POLLUTION PREVENTION SUCCESS STORIES AT THE OKLAHOMA CITY AIR LOGISTICS CENTER

Tinker Air Force Base, Oklahoma

Freddie E. Hall, Jr., PhD
Chemical Engineer
ENVIRONMENTAL MANAGEMENT DIRECTORATE
POLLUTION PREVENTION BRANCH

NDIA03-Paper #2

TINKER AFB, OKLAHOMA

Introduction

- Tinker AFB covers 5,031 acres
  - *Only 200 acres are undeveloped*
- 765 Facilities
  - *15.3M feet^2 of industrial operations*
- Three Creek Systems
- 700-plus Air Emission Sources
- 200 Underground Storage Tanks
- 11-Miles Industrial Wastewater Lines
- Three Wastewater Treatment Plants
- 36 Restoration Sites
- Provides Logistics Support to USAF Weapon Systems
  - *B-1, B-52, E-3 Sentry, C/KC-135 aircraft*

POLLUTION PREVENTION

Mission Statement

"To reduce pollution at the Source through a Hierarchy of Actions including source reduction, chemical substitution, recycle, reuse, treatment, and disposal"

"To incorporate the Compliance Through Pollution Prevention [CTP2] process into all environmental compliance sites by generating a 5-year Management Action Plan [MAP] to address the top five percent sites annually via Process Specific Opportunity Assessments [PSOAs] to reduce ESOH cost and risk"

POLLUTION PREVENTION

Program Overview

- Pollution Prevention Opportunities
  - *Purchased 2.1 million pounds of targeted EPA toxic chemicals*
  - *Purchased 328,000 pounds of ozone depleting substances [ODSs]*
  - *Disposed of 12 million pounds of hazardous waste*
  - *Disposed of 35 million pounds of municipal solid waste*
  - *Hazardous material pharmacy tracked 5000+ hazardous materials*
- Pollution Prevention Accomplishments
  - *Reduced chemical purchases by 71% [1.5 million pounds]*
  - *Reduced ODS purchases by 99.7% [328,000 pounds]*
  - *Reduced hazardous waste discharges by 67% [8 million pounds]*
  - *Reduced municipal solid waste by 59% [20 million pounds]*
  - *Reduced number of chemicals tracked hazmaterial pharmacy*
    - *Reduced number from 5000 to 800*

POLLUTION PREVENTION

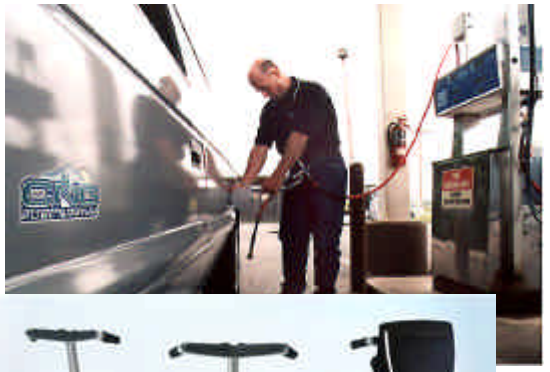
Overview of Benefits

- Environmental Benefits
  - *Use hierarchy of actions including source reduction, chemical substitution, recycle, reuse, treatment, and disposal*
  - *Eliminate / reduce EPA-listed chemicals*
  - *Minimize waste generation*
  - *Minimize water usage*
- Robotic Technologies
- Increase Worker Safety
  - *Isolate hazardous environment*
- Shorten Process Flow Days
  - *From days / weeks to minutes*
- Cost Savings
  - *Eliminated need for abatement control technologies*

POLLUTION PREVENTION

Alternative Fuel Efforts

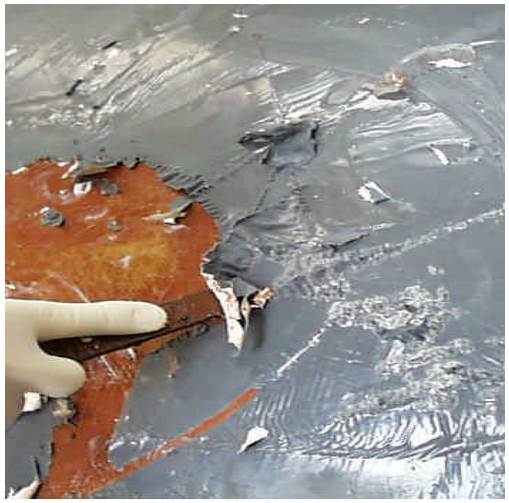
- 153 CNG Vehicles
  - *50,000 gallons with two fill stations*
  - *Reduced gasoline consumption by approximately 141,000 gallons per year*
  - *Reduces tailpipe emissions by 80%*
  - *Fuel economy [cost per mile] equivalent to diesel*
- 12 Electric NEV's
- 10 Segway units
- B20 Fuel for diesel
  - *700 vehicles converted to biodiesel*
  - *Use roughly 180,000 gallon per year*
  - *Reduces tailpipe emissions by 20%*



POLLUTION PREVENTION

Success Stories

- Aircraft Radome Chemical Depainting
  - *MEK EPA-listed chemical solvent*
- TAFB Searched for Alternative Process
  - *High-pressure water blast*
  - *Dry media blast [wheat starch, BOSS]*
  - *Laser coating stripper*
  - *Xenon flashlamp / CO_2 pellet blast*
  - *Radome protective barrier coating*
  - *Chemical alternatives to MEK*
- Chemical Alternative Tested
  - *Compatible with the radome materials*
  - *Capable of removing the protective coatings*
  - *Solvent is a blend of dibasic esters [DBE]*
    - ➢*Low vapor pressure and low toxicity*



POLLUTION PREVENTION

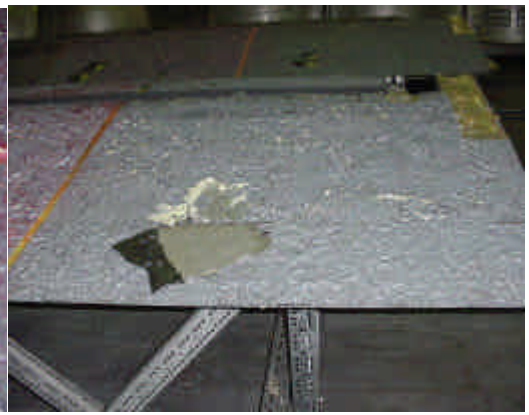
Success Stories [CONTD]

- Benefits of Aircraft Radome Depainting with Dibasic Esters [DBE]
  - *Ease of use*
  - *Goes further [less expensive to use]*
  - *Compatibility with radome materials*
  - *Not an EPA-listed material*
  - *Environmentally compliant*
  - *Lowers health risks to workforce*
  - *$0 implementation cost*
  - *Allows for increased workload*
  - *Reduces operating costs by $30K*
  - *Reduces HAP emissions by 78,000 lbs*
  - *Eliminates abatement requirements [$2M]*

POLLUTION PREVENTION

Success Stories [CONTD]

- Alternative EA Chemical Depainting Agents
  - *Prototyped EA two-part chemical strippers*
    - ➢*Eliminated 800,000 lbs per year*
    - ➢*Four-fold reduction in health risks*
    - ➢*Saved $245K annually*
  - *Prototyping EA one-part chemical strippers*
    - ➢*Projecting to save $300K yearly*
  - *Eliminated abatement requirement [$6M]*



POLLUTION PREVENTION

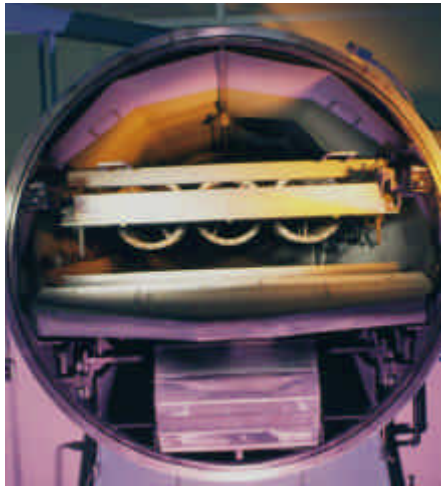
Success Stories [CONTD]

- Alternative Chemical Depaint Technology
  - *Harsh EPA-listed chemical strippers*
- Aircraft Component Subsystem [ACS]
  - *Robotically controlled*
  - *36,000 psi*
  - *Saves $1.3 million*
  - *Eliminates 140,000 lbs of HAPs*
    - *100,000 lbs waste [masking requirements]*
    - *8.3 million gallons of wastewater*
    - *76,000 lbs IWTP hazardous waste sludge*
    - *330 gallons of ODCs*
  - *Removes personnel from hazardous work environment*
  - *Reduces worker turnover rate*
  - *Eliminated abatement requirement [$20M]*

POLLUTION PREVENTION

Success Stories [CONTD]

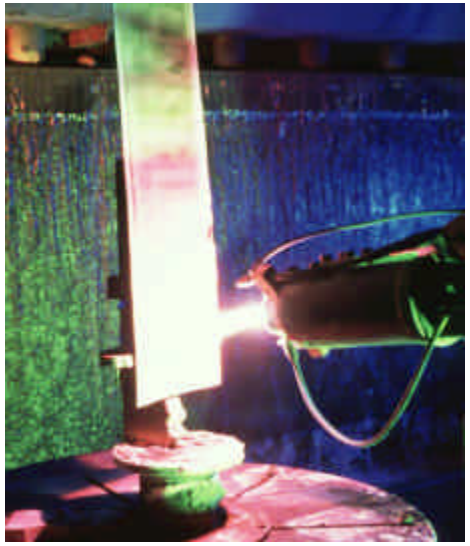
- Alternative Electroplating Technology
  - *Cadmium EPA-listed chemical*
  - *Cadmium plating most toxic operation*
- Ion Vapor Deposition [IVD]
  - *Erosion resistance and higher-temperature requirement*
  - *Temperatures up to 950°F, whereas cadmium is limited to 450°F*
  - *Applied to high-strength steel without the fear of hydrogen embrittlement*
  - *45 minutes compared to over 48 hours*
  - *Removes personnel from hazardous work environment*
  - *Eliminates 400 lbs of cadmium*
  - *Eliminates cyanide products*



POLLUTION PREVENTION

Success Stories [CONTD]

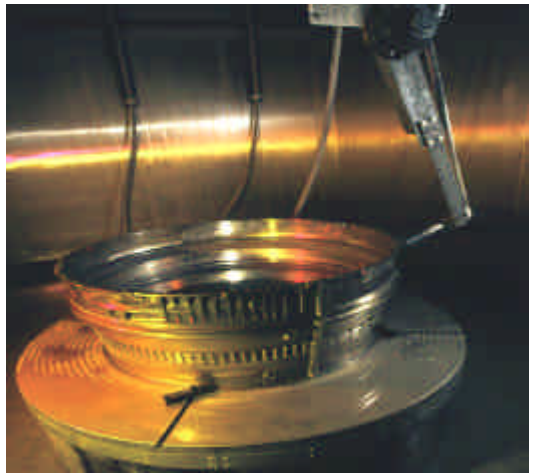
- Alternative Electroplating Technology
  - *Chrome EPA-listed chemical*
  - *Chrome plating accounts for 60% workload*
- High-Velocity Oxygen-Fuel Flame Spray
  - *Robotically controlled technology*
  - *High-energy thermal spraying process*
  - *Wear / erosion coatings and thermal barriers*
  - *Produces very dense, hard coatings*
  - *45 minutes compared to over 48 hours*
  - *Removes personnel from hazardous work environment*
  - *HVOF is very flexible*
    - ➢ *Capable of applying over 23 different coatings*
  - *Wastewater is eliminated because there are no rinse waters*



POLLUTION PREVENTION

Success Stories [CONTD]

- Alternative Cleaning Technology
  - *Water Jet Knife*
  - *Used to remove all abradable thermal spray coatings*
    - ➢ *Rubberized coatings, stripping abradable thermal spray coatings, fiberglass, paint, sealants, and adhesives*
  - *Robotically controlled technology*
  - *Operates at 20,000 psi with a flow rate of 20 gpm*
  - *Eliminated the use of 2,360 gallons per year of methylene chloride*
  - *20 minutes compared to days / weeks*
  - *Removes personnel from hazardous work environment*



POLLUTION PREVENTION

Success Stories [CONTD]

- Alternative Cleaning Technology
  - *CO_2 abrasive blasting*
  - *Removes carbon, corrosion, and paint*
  - *Replacing solvents, acids, and caustics to chemically remove the material*
  - *Replaced traditional grit blasting*
  - *CO_2 blasting eliminates the need for masking, since the solid CO_2 sublimes to a gas upon impact*
  - *Eliminated the use of 1,700 gallons per year of hazardous chemicals*
  - *30 minutes compared to days*
  - *Minimizes / eliminates hazardous waste generated by toxic chemicals*

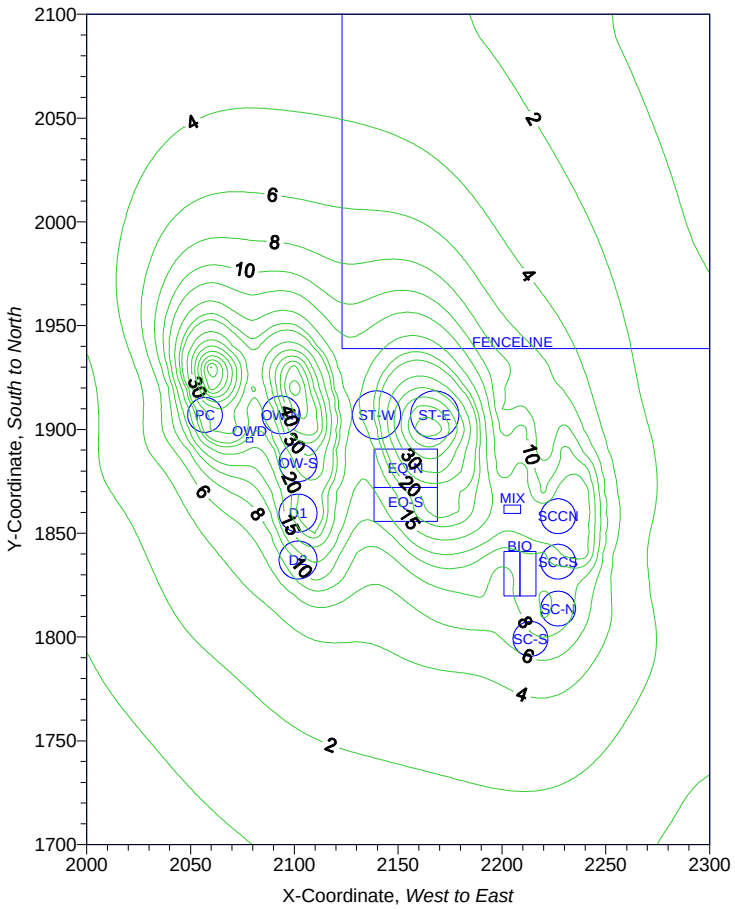
POLLUTION PREVENTION

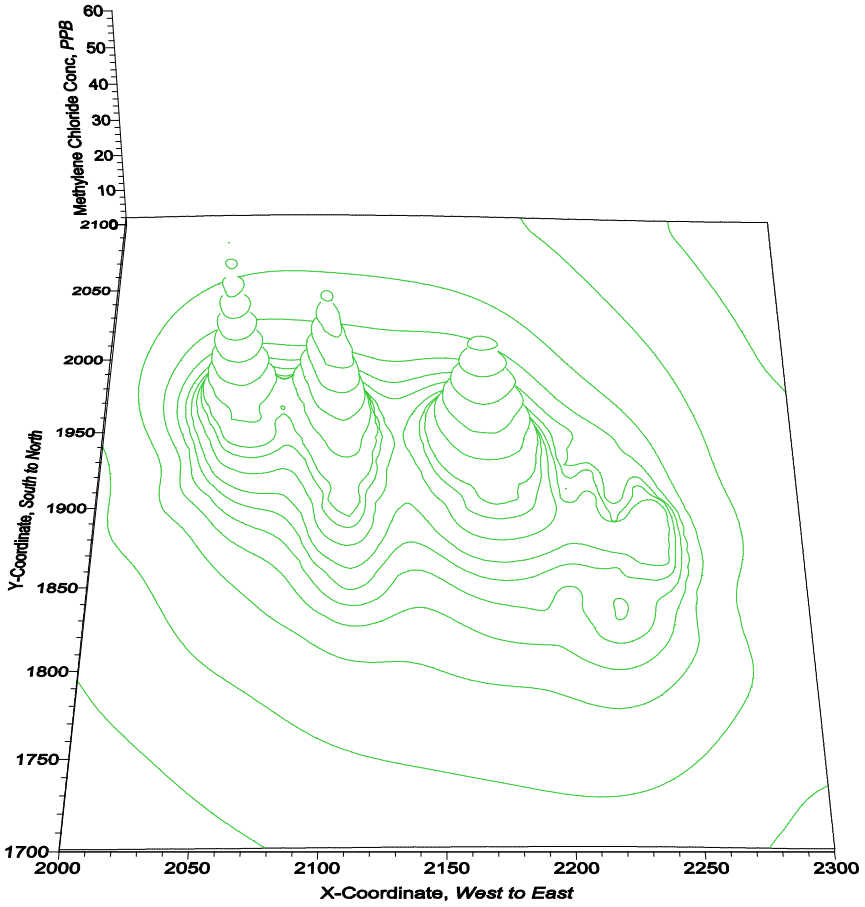
Success Stories [CONTD]

- Predictive Source Emission Model developed by EPA
  - *Recommended for estimating emission rate from IWTP process units*
  - *Only GFM developed for industrial wastewater collection / treatment processes*
  - *Requires minimal amount of process unit information and wastewater influent properties*
    - ➢ *Constituent concentrations, flow rates, physical dimensions of process unit, operating conditions, detention times, biological activity, etc.*
- Atmospheric Dispersion Model developed by EPA
  - *Generates annual-average & 24-hour maximum concentrations*
  - *ISC dictated by state protocol for air dispersion modeling*
  - *Emission source data*
    - ➢ *Need emission rate [factor] for individual process units*
  - *Meteorology data*
    - ➢ *Wind speed, direction, surface conditions, mixing height, etc.*
  - *Receptor data*
    - ➢ *Determine impact region, develop grid system, grid spacing, etc.*

POLLUTION PREVENTION

Success Stories [CONTD]





POLLUTION PREVENTION

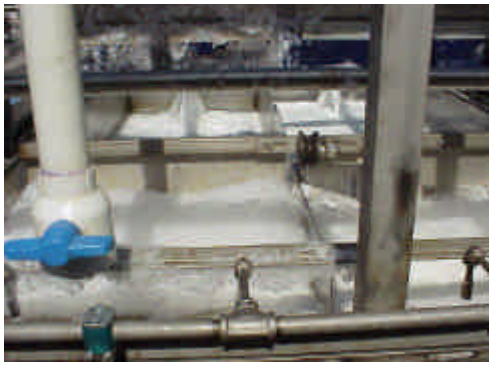
Proposed Technologies

- Sludge Dewatering Operation at IWTP
  - *Accounted for 39% of AFMC hazardous waste stream*
- Reduced hazardous waste sludge disposal by 6,764,420 pounds annually, [88 percent]
- Reduced hazardous waste sludge disposal costs by $1,247,630 annually, [88 percent]

POLLUTION PREVENTION

Proposed Technologies

- Air-Sparged Hydrocyclone [ASH] Technology
  - *Demonstrated on-site*
  - *Relatively cheap technology*
    - *Projected payback < 2 years*
  - *Pretreat chemical stripper waste stream*
  - *Removes 95+% of metals*
  - *Removes 25-90% of organics*
  - *AFFF removal of 86%*



POLLUTION PREVENTION

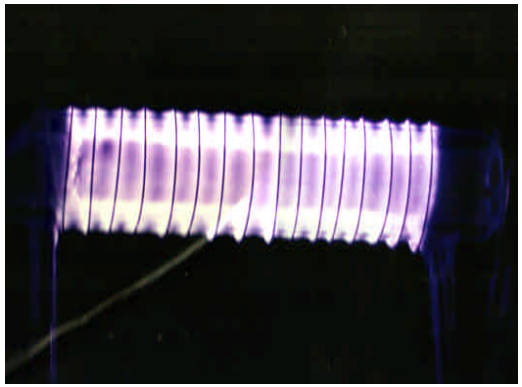
Proposed Technologies

- Geothermal Heat Pump Applications
  - *Identify opportunities for implementing geothermal heat pump technology by:*
    - *Recovering thermal energy from wastewater used in ground water treatment plant (GWTP)*
    - *and/or industrial wastewater treatment plant (IWTP) before it is reused or discharged.*
  - *Determine potential cost savings and payback using energy efficient technology*
    - *Energy recovery of 50-70 percent*
    - *Projected savings $400K-$500K annually*
  - *Incorporating radiant heat technology*
  - *Funded a more detailed investigation this summer*

POLLUTION PREVENTION

Proposed Technologies

- Plasma Technology for Pollution Control
  - *Low-temperature air toxics treatment*
  - *Destroying toxic chemical agents*
  - *Nitrous and sulfurous oxides [NO_x & SO_x]*
  - *Destroying VOC in paint / depaint processes*
  - *Military applications [destroying nerve gas]*
- Bench-Scale Reactor: Single Reactor Design
  - *Evaluate chemical system parameters: residence time, humidity, temperature, pressure, etc.*
  - *Evaluate electrical system parameters: electric field, power, electrode configuration, etc.*



POLLUTION PREVENTION

Proposed Technologies

- Other Expected DOD Benefits
  - *Improve local air quality*
  - *Develop durable paint systems*
    - ➢ *Extend operational life of coating system, less field maintenance, etc.*
  - *Shorten depot maintenance flow days*
  - *Reduce operating costs*
  - *Better corrosion protection for weapon systems*
    - ➢ *Extend the operational life of weapon system*
  - *Eliminate need to install expensive pollution abatement technology*
  - *Enable the installation to increase workload*

POLLUTION PREVENTION SUCCESS STORIES AT THE OKLAHOMA CITY AIR LOGISTICS CENTER

Tinker Air Force Base, Oklahoma

Freddie E. Hall, Jr.
OC-ALC/EMPD
7701 Arnold Street, Suite 204
Tinker AFB OK 73145-9100
COM: 405-734-3114
DSN: 884-3114
EMAIL: freddie.hall@tinker.af.mil