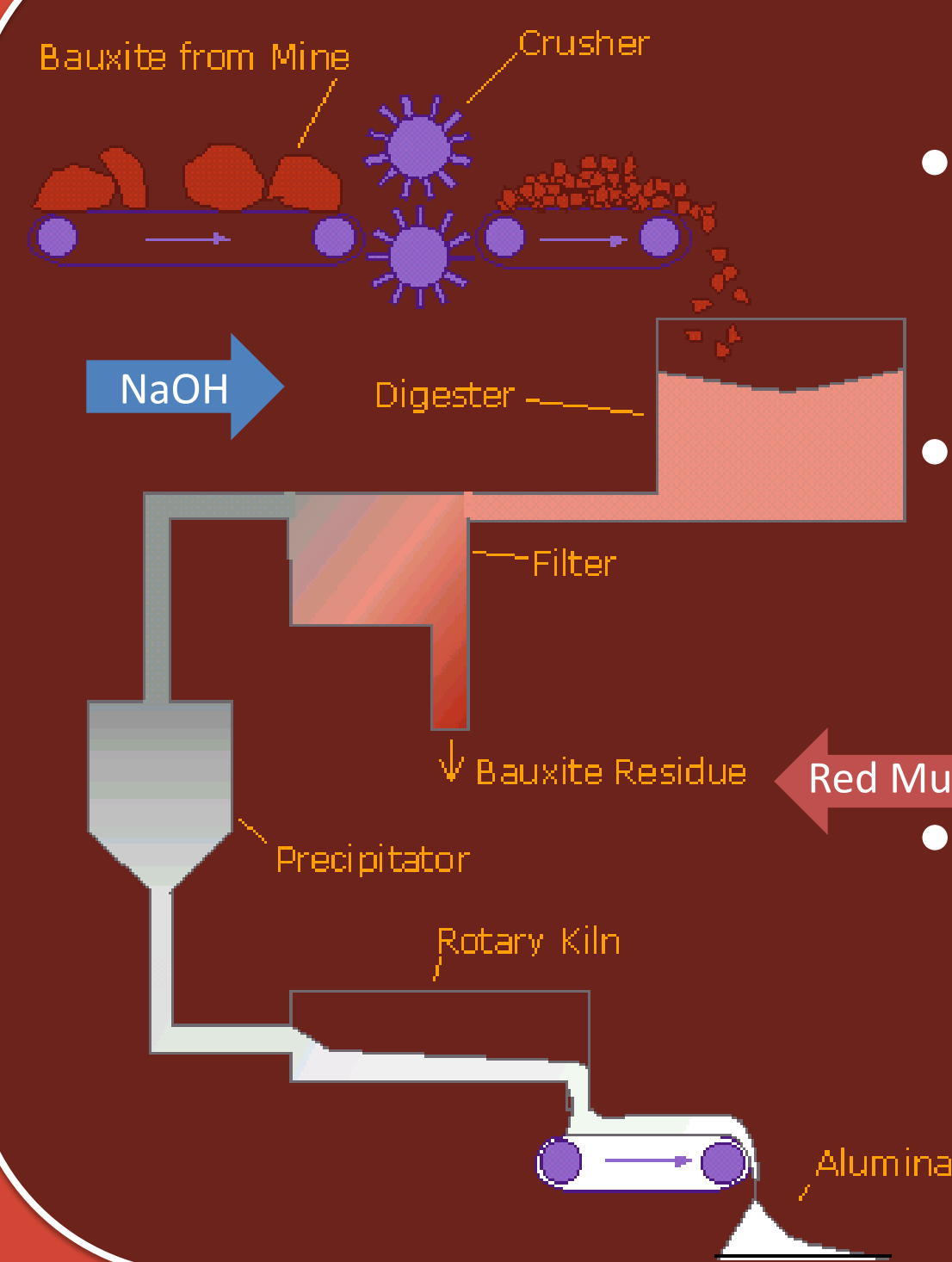


## Goals/Objectives

Our project is about finding the way to recycle and reuse the waste from the aluminum production, which is known as red mud.

Our goal is to find a solution to this red mud disposal issue, while keeping in mind that it has to be equitable to both companies and individuals.

## Background



- One of the most in demand materials is the Aluminum, which is widely used non-ferrous metal.
- Aluminum is never found in its metallic state, and bauxite is the only ore that aluminum can be economically retrieved.
- Waste from aluminum production is called Red Mud, which is highly alkaline (pH 10~13), toxic, and contains heavy metals such as lead, cadmium, chromium and so on.

## Abstract

Worldwide usage of aluminum is increasing annually due to urbanization, and with this information comes the question, what to do with the bauxite residue. The Bayer Process of aluminum production has been in use since its inception 120 years ago, however it produces a very dangerous and toxic byproduct red mud. Every ton of alumina that is produced through use of the Bayer Process creates three tons of red mud, which is then stored in extremely large volumes (millions of tons). The high alkalinity, toxicity, and pH all attribute to the dangerous aspects of red mud, and have made it an alarming threat to mankind and the environment.

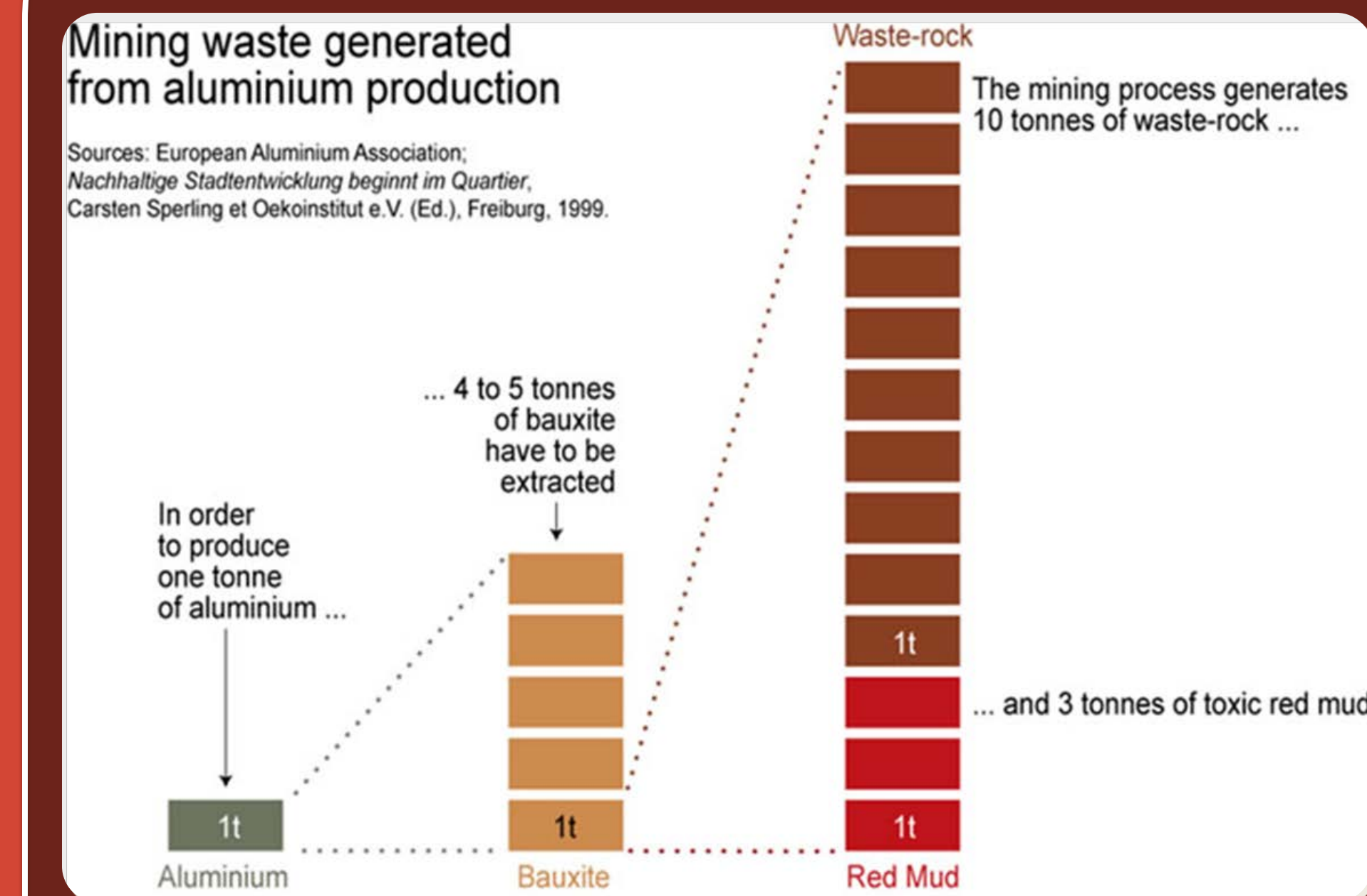


In this regard the main research goal was to establish Carbon Dioxide sequestration as an effective bauxite residue neutralization technique. Also, after neutralization, research was carried out and it was found that bricks, cements, and ceramics could be made or made stronger by the red mud. Extraction of metals from Red Mud was a possibility at all times, however efficiency was an issue. More over, the team has aimed to determine the efficacy of this method as a stabilizing agent, and to potentiate productive utilization of neutralized bauxite residue. Following the project outcomes, the team recommends the use of Carbon Dioxide sequestration for bauxite residue neutralization so that it can be further reused at a significantly reduced cost.

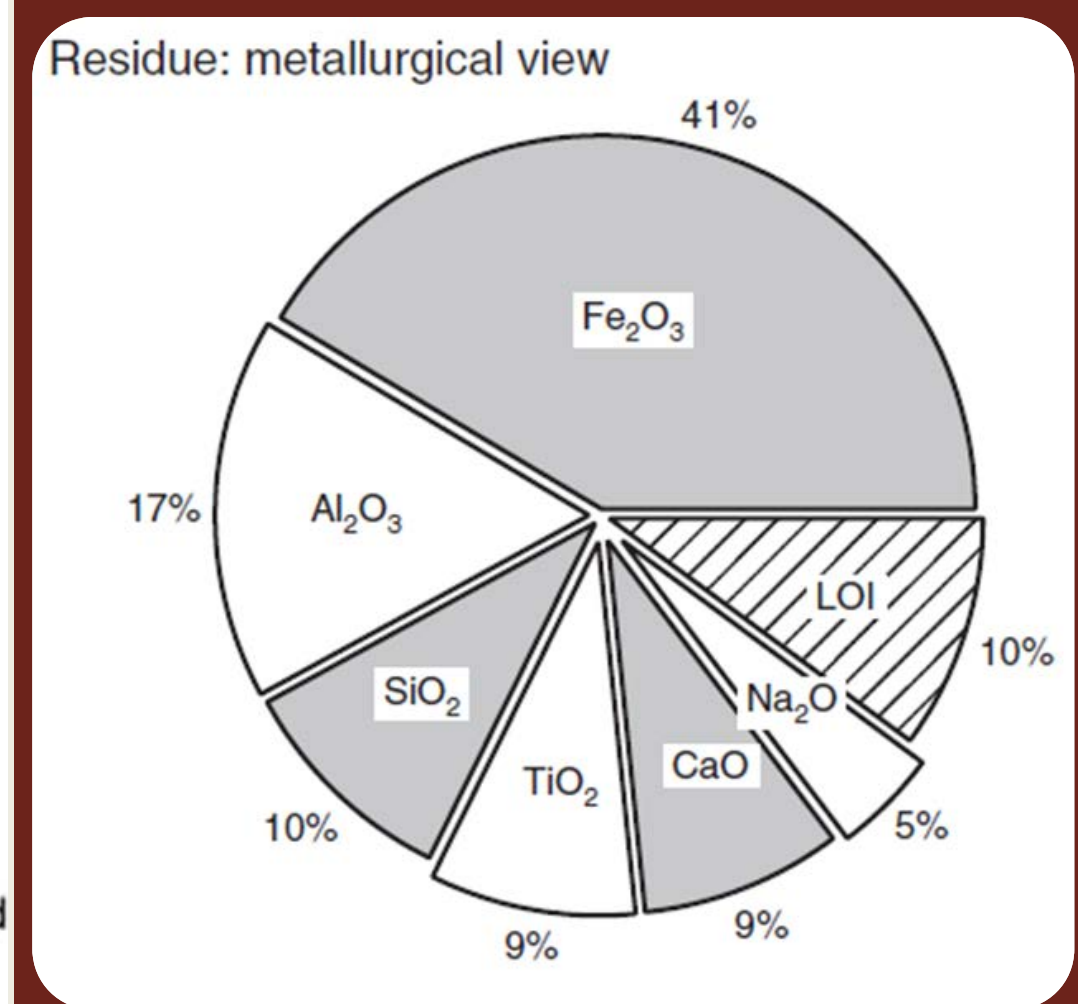
## Impacts

- Lower pH
- Safer in case of spills/leaks
- Reduces danger of chemical burns and soil destruction
- Reduce Carbon Dioxide emissions
- Decrease the speed of Global Warming
- Increase air quality
- Reduce amount of new materials needed
- Provide cheap building materials to those in need
- Is readily available
- As production of Aluminum increases so will the amount of Red Mud available for building materials

## Graphs



Aluminum Production



Contains

## Conclusions/Recommendation

- Carbon Dioxide Neutralization
- Reuse through construction materials
  - Cements
  - Bricks
  - Ceramics



## Acknowledgments

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 PLA: Katie Monighetti  
 Mr. Elwin Rooy (ALCOA)  
 Mr. Jerome Lucaes (RIO TINTO)

## References

1. G. Power, M. Gräfe, C. Klauber, 2011, Bauxite residue issues: I. Current management, disposal and storage practices, pp. 33-45.
2. C. Klauber, M. Gräfe, G. Power, 2011, Bauxite residue issues: II. Options for residue utilization, pp. 11-32.
3. Sameer Khaitan, David A. Dzombak, and Gregory V. Lowry, 2009, June. Mechanisms of neutralization of bauxite residue by carbon dioxide.

## Solution - Carbon Dioxide

- Carbon Dioxide reacts with OH<sup>-</sup> to precipitate out and reduce pH levels
- Over 80 days pH stabilized at ~9
- Liquid CO<sub>2</sub> added to Red Mud
- Liquid CO<sub>2</sub>: 0.235\$/lb
- Carbon Capture techniques would rise costs of electricity by .025-.04 cents/kWh
- Current Carbon Capture techniques include amine absorbers and cryogenic coolers

