AIR DYNAMICS
Industrial Systems Corporation™

CASE STUDY

Eliminating Sulfuric Acid Mist in Metal Pickling Environment

Air Dynamics Industrial Systems Corporation

Serving the industrial manufacturing industry since 1991.

CASE STUDY

Eliminating Sulfuric Acid Mist in Metal Pickling Environment

Background

The facility operates a continuous sulfuric acid pickling process to clean steel and prepare it for coating and fabrication. While essential, this process generates sulfuric acid mist and sub-micron vapors that degrade air quality, accelerate equipment corrosion, and increase compliance risk. An underperforming scrubber system—operating at less than half of ACGIH-recommended airflow—left the plant struggling with persistent air quality and operational challenges.

System Specifications Summary

Parameter	Value
Total Airflow	120,000 ACFM
Scrubbers	4 × 30,000 CFM
Fan Power	176 BHP total
Makeup Air	80,000 SCFM
Tank Temperatures	128°F – 146°F
Operation	24/7 Industrial Operation

THE CHALLENGE

A Complex Challenge Taking Shape

The plant's acid dip tank room presented a combination of problems that standard solutions could not resolve:

- Massive open tanks spanning 50 to 70 feet created unstable, turbulent airflow
- Acid mist and flux vapors escaped capture and spread across the workspace
- Corrosive conditions damaged infrastructure and reduced system lifespan
- Continuous operations limited opportunities for shutdown or retrofit

According to ACGIH standards, each tank required between 30,000 and 60,000 ACFM of airflow, depending on disturbance levels. The existing system fell far short of that threshold.

The result: poor contaminant capture, rising maintenance costs, and increasing pressure to meet safety and environmental standards.

83K CFM Hot Dip Galvanized APCD Unit

THE SOLUTION

Seeing the Air Differently

Air Dynamics approached the problem with a deeper question: What is the air actually doing inside this space?

Using Computational Fluid Dynamics (CFD) modeling instead of a physical pilot system, engineers visualized airflow patterns across the tank room. The findings changed the direction of the solution.

Acid vapors were not drifting passively. They were rising and roiling vertically, creating chaotic circulation that resisted capture.

Traditional exhaust-only systems could not control that behavior.

However, the **modeling revealed a turning point: with the right strategy, airflow could be reshaped entirely.**

Air Dynamics Industrial Systems Corp.
180 Roosevelt Ave., York, PA 17401

mysolution@airdynamics.net | www.airdynamics.net
P: (717) 854-4050 | F: 717-854-4020

Engineering a Controlled Airflow System

Rather than chasing contaminants, Air Dynamics designed a system that would control how they moved.

1. High-Capacity Wet Scrubber System

The foundation of the solution included four independent wet scrubbers:

- 30,000 ACFM per unit
- 120,000 ACFM total system capacity
- Corrosion-resistant PVC construction
- Integrated hoods, reagent systems, and 25-foot exhaust stacks

Each scrubber operates independently. Maintenance on one unit no longer forces a full shutdown. The system maintains 75% operational capacity even during service.

2. Push-Pull Ventilation Strategy

The most critical shift came through airflow design.

Instead of allowing vapors to rise uncontrollably, the system introduced a push-pull configuration:

- Pull: 30,000 ACFM per tank
- Push: 800 SCFM per tank

This approach converts vertical turbulence into a controlled horizontal airflow path. Contaminants move predictably toward capture points, improving efficiency across the entire tank surface.

3. Makeup Air System for Balance and Efficiency

Airflow control requires balance. To support the exhaust system, Air Dynamics installed:

- Two 40,000 CFM direct-fired makeup air units
- 80,000 CFM total capacity
- 92% energy efficiency
- Variable air volume with modulating gas controls

The result supports proper building pressure, consistent airflow performance, and improved thermal conditions for workers.

4. Facility Upgrades That Reinforce Performance

Airflow improvements alone would not solve the problem without addressing environmental factors.

Key upgrades included:

- Epoxy-coated elevated pads to protect equipment
- High-efficiency LED lighting to improve maintenance visibility
- Roof penetrations for optimized exhaust discharge
- A fast-acting roll-up door to eliminate cross-drafts

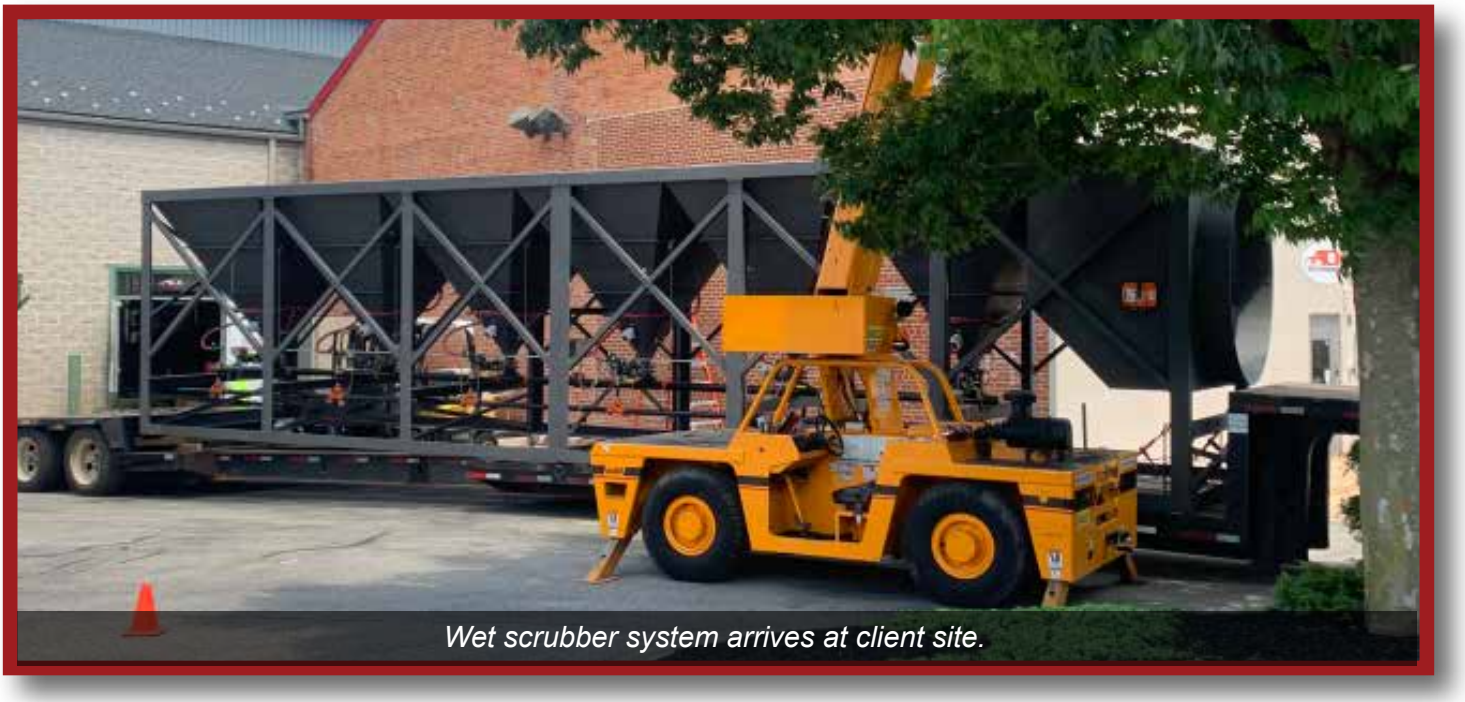
That door played a critical role. Eliminating cross-drafts stabilized airflow patterns, aligning performance with ACGIH recommendations.

5. Smart Controls and System Intelligence

The system operates through an integrated control architecture:

- VFD-driven airflow control
- Central PLC with localized scrubber panels
- Safety interlocks and instrumentation
- Expandable electrical design for future integration

Operators gained precise control over performance without increasing complexity.



Wet scrubber system arrives at client site.

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50,000 CFM Heated MAU

THE RESULTS

From Chaos to Control

Once installed and commissioned, the transformation became measurable across every category.

Air Quality

- Effective capture of sulfuric acid mist and flux vapors
- Compliance with ACGIH and OSHA standards

Operational Reliability

- Continuous operation supported through system redundancy
- Simplified maintenance through modular design

Process Efficiency

- Balanced airflow eliminated dead zones
- Consistent contaminant capture across large tank surfaces

Energy Performance

- High-efficiency makeup air systems reduced energy consumption
- Lower operating costs compared to the legacy system

Execution Without Disruption

Despite the complexity, the project aligned with the plant's operational demands:

- Engineering: 14–16 weeks
- Manufacturing: 40–48 weeks
- Installation: Coordinated alongside active production

Air Dynamics delivered full lifecycle support, including:

- System design and planning
- Controls programming and integration
- Air balancing and commissioning
- Operator training

Investment

- Wet Scrubber System: $3,788,200
- Makeup Air System: $1,807,023
- Total Investment: Approximately $5.6 million

CONCLUSION

A System That Changed How the Facility Operates

What began as an underperforming ventilation system evolved into a fully engineered air control strategy.

By combining ACGIH-based design, CFD-driven insight, and modular system architecture, Air Dynamics did more than improve airflow. The company reshaped how contaminants behave inside a demanding industrial environment.

The facility now operates with stable air quality, predictable performance, and a system built to last under corrosive conditions.

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