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GREEN AND SUSTAINABLE REMEDIATION: APPLICATION WITHIN THE AIR NATIONAL GUARD

Report Documentation Page

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Overview

- Air National Guard's (ANG) Green and Sustainable Remediation (GSR) Approach
- ANG's application of GSR
 - Tucson, AZ
 - Burlington, VT
 - Cheyenne, WY

ANG's RPO and GSR



- RPO is a tool by which the Air Force evaluates the status of remediation processes at sites
- RPO Primary Goals:
 1. Ensure protection of human health and environment
 2. Control Risk
 3. Improve cleanup efficiency (cost and time)
- GSR Primary Goal
 - Improve GSR parameters of existing remedies without compromising #1

GSR Evaluation



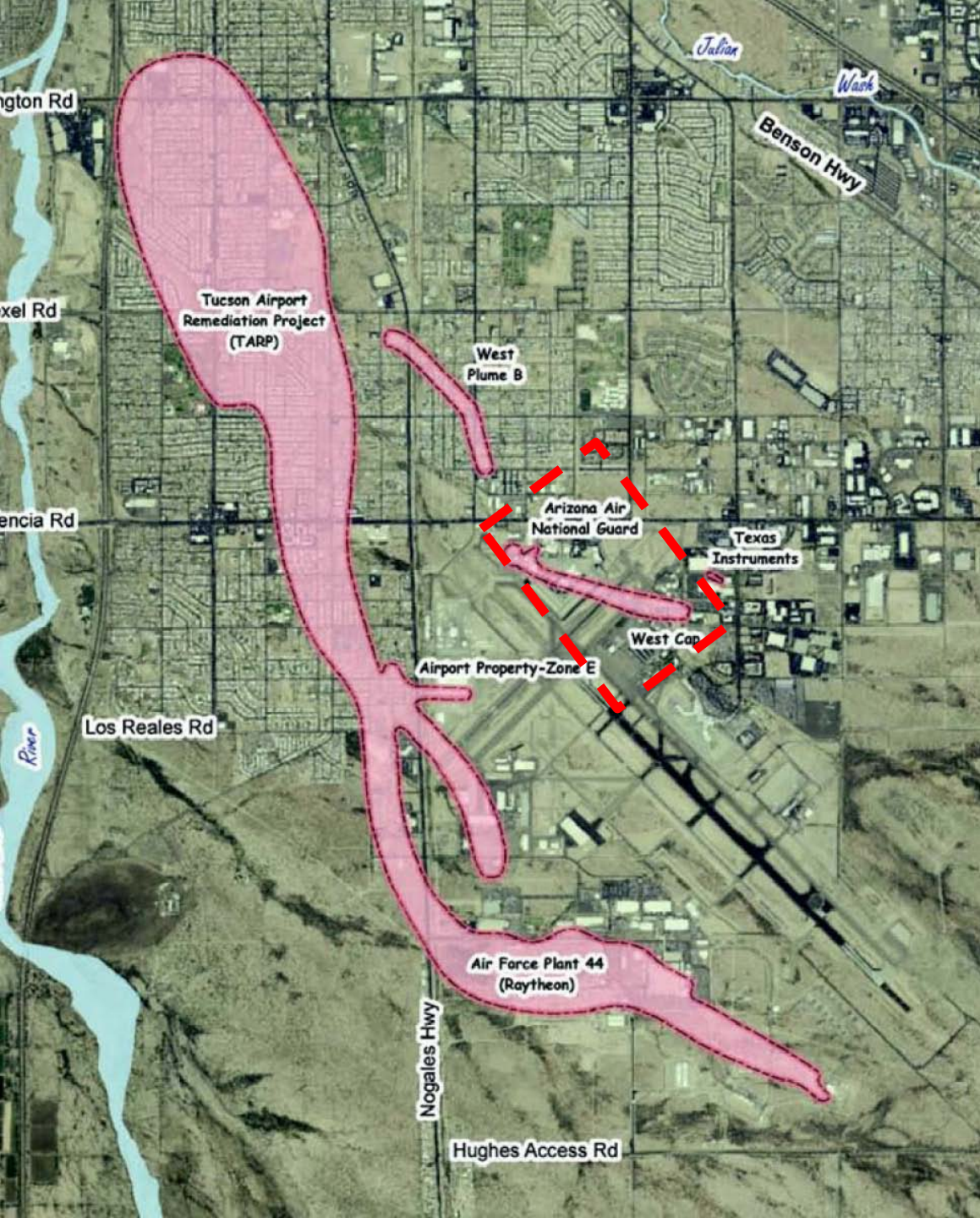
- Determine Scope
- Identifies opportunities to improve GSR parameters of existing remedies
 - Energy efficiency
 - Decrease air emissions (including CO₂)
 - Minimize material use and wastes generated
 - Minimize water use and maximize water reuse
 - Minimize soil and habitat disturbance
 - Improve long-term stewardship
- Ensure protection of human health and the environment

Case Study

Tucson, ANGB

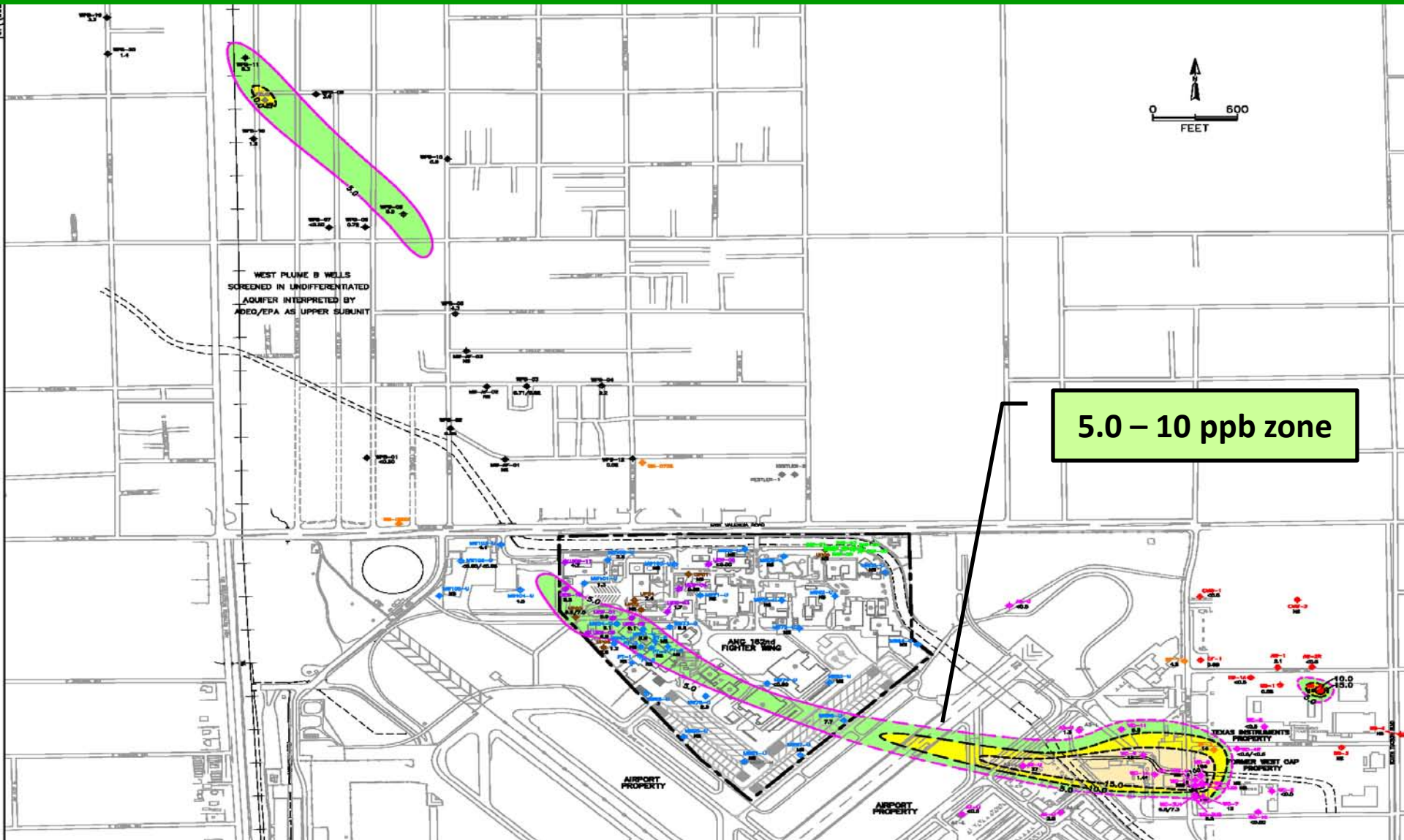
- Arizona Air National Guard, 162nd Fighter Wing, Tucson, Arizona
 - Portion of the Tucson International Airport Area Superfund Site
 - Primary chemical of concern – Trichloroethene (TCE)
 - Record of Decision (ROD)
 - Remedy Groundwater Extraction, Treatment, and Recharge System (GWETRS)
 - Groundwater capture and control
- Community Setting
 - Engaged Community
 - Downgradient water treatment infrastructure





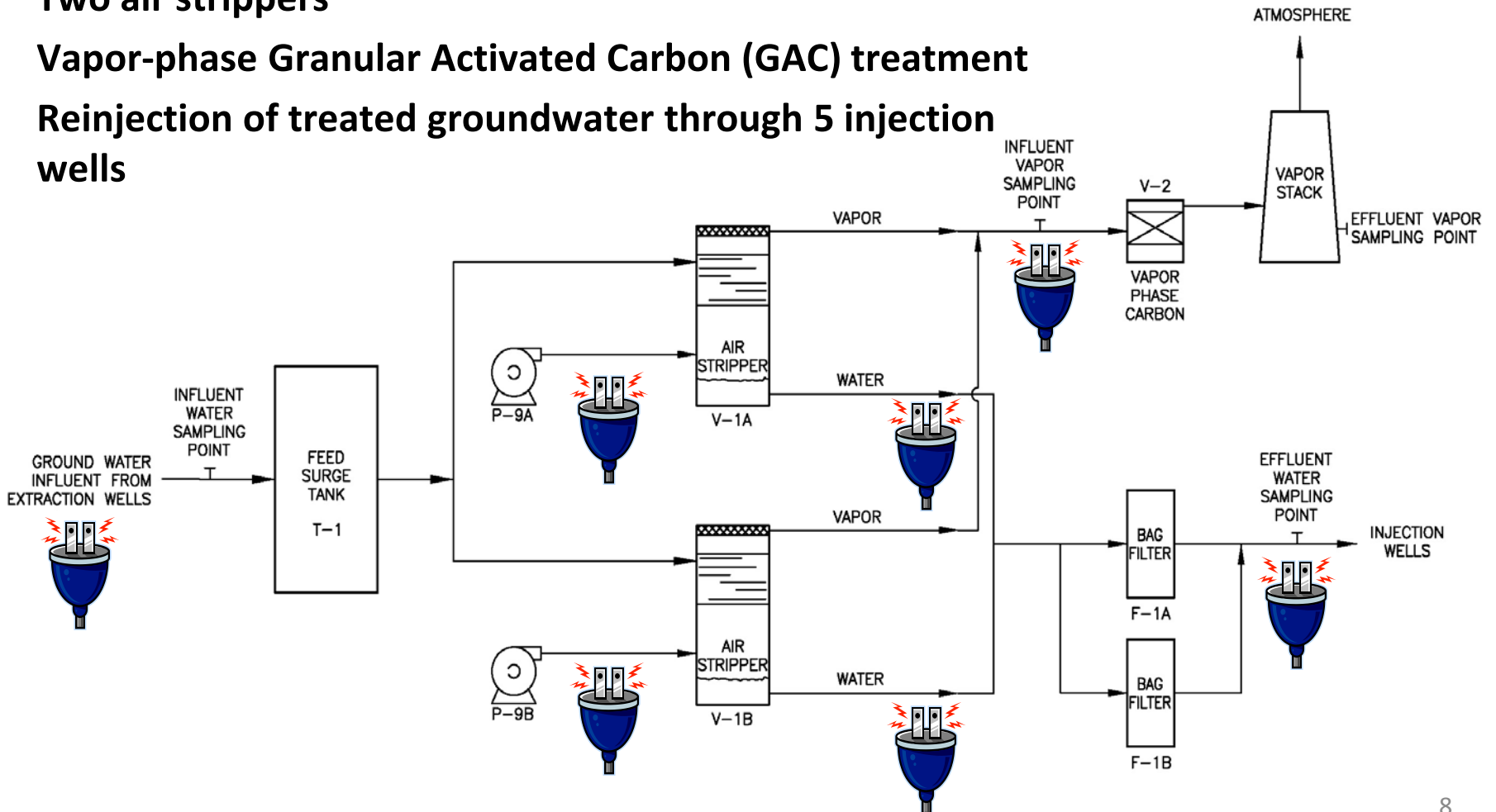
Tucson International Airport Authority Superfund Site

Plume B Area




Tucson System Details

- 15 Groundwater extraction pumps
- Pretreatment with sequestering agent
- Two air strippers
- Vapor-phase Granular Activated Carbon (GAC) treatment
- Reinjection of treated groundwater through 5 injection wells



Tucson - System Metrics



- 1997 – March 2010
 - Captured 708M gallons and removed ~ 37 lbs TCE (just over 3 gallons)
- April 2009 - March 2010
 - Influent ranges between 4.3 – 5.5 $\mu\text{g/L}$
- Averages based on 2008 GSR Evaluation
 - Average monthly energy consumption 22K (kilowatt-hours) kWh or 265K kWh per year (2.34% base annual consumption)
 - 249 metric tons CO_2 equivalents (e) emitted based on energy use
 - 14 metric tons (MT) CO_2 based on transportation
 - About 9 miles of polyethylene tubing (PET) used annually

Tucson Substantive Recommendations



- Based on continuation of GWETRS operations
 - Energy (reductions of over 50%)
 - Discontinue /reconfigure select equipment (e.g., cascade aeration)
 - Replace air strippers with liquid-phase granular activated carbon (GAC)
 - Remove vapor-phase treatment due to low concentrations
 - Material use & waste minimization
 - Initiate passive sampling validation study

GSR Actions



- Passive cooling
 - GSR Evaluation completed April 2009
 - Findings presented to USEPA Region 9, August 2009
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- In-situ Chemical Oxidation (ISCO) Pilot Test conducted in 2009
 - USEPA Region 9 and ANG working toward the goal of shutting the GWETRS down in favor of a more sustainable approach

Case Study

Burlington, ANGB

- Vermont Air National Guard, 158th Fighter Wing, Burlington, Vermont
 - Five active sites with cleanup underway
 - Primary chemicals of concern
 - Chlorinated solvents
 - Petroleum constituents
 - Free product (JP-4, JP-8)
 - GSR Evaluation completed September 2009



Burlington System Details

- Two operating Multi-Phase Extraction (MPE) Systems with product recovery and catalytic oxidation (CATOX) vapor treatment
- Bioventing System
- Pump and Treat (discharge to the City of Burlington Treatment Works)
- Soil Vapor Extraction (SVE)

Burlington System Metrics

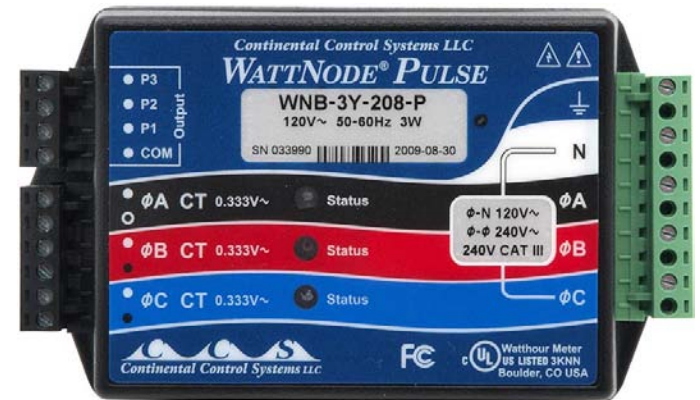
- Contaminants removed
 - Pounds of CO₂ equivalents emitted per pound of contaminant removed (energy use only)
 - Site 1 Pump & Treat ~ 4,400
 - Site 2 SVE ~ 276
 - Site 3 MPE ~ 256
 - Site 4 Bioventing ~ 63
 - Site 5B MPE ~ 400
 - Electricity consumption
 - 946 mega-watt hours annually (20% of entire installation energy usage)
 - Free product removal
 - 38,200 pounds over system lifetimes
 - Tailpipe emissions
 - Approximately 40 metric tons per year (all sites)

Burlington Substantive Recommendations



- Replace CATOX units (70 kW demand each) with vapor-phase GAC
 - Significant energy reduction

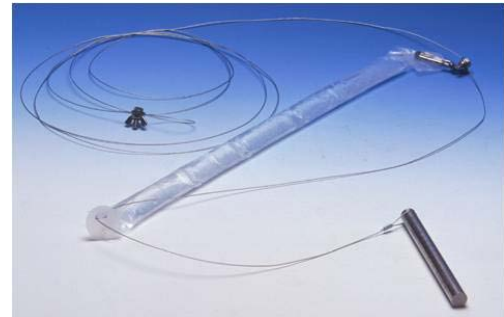
- Installation of energy management devices
 - Improve energy tracking and isolation of energy draw



Burlington Substantive Recommendations

- Use passive samplers for groundwater monitoring

- Reduction in material usage



- Use of local/regional vendors and suppliers
 - To the extent practicable to reduce tailpipe emissions



GSR Actions

- Base Wind Power Study completed 2009
 - Poor wind resources at the Base
- Solar powered AS/SVE analysis completed December 15, 2010
 - Over 20 yrs solar cost approximately \$245,000 more than traditional power
- Effectiveness comparison for replacing CATOX vapor treatment with vapor-phase GAC completed December 15, 2010
 - GAC costs approximately \$600K less over 10 years
 - Single CATOX use responsible for > 20 MT CO₂e/yr
 - Vermont Hazardous Ambient Air Standards initially not met with GAC for methylene chloride



Case Study

Cheyenne, ANGB

- Wyoming Air National Guard, 153rd Airlift Wing, Cheyenne, Wyoming
 - Contamination migrates off-base
 - Primary chemicals of concern
 - TCE
 - Carbon Tetrachloride
 - Groundwater capture system (building, well vaults, and discharge) located in a community park.
- GSR Evaluation completed October 2010





Cheyenne, WY ANGB Site 4

Community Involvement



- Legacy
 - Founder's Day Air Show
 - Earth Day: Environmental booth where Site 4 clean-up information is provided
 - Wing Commander regularly briefed on community involvement
- Site 4 Specifics
 - Door-to-door communication to residents about Site 4 plume accompanied by WDEQ
 - Private well water sampling and installation of individual water treatment systems as needed until conversion to municipal water
 - Residential vapor intrusion studies
 - Park treatment system installed during off-peak hours
 - Quiet equipment
 - Provided additional paved parking in the Park

Mylar Park

Bicycle Path, Fishing,
Pond, Picnic Facilities,
Play Area, Rental
Shelter, Restroom,
Horseshoes,
Volleyball and Grills



Cheyenne System Metrics



- Low influent concentrations
 - Approximately (20 $\mu\text{g/l}$) total volatile organic compounds
- Based on a mass removal rate of nearly 1.2 lbs/year:
 - 830 lbs of GAC used/lb contaminant removed
 - 29 MT of CO_2e emitted/lb contaminant removed
 - 5.4M gallons of water processed/lb contaminant removed
- Over 3 miles of PET used annually
- Electricity consumption
 - 52.4 mega-watt hours annually (just over 1% of entire installation energy usage)
- Tailpipe emissions
 - Approximately 12.6 MT per year CO_2

Cheyenne Substantive Recommendations

- Optimize system with energy efficient equipment
- Wind is an abundant renewable resource in Wyoming
 - Evaluate opportunities to power the groundwater capture system with wind
- Eliminate NPDES discharge exceedences by enhancing breakthrough protection/minimizing fouling
- Move toward a more passive remedial option

Cheyenne Substantive Recommendations

- Material use & waste minimization
 - Initiate passive sampler validation study
- Community Education
 - Create a walking tour of the park treatment system through interpretive panels



Questions & Contact Information



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