Let's Get the Lead Out: Designing Lead Emissions Out of the Manufacturing Process

Steven J. Weik - EnerSys
Vice President – Global Operations
Key Business & Product Drivers

• EPS
• Increased Through-Put
• Lower Scrap Rates
• Reduced Downtime
• Easier Maintenance
• Better Efficiency
• Quick Change-Overs
• Gross Profit

Your Performance
Your Control
“Not So” Key Business & Product Drivers

- Health & Safety of the Public
- Cost of Environmental Compliance
- Reduced Air Leads
- Health & Safety of Our Employees
- Reduced Blood Leads
- Electricity Costs
- Waste Disposal
- Sustainability of Products & Process

Your Performance
Regulators Control
Facts

• Our industry does a fantastic job when dealing with lead emissions
• As regulations become more stringent, the cost of our operations become increasingly higher
• Our industry is no different from others in that regulations that govern our operations, are becoming tighter and tighter
• Most companies in our industry spend a considerable amount of money addressing lead emissions AT THE END OF THE PROCESS
  – Examples:
    • OEM equipment installation requires connections to plant ventilation, exhaust systems and possibly make-up air systems
    • Baghouse technology / Filtration systems
• Why don’t we address lead exposures & emissions directly at the source?
• In fact, why don’t we establish a goal of zero lead exposures and emissions at the equipment & material level?
  – Lofty goal – no doubt – but why not – is it possible – we will never know without getting started!
  – Talking about getting started – this presentation and what we discuss here today is just the beginning, it will take time, resources, collaboration, dedication, and a commitment to excellence to get there!
Who’s Involved

- BCI
- Equipment Manufacturers
- Material Suppliers
- Battery Manufacturers
- Ventilation & Waste Water Consultants
- Environmental Consultants

ARE YOU UP TO THE CHALLENGE?
Agenda

- Steve Weik of EnerSys – Opening /Lead In
- Tim Lafond of JCI
  - Background / Overview of Regulations
- Troy Greiss of East Penn Manufacturing
  - Industry Actions / Impacts /Cost
- Chris Glascock of BM-Rosendahl, Doug Bornas of MAC Engineering, and Alessandro Fossemo of Sovema
  - Equipment Supplier Presentations
- YOU
  - Open forum for questions, comments, etc.
- Session Wrap-Up - Steve Weik
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Timothy J. Lafond, PE
Director of Environmental Engineering
Johnson Controls, Inc.
USA Air Rules: “where we started....how far we’ve come”

- 1955 Air Pollution Control Act
- 1970 Clean Air Act
- 1977 CAA Amendments (PSD, non-attainment)
- 1978 NAAQS for Lead established at 1.5ug/m³
- 1982 NSPS for Lead Acid Battery Plants
- 1990 CAA Amendments (Expansion of NESHAPS)
- 2008 NAAQS for Lead Reduced to 0.15ug/m³
How Have We Done in the USA ???

- National average concentrations of lead in the air have dropped more than 90 percent since 1980.
- Since the late 1970s, average blood lead concentration for children aged 1 to 5 have dropped significantly, from about 15 micrograms per deciliter (µg/dL) to less than 1.2 µg/dL.
- Occupationally exposed workers’ blood leads have also been greatly reduced.
- Currently there are 21 areas designated as nonattainment for the 2008 air quality standards for lead. These areas are taking action to control particular industrial sources including battery plants.
USA Ind. Hyg. Rules: “where we started....where we went”

- 1971 OSH Act (Lead PEL Established at 200 \(\text{ug/m}^3\))
- 1978 OSHA Lead Standard Established (PEL 50\(\text{ug/m}^3\))
- 1990 NIOSH Sets Goal of No blood Leads Above 25 \(\text{ug/dL}\)

Despite no new US Ind. Hyg. regulations or updates to existing rules, the battery industry has achieved incredible reductions in employee blood lead levels. Similar significant reductions have been achieved in Europe and Asia.
Consolidation of battery manufacturing processes and plants has resulted in lead "hotspots" at property boundaries. >> 0.15ug/m^3

Continued agency focus on revising the NAAQS lower based upon health effects. Formally required every 5 years.

Women of childbearing age entering our workforce

Scientific studies on the health effects of lead coming in faster than battery process engineering gains.

Employee blood lead reduction has hit a plateau.

With All That Good News.... What Is The Problem???
Troy A. Greiss MSc, CIH, CSP
Director EHS
East Penn Manufacturing Co.
BCI BLL Improvement

% Battery Plant Workers ≥20 µg/dl

BCI Blood Lead Data Battery Plant Workers:

99.9% < 40
98.9% < 30
85.9% < 20
Regulatory Compliance

- Regulatory Initiatives directed toward Lead Industry
- Significant Activity Dedicated to Ambient Air Quality, EPA
  - Public Health
  - Children
- Increased emphasis directed toward Indoor Air Quality/Occupational Exposure
- US OSHA Lead Standard based on Indoor Air Quality/Employee Exposure
  - Action Level
  - Permissible Exposure Limit
  - Hazard Prevention and Control
  - Major Emphasis on Hierarchy of Controls
Occupational Lead Exposure Control Techniques

• Hierarchy of Controls
  – Elimination
  – Substitution
  – Engineering Controls
    • Ventilation
    • Isolation
    • Enclosure
  – Administrative Controls
    • Job Rotation
    • Work Practices
  – Personal Protective Equipment (PPE)
Engineering Control Challenges

• Effective and Efficient use of Air/CFM ($)
  – Point of Operation Capture/Control
  – Common/Non-Routine Points of Exposure
    • Access
    • Exposure Control
  – Hybrid Approach
• Isolate/Enclose/Ventilate
• Are We Talking “Clean Room Technology”?
Next Steps

• Collaborative Effort – Mutual Survival
  – Equipment manufacturers
  – Battery Manufacturers
  – BCI

• Resources:
  – ACGIH Industrial Ventilation Manual
  – BCI Particle Size Data
  – BCI Job Specific Battery Plant Data
  – OSHA E-Tool

• Enhanced Equipment Design for Employee Exposure Control and Regulatory Compliance, Build a Better Mouse Trap

Continued Improvement Efforts necessary from all parties;
“Let’s Get the Lead Out”
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Chris Glascock
North American Representative
ENVELOPING AND STACKING

As BM gets faster, lead in air control becomes more critical!

BM 10 (1998) 120 PE enveloped plates per minute
BMV 10 (2006) 140 PE enveloped plates per minute
BMR 10 (2014) 160 PE enveloped plates per minute
What are we dealing with?

Austria Required Test institute: ÖSBS
Test 1 – Plate loading area
Test 2 – 9 feet in front
Test 3 – 9 feet in back

Operators typical lead contact:
1) Stack breaking/plate feeding
2) Up Righting Exit Conveyor
3) When they have to get inside the stacker
Design Criteria For Lead In Air

- Tighter fitting, easy access, and robust plexiglas doors and windows
- Servo controls for soft plate feeding and stacking at high speeds
- Plate surface vacuuming
- Maximize sight lines for safe trouble shooting
- Eliminate internal horizontal surfaces to prevent lead dust build up
- Source capture dust where it is created
Ventilation Design criteria

- Maximum face velocity and high negative pressure at plate stack breaking.
- Low static pressure duct design reduces amount of ventilation required.
- High efficiency vacuum system (filter house with blow back and high capacity filter cartridge).

BMV10: 11,200 CFM @ 3,350 ft/min

BMR10: 5,900 CFM @ 4,100 ft/min
Conclusion: Moving Forward

- Add down draft ventilation over operator at plate feeding
- Balance the +/- pressures within the plant to eliminate dust movement
- Perform lead in air tests - operator station: Know what you are dealing with
- Increase use of ventilation tables and ventilated waste bins
- Maximize training of operators for safe cleaning procedures
- Automatic clean out of drop out drawers
- Enhance pasting papers to reduce lead dust at assembly
- THE ULTIMATE GOAL: Auto-Loading Systems for Plate Feeding:
  An operator free operation

THANK YOU!
Let’s Get the Lead Out: Designing Lead Emissions Out of the Manufacturing Process

Douglas Bornas - MAC Engineering
VP Sales and Marketing
MAC has worked on reducing lead in air by offering equipment that helps reduce handling of the plates through the Pasting and Curing processes.

We feel that one of the best ways to reduce lead emissions is to keep paste where it belongs and not allow paste to easily fall off downstream in the process.

To this end, we offer continuous line Pasters, Dividers, Flash Drying Ovens, Parting / Brushing, Stacking, Robotic Palletizing and Rack Handling systems to help reduce operator involvement.
Prior to 2010, MAC was learning more and more each day in regards to restrictions, blood level, operator exposure to lead in air.

Traditionally we made cotton belt pasters, standard Ovens, Parters, and COS machines. We were just getting into automated equipment such as Stackers with brushing, Robotics, and off load. Reducing lead in air was not always a primary focus for us.

At that point, we had to re-adjust our thinking and focus more on what we could do to make equipment that would help battery manufacturers in this fight against emissions. This is where we headed.
MAC Engineering and Equipment Company, Inc.
Approach to Lead Emission Reduction - Present

• Currently, we have made great strides in equipment that can help reduce lead in air.
  – Steel belt Paster,
  – Flash Drying Ovens with LO-NOx Burners
  – FlowMAC Parters to brush lugs and part grids
  – Stackers with capability to brush all four sides
  – Robotic Offload for Palletizing
  – Rack Handling Systems

ALL DESIGNED TO KEEP PASTE FROM GOING DOWNSTREAM and REDUCING AMOUNT OF OPERATORS
WHERE TO GO FROM HERE:

Mac is continuing to develop new ideas and new ways to help in this fight.

We are trying to challenge ourselves daily to come up with ways to reduce operator involvement, as we believe this to be the most efficient and easiest way to conquer this problem.

We know that some operator involvement will always be needed and in those areas we will strive to make equipment like we have recently to further protect the operators and their safety.
CONCLUSION:

Got a call from a small company about LO-NOx..

Moving Forward, MAC will continue to improve our machines to meet customer demands.

Machines that help reduce lead in air to keep blood levels down is something we are certainly concerned with and working on solutions to make things better.

This will need to be a combined effort between the Manufacturers and Suppliers in order to be successful. We need to exchange ideas and solutions in order to make a dent in this problem area.
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Alessandro Fossemo’ – Sovema S.p.A. General Manager US branch
Sovema builds a complete line of production machinery for battery manufacturing operations. Beginning with the lead ingot through to the final product, including production control and automation systems designed around state-of-the-art technological concepts.
• NO HEPA FILTER (secondary filter).

• BAG-HOUSE FILTER: New bags with big holes or clogs.
HEPA FILTER
making sure exhaust air has a filtration grade conform to H13

PULSE JET: Continuous cleaning and control of the filters bags to check if they are clogged or damaged (by mean of a detection of differential pressure).

ENCLOSED DIRECT DRIVE MOTOR: Noise /emission reduction and efficiency increase (30T units requires -10% energy than classic 24T)
• NEW DESIGN (Direct Drive and bigger filters) is showing continuous improvement of overall efficiency.

• NEW PELLET SYSTEM: no lead pot and no cylinder caster (to minimize lead emissions).
CONCLUSIONS

Environmental requirements in all continents

Bidirectional communication with the users

Benchmark of other industries

A long journey to a green process!

The implementation of the most stringent specs

700+ units installed all around the world
127th Convention + Power Mart Expo
Empowering innovation through imagination and determination