

# TRANSIENT PLUME INSTRUMENT MARKET SURVEY & EVALUATION

Patrick Wicks, PE, CHMM

Chuck McDonald

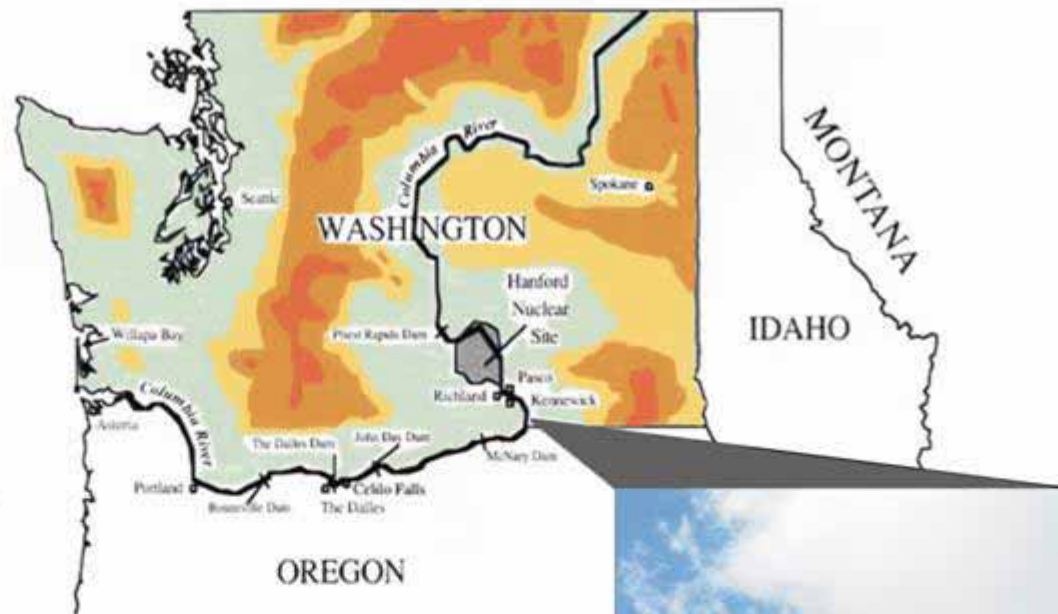




# ***North Wind***

- (8a) Woman-Owned
- Small business with over 250 Scientific, Engineering and Technical Staff
- Full Service Consulting Solutions:
  - Environmental Remediation
  - Waste Management/Environmental Compliance
  - Technology Development
  - Engineering
  - Construction
  - Decommissioning & Decontamination





- Lewis & Clark Corps of Discovery saw the Columbia River for the first time near the present day location of the Tri-Cities, WA on October 16, 1805.
- Embarked on overland route back home leaving the Columbia at the Wallula Gap on April 28, 1806



"Having gone 21 miles we have arrived at the Great Columbia River, which comes in from the Northwest. We encamped on the point between the two rivers. The country all round is level, rich and beautiful, but with out timber!"

SGT. Patrick Gass. Oct. 16, 1805

# INTRODUCTION

- Legacy chemical & rad waste in SST's in 12 Tank Farms
- Passive ventilation
- Released vapors:  
Ammonia, Nitrous Oxide, VOCs, Others
- Workers health a concern
- Source of Vapors: Tanks, Lines, Enclosures
- Plumes are transient & unpredictable



# Representative Hanford Tank Farm



# Approach to Instrument Survey & Evaluation

- Historical
- Defined Instrument Parameters
- Defined Operating Environment
- Market Search
- Compare, Evaluate



# Historical Documentation: Transient Plumes

- Plumes for water studies (ground water, Oceans, etc.)
- Plumes for Stack Emissions
- Plumes for polluted ambient air



# Instrument Requirements

- Suitable for outside use
- Simple
- Suitable for Transient Plume Detection
- Commercial availability
- 1 year proven operating experience



# Instrument Requirements Continued

- Portable
- Battery life of at least 4 hours
- Response – Real Time
- Data Acquisition Capability

# Where We Looked

- DOE – Information Bridge ([www.doe.gov](http://www.doe.gov))
- EPA – Technical Evaluation web site ([www.epa.gov](http://www.epa.gov))
- [www.google.com](http://www.google.com)
- [www.globalspec.com](http://www.globalspec.com) Engineering Search Engine
- Experts
- Practitioners



# What We Found

- Thermal Imaging Devices
- Gas/Vapor Monitoring Analyzers
- Variety of analytical techniques
- No previous experience in transient plume detection



# Example of Portable Gas/Vapor Instruments



# Survey Results

- Infrared (IR)
  - Thermal Imaging
  - Fourier-Transform Infrared (FTIR)
- Laser Induced Breakdown Spectroscopy (LIBS)
- Light Detection And Ranging (LIDAR)



# Infrared (IR)

## 5 types

- Thermal Imaging
- Night Vision Goggles
- FTIR
- Photo Acoustic IR
- Long Path IR



# Portable Thermal Imaging Device

## FLIR SYSTEMS

- High Performance Portable infrared camera for Thermal Imaging
- The ThermaCAM® P60 infrared camera, noninvasive means of monitoring and diagnosing the condition of surrounding environment.



# FLIR Model P60



# Open Path Fourier-Transform Infrared Spectroscopy (FTIR)

MIDAC AM/Boreal Laser

- Real Time analysis of contaminants
- 15 min set up & dismantle
- Currently used for fence line measurement
- Other environmental applications



# MIDAC Open Path FTIR Air Monitoring System



# Boreal Laser Inc. GasFinder Open Path Monitor

GasFinder - Side View



# Light Detection And Ranging (LIDAR)

ORCA Photonics

- Uses same principle as RADAR
- Best for aerosols/particulates
- Light transmitted, scattered/reflected and analyzed
- Portability requires castors – Weight > 25#



# ORCA Photonics LRS Aerosol Lidar System



# Laser Induced Breakdown Spectroscopy (LIBS)

## Ocean Optics

- Real-time response
- High sensitivity (nanograms),
- Can be made small (shoebox size),  
<10 lbs
- Point sensor or as standoff detector,
- Standoff distances of 100 meters or greater



Head's-up display

Joystick for control

Laser

Microplasma

Backpack contains broadband spectrometer, laser power supply, battery, and computer



# Conclusions

- Experts - no transient vapor plume experience
- Current portable devices not applicable
- Newer technologies show promise
- Some Manufacturers will modify
- Field test at Hanford to validate
- More than one device may be necessary



# Recommendations

- CVST request proposals for evaluation
- 4 Techniques - example manufacturer
  - Thermal Imaging
    - FLIR Systems
    - Land International
  - Open path Fourier-Transform Infrared (FTIR)
    - MIDAC AM System
    - Boreal Laser Inc – Gas Finder Open Path



# Recommendations Continued –

- Laser Induced Breakdown Spectroscopy (LIBS)
  - Ocean Optics
- Light And Ranging (LIDAR)
  - ORCA Photonics
  - CLR LIDAR Technology

