

**Air Ionized Odor Control for Wastewater Treatment  
Plants and Collection Systems Provides Sustainable  
Solution**

**Ohio WEA Conference 2013**

**Great Wolf Conference Center**

**Mason, OH**

**June 18,2013**

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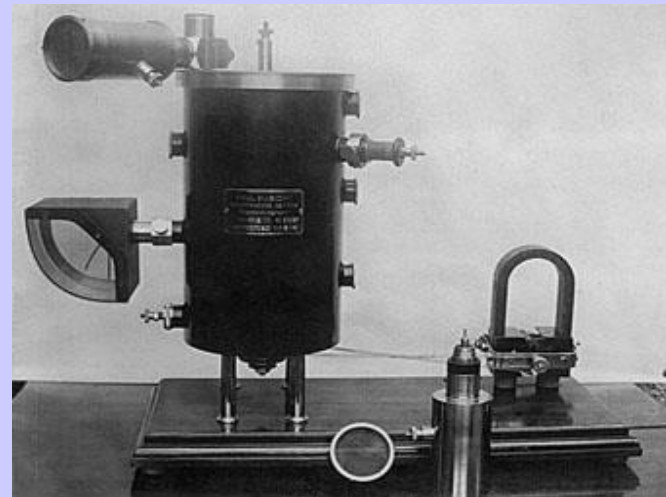
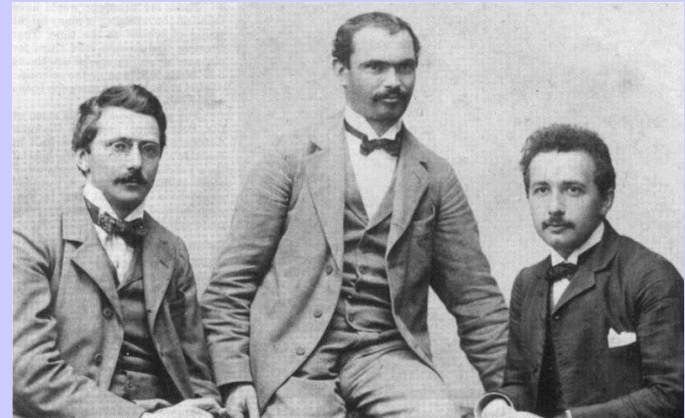
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**[www.trans-tech.org](http://www.trans-tech.org)**



# History of Ionization

- Conrad Habicht, Solovine, and Albert Einstein in Bern Switzerland 1903
- Jointly conceived photomultiplier tube and measured electricity in air “air ionization” 1910
- Conrad Habicht’s son, John Conrad Habicht develops and markets first ion tube in 1955 forms Bentax™ which he sells in 1988
- Tube has been improved over the years but still a direct historical link to our current supplier in Switzerland who originally worked for John Conrad Habicht



# Pollution Sources and Sites

- Many natural and industrial chemical pollution sites exist
- Without a mechanism for toxic chemical contaminant oxidation our thin atmosphere would not support life

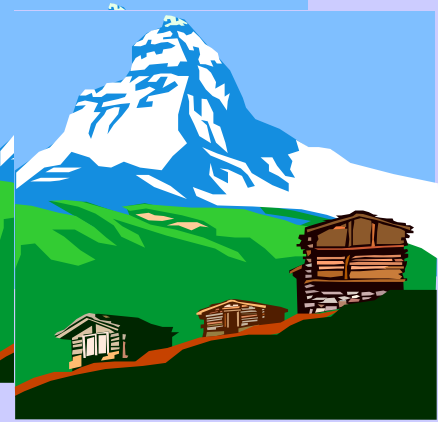


# Natural Ionization Sources



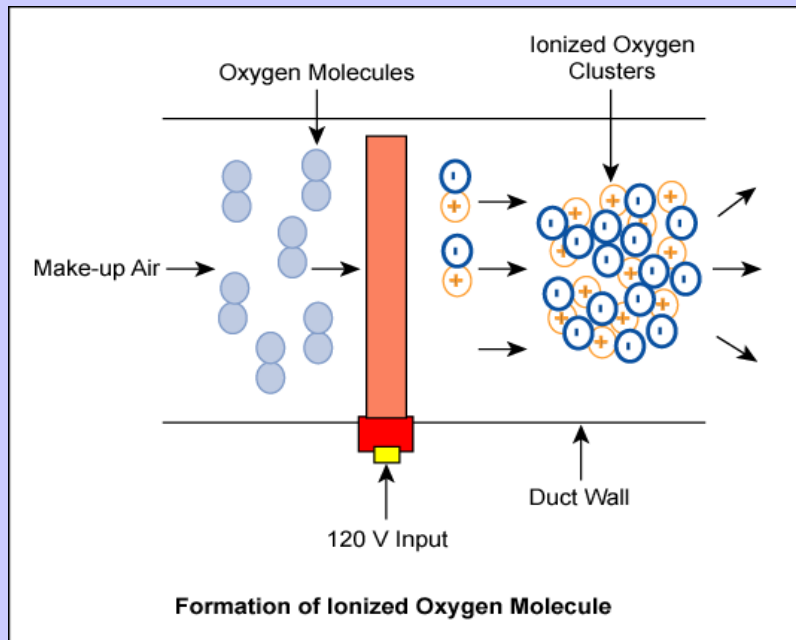
- Natural ionization sources include:
- Waterfalls
- Ultraviolet light from the sun and
- Cosmic radiation

# How Does it Work?



- Ion tubes produce via an electrical corona a measurable and controllable quantity of positive and negative ions, but *no ozone*.
- Polarized reactive oxygen ions ( $O_2^-$  and  $O_2^+$ ) molecular clusters are formed
- Clean mountain air contains (1000 negative and 1200 positive oxygen ions/cm<sup>3</sup>)
- Offices/plant facilities may contain only 50 or less negative oxygen ions/cm<sup>3</sup>
- Polarized ionizing systems creates 1000 negative and 1200 positive oxygen ions/cm<sup>3</sup>, or 10-20 ppb, indoors, odors begin oxidizing at 1 ppb.
- Higher energy ions and oxygen molecules oxidize odors, VOCs, and bacteria.

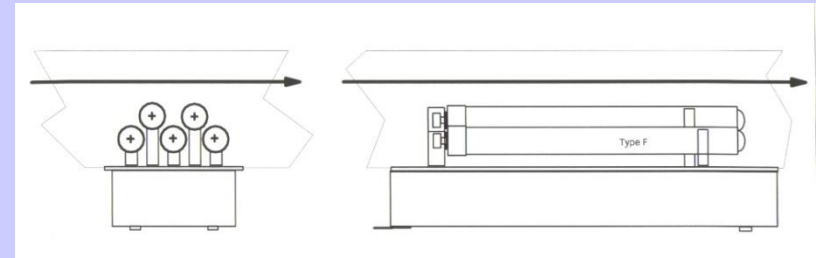
# ***TRANS-TECH ENERGY AND ENVIRONMENTAL INTRODUCES POLARIZED AIR IONIZATION***



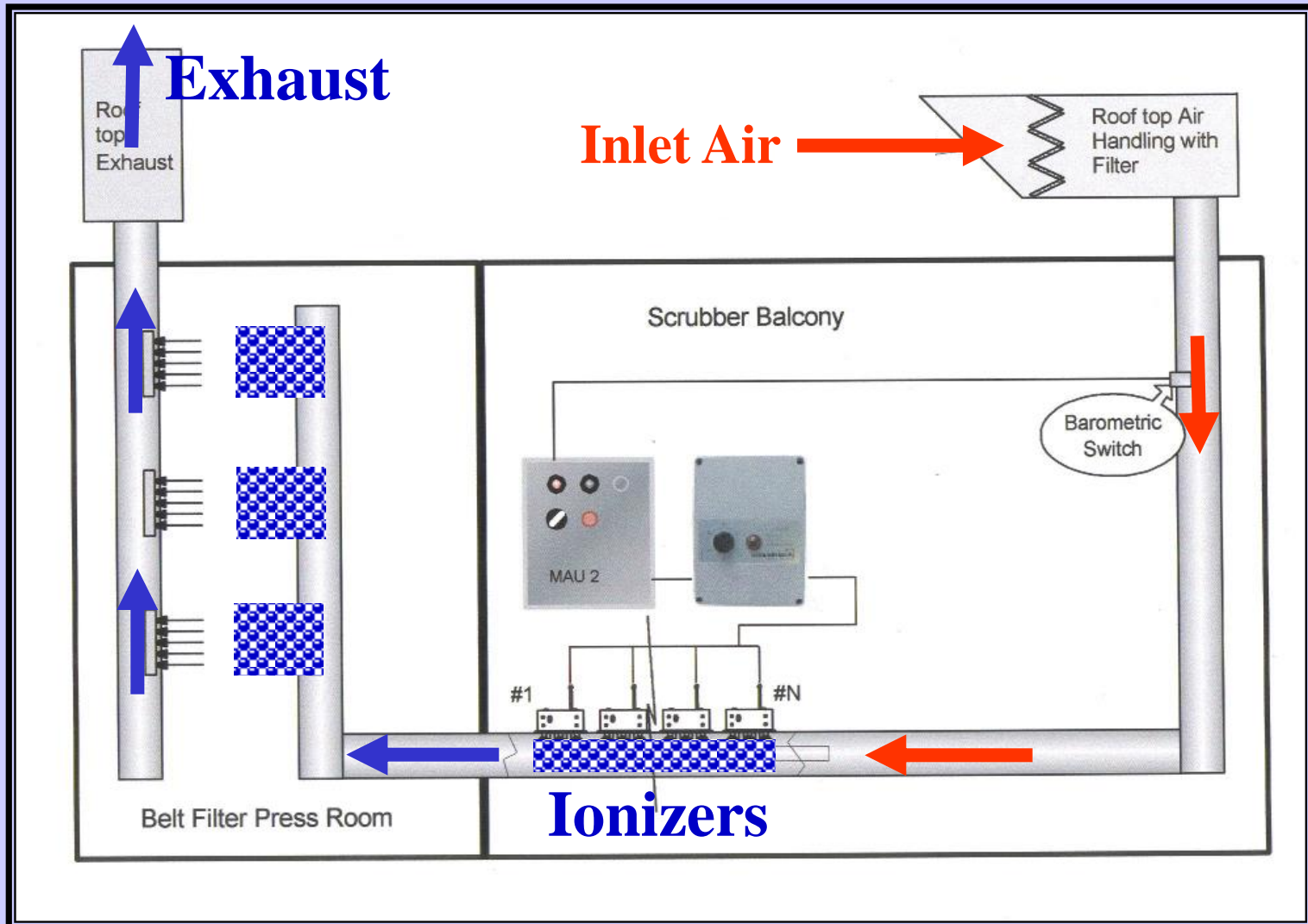
- **Oxidizes air borne VOCs and chemicals**
- **Kills bacteria and sterilizes the air**
- **Produces no ozone**
- **Enhances breathing and concentration.**

# 50F5 Modular Ionizers

- Ionizer modules can be rack or flange mounted to fresh air inlet duct or recirculation plenum or duct
- Power consumption only 35 watts per module
- Air flow over tubes becomes polarized - ionized and reactive
- Ionized air flows via HVAC air distribution ducts to building or enclosure.



# Trans-Tech General Air Ionization Flow Diagram





# Chemical Transformation of H<sub>2</sub>S in Ionized Oxygenated Air

- $\text{H}_2\text{S} + \text{O}_2 = \text{H}_2\text{O} + \text{SO}$
- $\text{SO} + \frac{1}{2} \text{O}_2 = \text{SO}_2$
- $\text{SO}_2 + \frac{1}{2} \text{O}_2 = \text{SO}_3$
- $\text{SO}_3 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4$
- $\text{H}_2\text{SO}_4 + n \text{H}_2\text{O} = 2\text{H}_3\text{O}^+ (\text{aq}) + \text{SO}_4 (\text{aq})$

# Ionization of VOCs Shown to be Effective

- Ammonia
- Acetic Acid
- Acetone
- Butyl Alcohol
- Carbon Monoxide
- Chloro Benzene
- Chloroform
- Dimethyl Disulfide
- Diethylamine
- Ethyl Cyanide
- Formaldehyde
- Hydrogen Sulfide
- Methane
- Methyl Mercaptans
- and many more ....

# Air Ionization Advantages

- Induct design requires minimal installation footprint
- Totally electronic system uses no chemicals
- System uses no water
- Minimal power usage (35 watts per model 50-F5 module)
- Low operation and maintenance cost.

## Model 50F5

- Flange mounting or shelf mounting to plenum
- Design scales up linearly
- One 50F5 module for 5,000 to 10,000 CF of WWTP space or at 12 AC/Hr. about one (1) module per 1000 CFM

Bentax™ pure air systems

### 50-F5 Description



<b>Insert:</b>	Climate and ventilation concern, Intake and exhaust air ducts in industry, Administration building, Office, Railroad, Airplane, Ship, Waste treatment, Exhaust air, etc
<b>Dimensions:</b>	Width: 24.41 inch (62 cm) Depth: 8.66 inch (22 cm) Height: 8.27 inch (21 cm)
<b>Power:</b>	110/120 Volt, 50/60Hz
<b>Energy consumption:</b>	35 Watt
<b>Fuse:</b>	2 x 0.2 Amp
<b>Ionisation tube:</b>	5 x Type F
<b>Air processing:</b>	min. 176.6 cfm (300 m <sup>3</sup> /h ) max. 2942.5 cfm (5000 m <sup>3</sup> /h)
<b>Height in duct:</b>	3.74 inch (95 mm)
<b>Weight:</b>	16.53 lbs (7.5 kg)
<b>Achievement area:</b>	5,593 - 17,655 ft <sup>3</sup> (300-500 m <sup>3</sup> ) Room volume.
<b>Flow:</b>	V <sub>max</sub> = 3938 ft/min (20 m/s)
<b>Air velocity over tubes:</b>	V <sub>min</sub> = 787.6 - 3938 ft/min (4 - 20 m/s)
<b>Volume quantity:</b>	Vol <sub>min</sub> = 176.55 cfm (300 m <sup>3</sup> /h)

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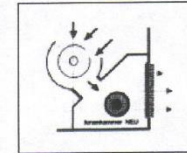
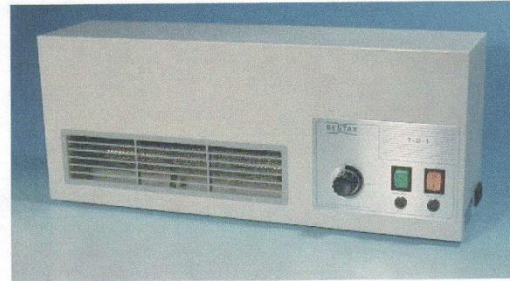
# Model 7D-1

- Control rooms or offices
- Recirculation style system (138 CFM)
- Treats 3500-5200 CF WWTP Space

## Pure climate device

Bentax 7-D-1

Bentax 7-D-1i



7-D-1 is available in two versions: 7-D-1 with D-tube, 7-D-1i with E-tube and stronger blower.

Bentax 7-D-1	pure air device, mobile
Locations of use:	physician practices, offices, waiting rooms, hotel, restaurants, dwellings, etc.
Dimensions:	Length 58 cm (22.84 inch), Depth 14.2 cm (5.6 inch), Height 23.8 cm (9.37 inch)
Connection:	110/120 volt, 50/60 Hz
Energy consumption:	D-1: 30 Watt D-1i: 35 Watt
Fuse:	0.2 Amp. Slow, 20 x 5 mm
Ionisation tube:	type D-1: single D-tube type D-1i: single E-tube
Ventilation:	type D-1: Two speed fan, 138 cfm, (235 m <sup>3</sup> /h) type D-1i Two speed fan, 185 cfm, (315 m <sup>3</sup> /h)
Filter:	578 x 130 x 25 mm (2-level)
Weight	ca. 16.5 lbs, 7.5 kg

### **Trans-Tech Energy and Environmental, Inc.**

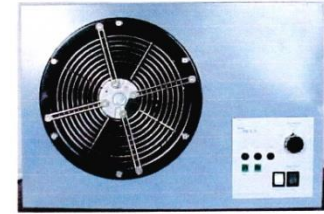
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DMTTEI@AOL.COM

# Model 70VE5

- Large shelf mount recirculation system (500 CFM)
- Treats 10,600 CF of WWTP plant space

## Model 70-VE-5 Description and Operation

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WWW-TRANS-TECH.ORG



### Technical Data

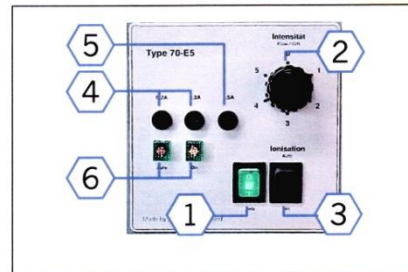
Dimensions:	L: 600mm (23.6"), W: 270mm (10.6"), H: 410 mm (16.1")
Power supply:	115 Volt, 50/60 Hz
Power consumption:	65-165 Watt
Treated air volume:	300 to 500 M <sup>3</sup> (10,600 to 17,700 ft <sup>3</sup> )
Ionization tubes:	5 E Tubes
Flow:	1,600 m <sup>3</sup> /h (960 cfm), 5 steps
Weight:	15 kg (33 LB)
Color:	Blue (standard)

### Technology

1. 70-VE-5 purifies and neutralizes air on the molecular scale. The unit is specially designed for industrial and commercial applications requiring a self contained blower. Not intended for use in small room or closet applications.
2. Internal air quality is improved by odor abatement, degermination and toxin reduction.
3. The system 70-E-5 operates electronically, without radiation, and basically does not require servicing.

### Measurements and reliability

1. The maximum allowable ozone level is not attained during operation (EMPA test no. 1 S'1 743).
2. The units ensures odour reduction, elimination of up to 90% of the micro-organisms and leads to improved breathing of the air, even at low power setting.
3. Most but not all toxic gases and VOCs (Volatile Organic Compounds) are reduced.
4. The unit is not explosion proof and should not be exposed to dripping water.



### Operation elements

1. Main power switch (on/off)
2. 5 step regulator
3. Max ionization for all fan speeds
4. Fuses for ionization
5. Main fuse 115 VAC: 1.5 A
6. Control lights

**Caution:** This unit is operated at high voltage and shall not be opened (electric shock). This unit shall only be opened and/or serviced by personnel trained by Bentax of North America, Inc. Unauthorized manipulation will result in the rejection of any personal or material claims or warranty obligations. Bentax of North America, Inc. also refuses any liability claim in case of gross mistakes.

**Not protected against explosion, not drip proof**

# Rifle Regional Wastewater Treatment Facility

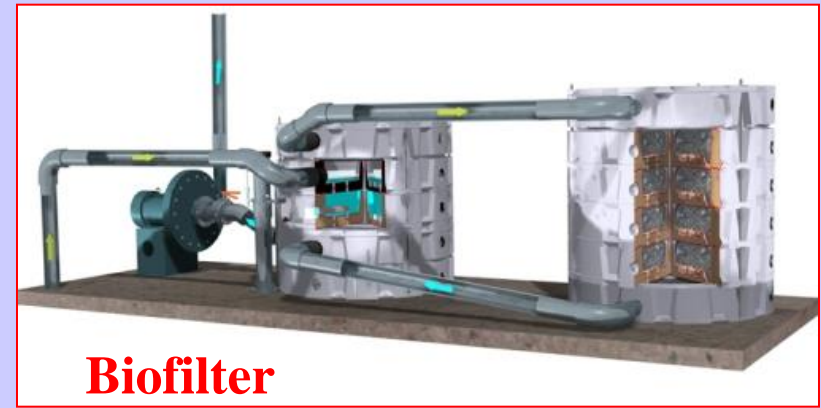
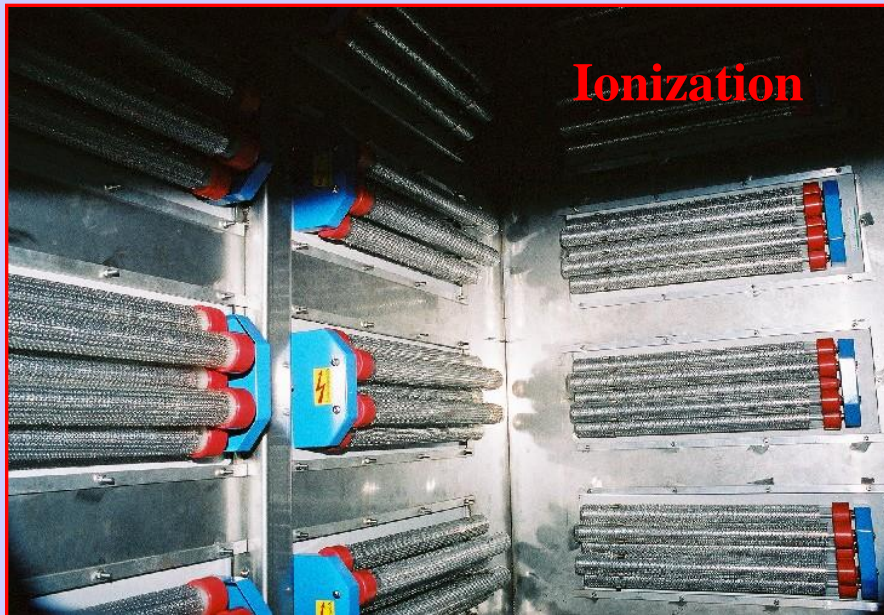
## Project: Schmueser Gordon Meyer Engineer

- Air ionization systems address all odor sources
- Shown are air ionization supply plenums for head works



# Why Huge Energy Savings over Collect and Treat Systems?

1. Rifle has open ion exchange plenums with minimal pressure drop
2. Capture and treat systems require high pressure blowers to push foul air through packed media
3. Ionizers use only 35 watts per module





# Ninety-Six Percent (96 %) Energy Savings Over Traditional Collect and Treat Systems

- The Rifle WWTF air ionization systems currently use 1120 watts of power. This represents a total power savings of 96% compared to a biofilter, costing the utility \$980 per year in power and saving \$21,659 annually.
- The Rifle WWTF carbon footprint is reduced by 164 tons CO<sub>2</sub> per year by using air ionization
- Power cost are projected to rise dramatically while high tech costs (ion tubes) are not.

# Twenty Year Savings for Rifle's 11,000 CFM Total Ionization System(s) versus Biofilter(s) about One Half Million Dollars

System		Annual Costs	Twenty Year O&M	Capital Cost	Total 20 Year Cost
<b>Ionization</b>	Power	\$629			
	Tube Cleaning	\$2406			
	Tube Replacement	\$7995			
	Annual O&M	\$11,030	\$220,600	\$555,102	\$775,702
<b>Biofilter</b>	Power	\$21,773			
	Media Replacement	\$1,714			
	Water	\$8508			
	Annual O&M	\$31,995	\$639,900	\$550,000	\$1,189,900

Basis 11,000 CFM total of Air Ionization versus Biofilter



# Silverthorne/Dillon JSA Pilot Test July 2004

- Preliminary Treatment Building with aerated grit tanks and septic receiving station
- Baseline tests run with air ventilators on, ionizing tubes off, and biofilter disconnected.
- Active ion tests run with air ventilators on and ionizer tubes on



# Pilot Test Sampling at Preliminary Treatment Building Blower Exhaust

- Canister sampling for gas chromatograph analysis
- Twenty organic compounds tested



Testing performed by Zachary Margolis Silverthorne /Dillon JSA

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

**Client:** Silverthorne/Dillon JSA  
**Client Sample ID:** #3  
**Client Project ID:** JSA PRETREATMENT

CAS Project ID: P2401935  
 CAS Sample ID: P2401935-001

**Test Code:** ASTM D 5504-01  
**Instrument ID:** HP5890 II/GC5/SCD  
**Analyst:** Zheng Wang/Wade Henton  
**Sampling Media:** Silco Canister  
**Test Notes:**  
**Container ID:** SL00037

**Date Collected:** 9/1/04  
**Time Collected:** 12:00  
**Date Received:** 9/2/04  
**Date Analyzed:** 9/2/04  
**Time Analyzed:** 14:00  
**Volume(s) Analyzed:** 1.0 ml(s)

Pi 1 = -3.2 Pf 1 = 3.0

D.F. = 1.54

# Baseline GC Analysis

CAS #	Compound	Result	MRL	Result	MRL	Data Qualifier
		µg/m <sup>3</sup>	µg/m <sup>3</sup>	ppbV	ppbV	
7783-06-4	Hydrogen Sulfide	4.250	11.0	3.050	7.70	
463-58-1	Carbonyl Sulfide	ND	19.0	ND	7.70	
74-93-1	Methyl Mercaptan	96.8	15.0	49.2	7.70	
75-08-1	Ethyl Mercaptan	ND	20.0	ND	7.70	
75-18-3	Dimethyl Sulfide	ND	20.0	ND	7.70	
75-15-0	Carbon Disulfide	ND	12.0	ND	3.85	
75-33-2	Isopropyl Mercaptan	ND	24.0	ND	7.70	
75-66-1	tert-Butyl Mercaptan	ND	28.0	ND	7.70	
107-03-9	n-Propyl Mercaptan	ND	24.0	ND	7.70	
624-89-5	Ethyl Methyl Sulfide	ND	24.0	ND	7.70	
110-02-1	Thiophene	ND	26.0	ND	7.70	
513-44-0	Isobutyl Mercaptan	ND	28.0	ND	7.70	
352-93-2	Diethyl Sulfide	ND	28.0	ND	7.70	
109-79-5	n-Butyl Mercaptan	ND	28.0	ND	7.70	
624-92-0	Dimethyl Disulfide	ND	15.0	ND	3.85	
616-44-4	3-Methylthiophene	ND	31.0	ND	7.70	
110-01-0	Tetrahydrothiophene	ND	28.0	ND	7.70	
638-02-8	2,5-Dimethylthiophene	ND	35.0	ND	7.70	
872-55-9	2-Ethylthiophene	ND	35.0	ND	7.70	
110-81-6	Diethyl Disulfide	ND	19.0	ND	3.85	

ND = Compound was analyzed for, but not detected above the laboratory detection limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: EHH Date: 09/16/04

## RESULTS OF ANALYSIS

Page 1 of 1

Client: Silverthorne/Dillon JSA  
 Client Sample ID: 1  
 Client Project ID: JSA PRETREATMENT

CAS Project ID: P2401562  
 CAS Sample ID: P2401562-001

Test Code: ASTM D 5504-01  
 Instrument ID: Agilent 6890A/GC13/SCD  
 Analyst: Zheng Wang/Wade Henton  
 Sampling Media: Silco Canister  
 Test Notes:  
 Container ID: SL00052

Date Collected: 7/22/04  
 Time Collected: 11:00  
 Date Received: 7/23/04  
 Date Analyzed: 7/26/04  
 Time Analyzed: 12:56  
 Volume(s) Analyzed: 1.0 ml(s)

Pi 1 = -3.6

Pf 1 = 3.5

D.F. = 1.64

# Ionized GC Analysis

CAS #	Compound	Result	MRL	Result	MRL	Data Qualifier
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	ppbV	ppbV	
7783-06-4	Hydrogen Sulfide	ND	11.0	ND	8.20	
463-58-1	Carbonyl Sulfide	ND	20.0	ND	8.20	
74-93-1	Methyl Mercaptan	ND	16.0	ND	8.20	
75-08-1	Ethyl Mercaptan	ND	21.0	ND	8.20	
75-18-3	Dimethyl Sulfide	ND	21.0	ND	8.20	
75-15-0	Carbon Disulfide	ND	13.0	ND	4.10	
75-33-2	Isopropyl Mercaptan	ND	26.0	ND	8.20	
75-66-1	tert-Butyl Mercaptan	ND	30.0	ND	8.20	
107-03-9	n-Propyl Mercaptan	ND	26.0	ND	8.20	
624-89-5	Ethyl Methyl Sulfide	ND	26.0	ND	8.20	
110-02-1	Thiophene	ND	28.0	ND	8.20	
513-44-0	Isobutyl Mercaptan	ND	30.0	ND	8.20	
352-93-2	Diethyl Sulfide	ND	30.0	ND	8.20	
109-79-5	n-Butyl Mercaptan	ND	30.0	ND	8.20	
624-92-0	Dimethyl Disulfide	ND	16.0	ND	4.10	
616-44-4	3-Methylthiophene	ND	33.0	ND	8.20	
110-01-0	Tetrahydrothiophene	ND	30.0	ND	8.20	
638-02-8	2,5-Dimethylthiophene	ND	38.0	ND	8.20	
872-55-9	2-Ethylthiophene	ND	38.0	ND	8.20	
110-81-6	Diethyl Disulfide	ND	20.0	ND	4.10	

ND = Compound was analyzed for, but not detected above the laboratory detection limit.

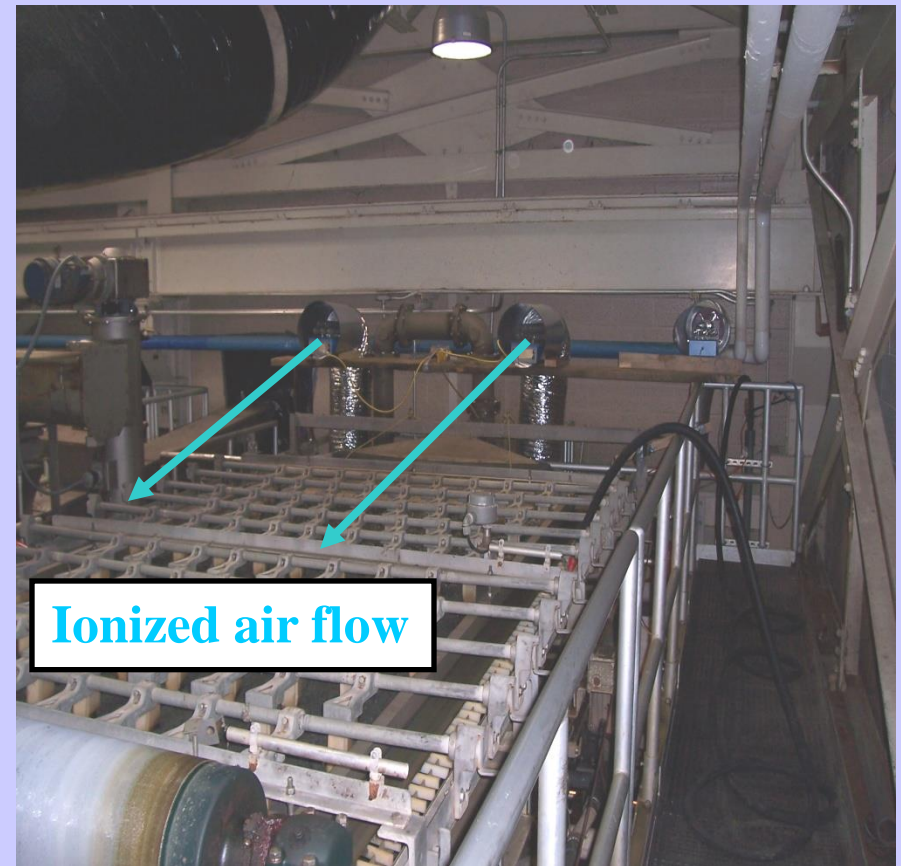
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: KWH Date: 08/06/04

# Belt Filter Press Room Pilot Test

## Grand Glaize, MO WWTP

- Baseline testing of 39,000 FT3 Sludge Belt Filter Press Room
- Active ion testing at identical Air Change rate, 11 AC/Hr.





# Sulfur Compound Reductions

- All TRS (Total Reduced Sulfur) gases reduced by 90 percent or greater.
- Dispersion modeling of pilot exhaust showed all compounds below odor threshold at plant fence line
- Polishing of exhaust with secondary fresh air ionization would have provided even higher reductions.

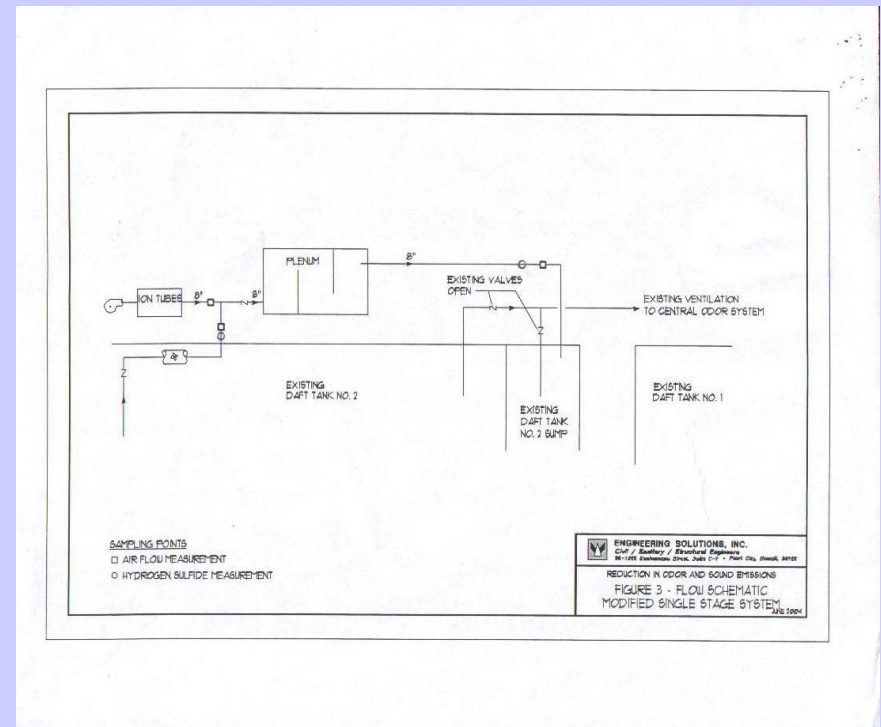
Table 4 Summary of chemical compound reductions from G.C Analysis (Average of Three Samples Drawn)

Sample Description	Average baseline level ppbv	Average Active ion Level ppbv	Removal Percent (%)	Component level at Property Line ppb(v)	Odor Detection Threshold ppb(v)
Hydrogen Sulfide	135	18.9	89	0.62	5.0
Carbonyl Sulfide	4.25	ND	100	ND	2.0
Methyl Mercaptan	445	54.5	90	1.53	2.0
Carbon Disulfide	6.75	ND	100	ND	2.0

# Kailua, HI, DAF Tank Pilot ROSE Program City and County of Honolulu

Testing Company: Engineering Solutions, Inc.

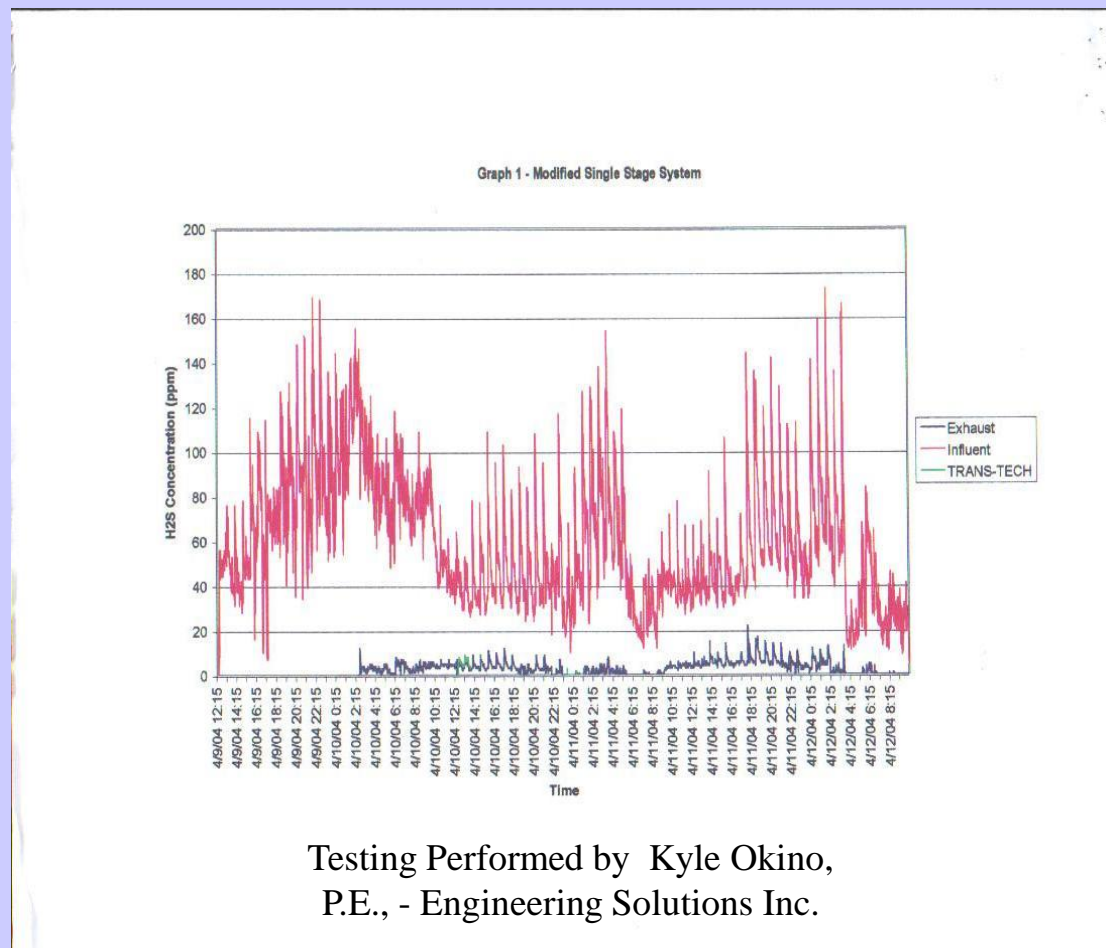
- Continuous real time monitoring of hydrogen sulfide gas emissions.
- A 100 CFM tank exhaust stream was mixed and treated with fresh ionized air “end of pipe”



# Pilot Data Kailua, HI DAF Tank

## Testing Company: Engineering Solutions, Inc.

- H<sub>2</sub>S reduction after subtracting out dilution ranged from 72 to 92 percent
- With dilution overall H<sub>2</sub>S reduction ranged 92 to 100 percent
- A second stage polishing system would have eliminated any residual H<sub>2</sub>S
- Odor at the exhaust was not a problem as reported by City Engineer Cyril Hamada, P.E. on site.



# Existing PELs for Hydrogen Sulfide do not Protect Workers

- Industrial Wastewater June 1999
- Respiratory – Chronic bronchitis, occupational asthma
- Eyes – Photophobia, corneal vesiculation
- Mental – Chronic fatigue, irritability, insomnia
- Gastrointestinal disturbances.



# Denver Metro Sludge Processing Building

## Full System Design

- Air ionizing plenum AIU-2 is downstream of air handler MAU-7 and is positioned on the centrifuge room floor for easy access of eighteen (18) flange mounted ion modules
- Fresh makeup air from MAU-7 (20,200 CFM, 34,138 M<sup>3</sup>/Hr.) passes over ion tubes and is ionized and then vented to the sludge Processing Building Basement one floor below. An additional plenum AIU-1 houses six (6) modules providing an additional 6,600 CFM, 11,154 M<sup>3</sup>/Hr. of ionized air for a total of 26,800 CFM, 45,292 M<sup>3</sup>/Hr.



# Metro MAU-7 Air Handler

- Air handlers for the SPB Basement, MAU-1 and MAU-7 include pre-filters and high efficiency filters
- Shown here is MAU-7 (design flow 20,200 CFM, 34,138 M<sup>3</sup>/Hr.) with the high efficiency air filters installed.



# Ionized Air Ducting



- Shown are the ion tubes extending inside AIU-2
- Ionized air is feed to the SPB aisles via ventilation ducting as well as directly at the sludge on the conveyor belt with special extended air inlet ducts.

# Sludge Odor is Oxidized at the Source



- After Trans-Tech's ionization system was installed 4-14 PPM H<sub>2</sub>S in aisles and 42 PPM H<sub>2</sub>S in sludge drop zones was reduced to zero
- The Metro SPB Basement system has passed compliance testing and has been operating successfully for ten (10) years.



# Metro's Huge Energy Savings Over Traditional Collect and Treat Systems

- Low 35 watt air ionization modules and low system pressure drop eliminates large 127 HP end of pipe system exhaust air blower
- Denver Metro Wastewater Reclamation District (Metro) Sludge Processing and Cake Storage Areas treats 73,921 m<sup>3</sup>/h (43,500 ft<sup>3</sup>/min) using \$883 on power annually and **saving \$48,523 annually based on \$0.06 per kilowatt-hour** as compared to a biofilter, scrubber, or carbon system.
- **Metro carbon emission footprint reduced by 605 tons carbon dioxide per year**
- Power cost are projected to rise dramatically while high tech costs (ion tubes) are not.

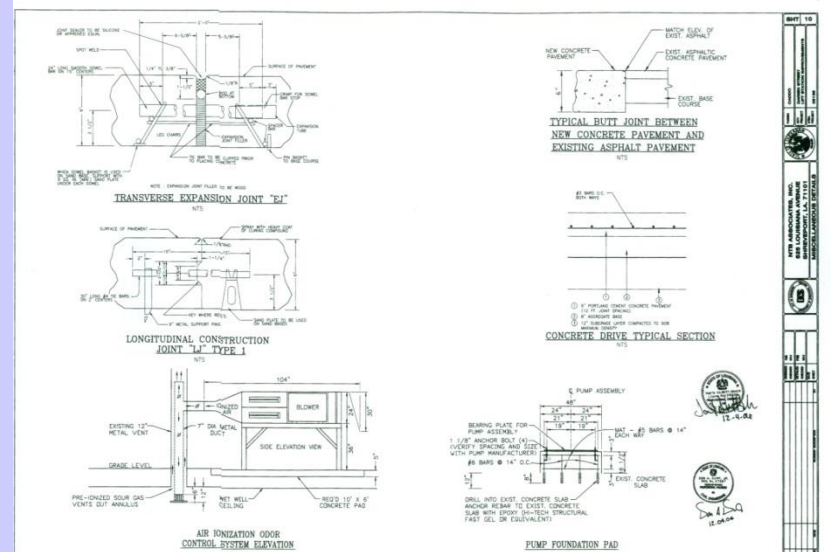
# Silverthorne/Dillon JSA Ionized Air Supply Header

- Registers blowing ionized air over grit tanks
- Odor level is minimal two (2) dilutions to threshold (D/T)

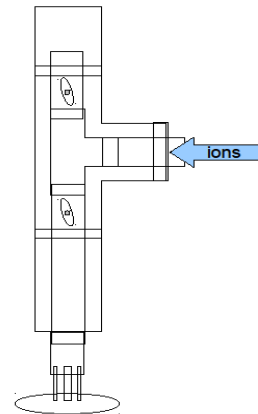


# Darien Lift Station, Shreveport, Louisiana

- Ionized air supply directed through patented annular diffuser
- Pretreated well gas vented through stack annulus
- Additional fresh ionized air blended into exhausting pretreated gas for polishing
- Ionization Process Protected by United States Patent



Vertical Annulus Assembly

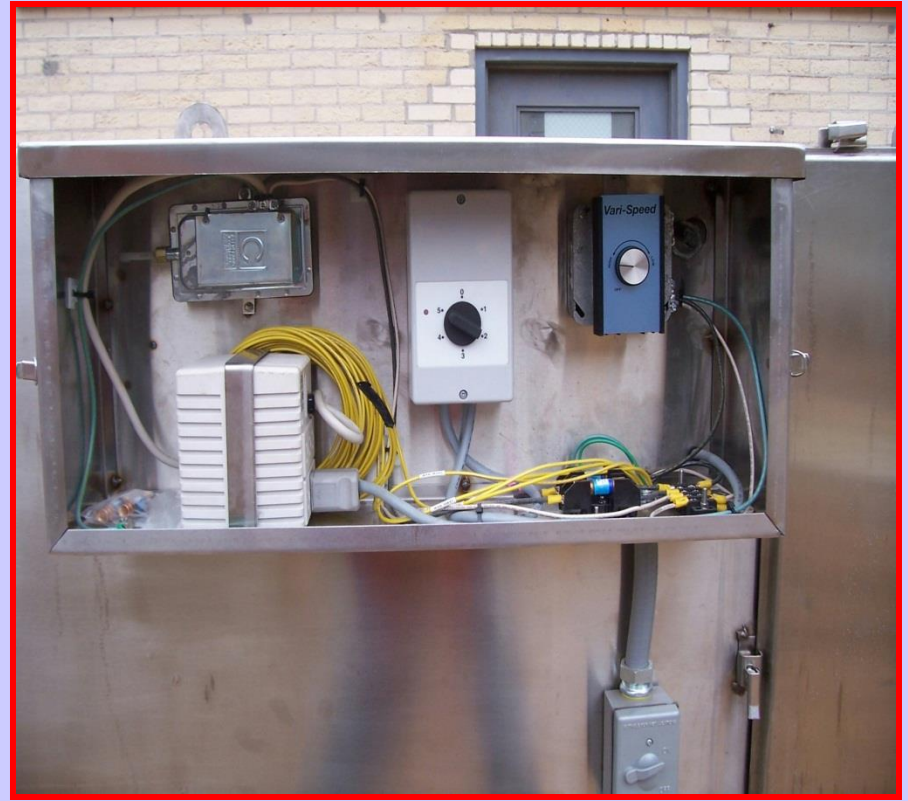


# Darien Lift Station

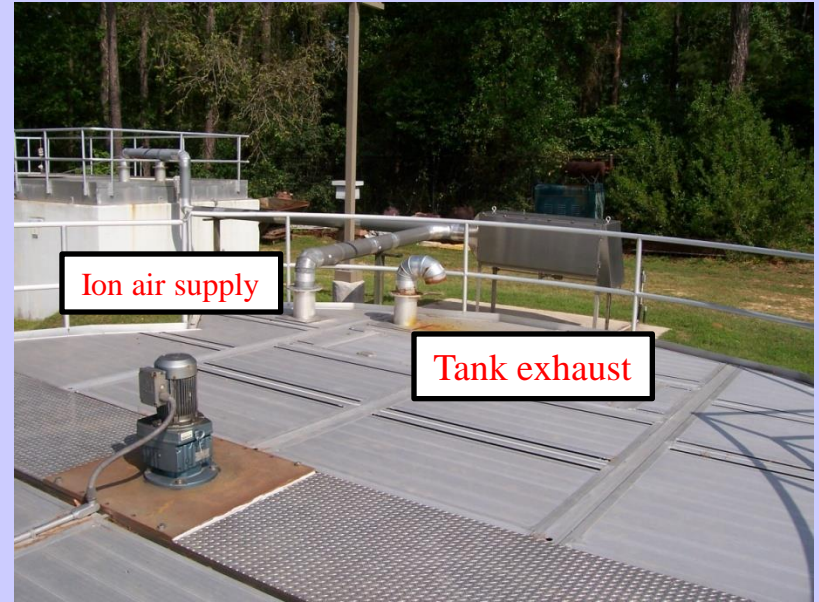
- Ionized air treats headspace
- Vented well gas is polished with additional fresh ionized air while exhausting out stack
- Nearby community free of problem odors



# Darien Lift Station Weatherproof Package System Side View and Control Panel Behind Access Door



# SJRA Standard System Treating both Grit Tank and Sludge Holding Tank



# A Gravity Sewer Line is Ionized to Eliminate Odor

- A weatherproof enclosure is built to house the ionizer
- Ionized air is pumped through the gravity line headspace

A 500 METER SEWER LINE CAUSED ODOR PROBLEMS FOR A NEARBY COMMUNITY THAT IT SERVED.

THE SOLUTION WAS TO IONIZE THE GAS IN THE SEWER LINE.

KANAL-2.JPG



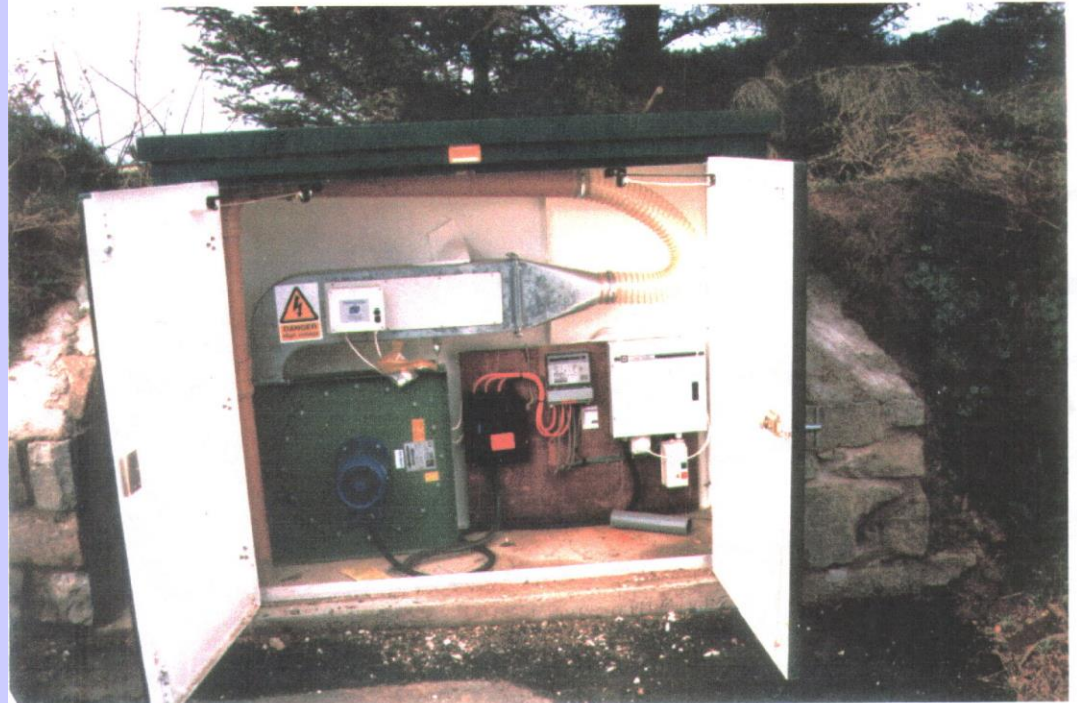
TRANS-TECH ENERGY AND ENVIRONMENTAL, INC.  
9212 HIGHLAND ROAD  
PITTSBURGH, PA 15237  
412-366-9177

# Ionization of Gravity Sewer Line

- A single “F Style” Ion Tube is used to blow ionized air into the headspace of the gravity fed sewer line.
- Odor is eliminated throughout the line.

AN IONIZER TUBE IS ADAPTED TO A GALVANIZED STEEL BOX WITH ACCESS PLATE FOR SERVICING. FRESH AIR IS DRAWN THROUGH AN ID FAN AND FORCED ACROSS THE ION TUBE, AND THEN DUCTED TO THE SEWER LINE, FOR POSITIVE PRESSURE AIR FEED.

KANAL-3.JPG





# **Port Clinton Ohio Wastewater Treatment Plant Headworks Influent - MAU-3 Ionized Supply Air with Four Model 50F5 Ionizer Modules**

**Engineer: Floyd Browne Group,  
Plant Superintendent: Ernie Isaac**



# MAU-1 - Ionized Air Supply to Grit Room Port Clinton, OH WWTP



# FS200 Ion Level Controller

- The FS200 allows ion levels to be adjusted in five (5) intervals from one to five.



# Clifton WWTF Headworks Tetra

## Tech/RTW Engineer

Modular ionizers installed in headworks plenums AIU-1A and AIU-1B provide ionized air supply to influent channels



Ionized air is supplied to headspace of covered influent channels with six inch (6") aluminum supply ducts as shown



# Clifton Aerobic Digesters and Truck Bay

- Air ionizing plenum AIU-2A treats the aerobic digester tanks and AIU-2B the truck bay
- Shown below are these two plenums and the ionized air supply ducts that treat the headspaces of the aerobic digester tanks



# Clifton Aerobic Digesters

- Diffusers under digester tank ceiling distribute ionized air in headspace
- Fresh polishing ionized air mixes with pretreated exhaust of tank headspace for additional treatment prior to exhaust.



# Rifle, Colorado WWTF Headworks – Schmueser Gordon Meyer Engineer

.



System treats entire room rather than just channels, supply and exhaust registers vent both high and low

# Rifle, CO WWTP Biosolids Belt Filter Press Dewatering





# Rifle, CO WWTF Screen Room



# Ion Tube Performance Test Rifle WWTF after Three (3) Years Operation

Tube Number	Ions/cm3 Dirty (Six Months Between Cleanings)	Ions/cm3 Clean	Ions/cm3 New*
1617-0009-187	750,000	890,000	895,972
1617-0009-191	850,000	800,000	944,893
1617-0009-190	600,000	860,000	810,096
1617-0009-189	840,000	1,100,000	974,345
<b>Averages:</b>	<b>760,000</b>	<b>912,500</b>	<b>906,326</b>

\* Test data column (Ions/cm3 New) from 2007 archived data measured at time new units were delivered to job site

# Solar Energy Array Rifle WWTP, CO

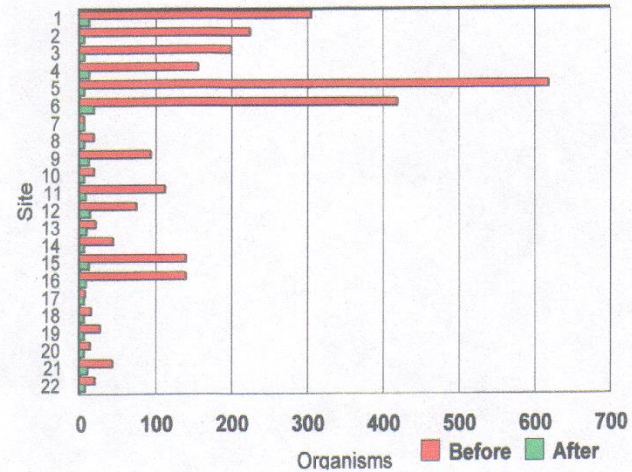
- 1.72 Megawatt Solar Voltaic System
- Rifle WWTP is 100 percent sustainable and carbon negative



# Eliminates Air Borne Bacteria

- Air borne organism testing before and after polarized ionization
- Anderson sampling
- Over 90 percent organism reduction
- 100 percent mold reduction.

Surviving organisms before and after



	Before		After	
	organisms	moulds	organisms	moulds
1	306	0	13	0
2	225	6	<6	0
3	200	0	<6	0
4	156	0	13	0
5	619	0	<6	0
6	419	0	19	0
7	<6	0	<6	0
8	19	0	<6	0
9	94	0	12	0
10	19	0	<6	0
11	113	0	8	0
12	75	0	14	0
13	21	0	9	0
14	44	2	<6	0
15	140	2	12	0
16	140	1	8	0
17	7	1	<6	0
18	15	2	<6	0
19	27	4	<6	0
20	14	1	<6	0
21	43	3	10	0
22	20	2	7	0

# ARA Mannedorf Wastewater Treatment Plant

- The Mannedorf treatment plant is located on Lake Zurich adjacent to a busy marina where boaters enjoy the lake activities.
- The plant does not emit odors due to the polarized air ionization systems that are installed.
- No fresh air supply makeup used in headworks



# ARA Mannedorf

- Shown are the large modular in duct ionizers and the Preliminary Treatment Building bar screen.
- A Preliminary Treatment Building sealed shut with no fresh supply air would show huge corrosion problems without the polarized air ionization.



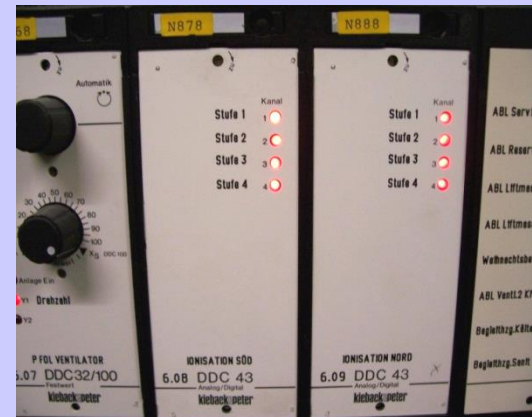
# Hotel Movempick Zurich Airport

- 350 rooms with a total room volume of 259,455 cubic feet (7,350 cubic meters)
- Air is recirculated 5 to 6 times per hour
- With very little (only 5 percent ) fresh outside air makeup the system saves large amounts on energy
- The hotel is mountain fresh.



# Hotel Movenpick Air Handler

- There are a total of fourteen (14) modular ionizers for the entire hotel
- That includes all rooms as well as the restaurant and bar area.
- Shown in the lower photo are the closed loop ion level controllers that respond to VOC or odor levels in the hotel.





# Hagen Library West Palm Beach, FL

**Huge 600,000 FT3 Space with Foul Air “Sick Building”**

**Single 50F5 Ion Module Successfully Treats Entire Space**



# Balancing Ions adds Vitality to Life

- Increases oxygen absorption by ten percent
- Elevates the mood and energy level
- Increases worker concentration and productivity
- Attached article references Dr. Kruegers' work Berkeley U of C

Reprinted from READER'S DIGEST

## Ions Can Do Strange Things

Research workers believe that through control of the electrical charges in the air we breathe, our moods, energy and health can be markedly improved

By Robert O'Brien

ONE SWELTERING summer's day a man sat before a small metal box resting on a hospital filing cabinet. It was plugged into an ordinary wall point. A doctor pressed a switch. Inside the box a small fan whirred; the box hummed distantly, like a high-tension wire, and gave off a faint, sweetish odour.

Soon the man felt alert, magically refreshed, as though he'd been taking deep gulps of sparkling autumn air. The doctor turned the machine off, switched on another that looked just like it. The air quickly grew stale. The man's head felt stuffy. His eyes smarted. His

head began to ache. He felt vaguely depressed and tired.

With this simple experiment, the scientist—Dr. Igho Kornblueh, of the American Institute of Medical Climatology—demonstrated the effect that atmospheric ions can have on human beings. The first machine generated negative ions; the second, positive ions.

The air around us is filled with these electrically charged particles. They are generated in invisible billions by cosmic rays, radioactive elements in the soil, ultraviolet radiation, storms, waterfalls, winds, the friction of blowing sand or dust. Every time we draw a breath they

# Hotel Movenpick

- Our group is enjoying the hotel food and wonderful air quality after a busy day of touring the Swiss applications.





# CONCLUSIONS

- Polarized air ionization provides a simple and cost effective odor control solution
- Added value includes corrosion control, health and safety, no chemicals, minimal footprint, **huge energy savings of 98 percent**
- Recommendation: Do not allow simplicity of concept to be misinterpreted as lack of need for thoughtful system design and engineering
- **Over the past ten years one hundred percent (100%) of the more than 300 model 50F5 ionizer units sold in US are in use, none have been shut down due to end of life, poor performance, etc. A reliability claim few odor control technologies can make**
- Total costs - capital plus O&M are much less than “end of pipe” odor control system alternatives
- Trans-Tech customers are very happy with the installed systems



# Acknowledgements

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