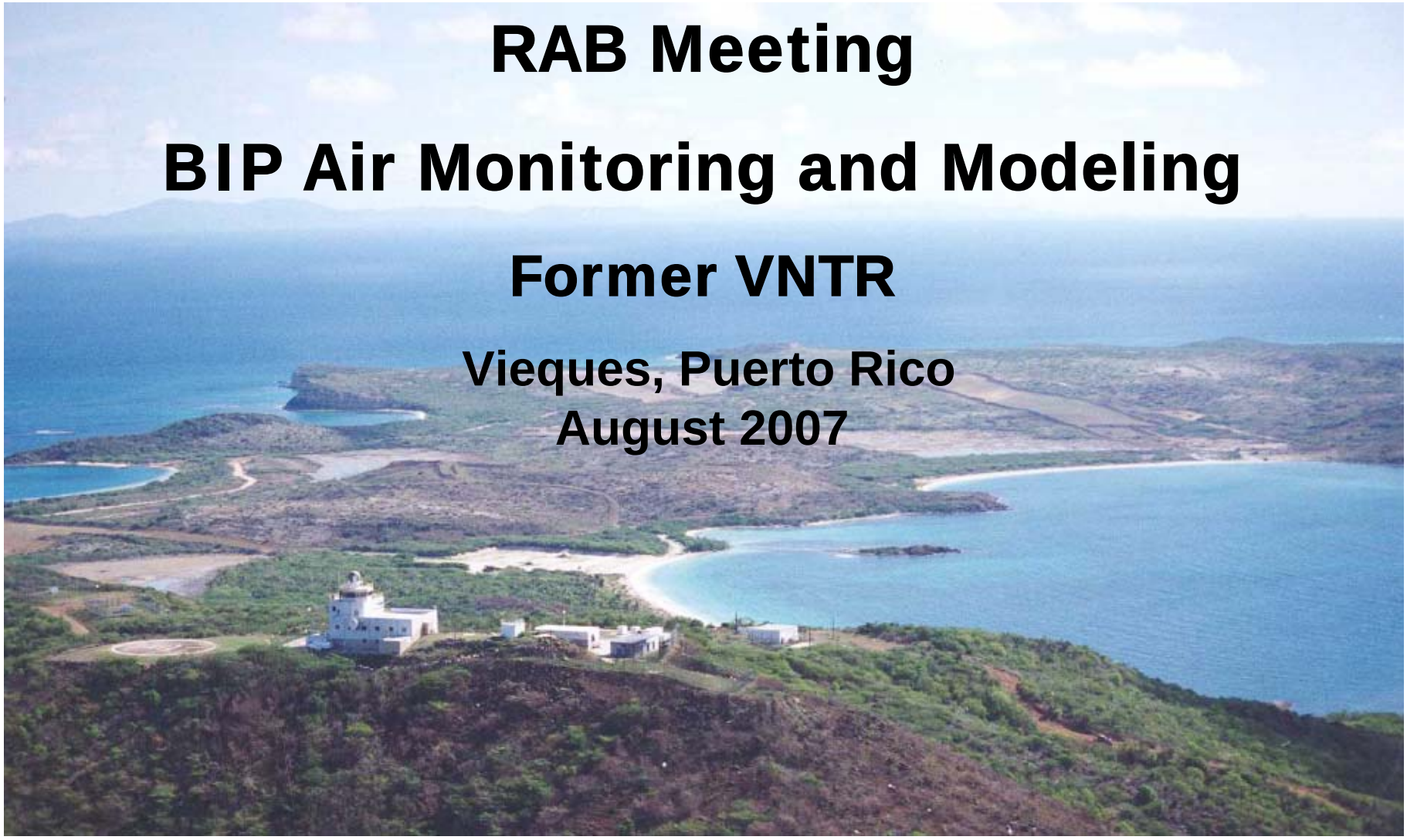
RAB Meeting

BIP Air Monitoring and Modeling

Former VNTR

Vieques, Puerto Rico
August 2007



Time Critical Removal Action (TCRA)

- To meet the TCRA clean-up objectives, old ordnance is destroyed by blowing it up on the target area; Blow-in-Place or BIP

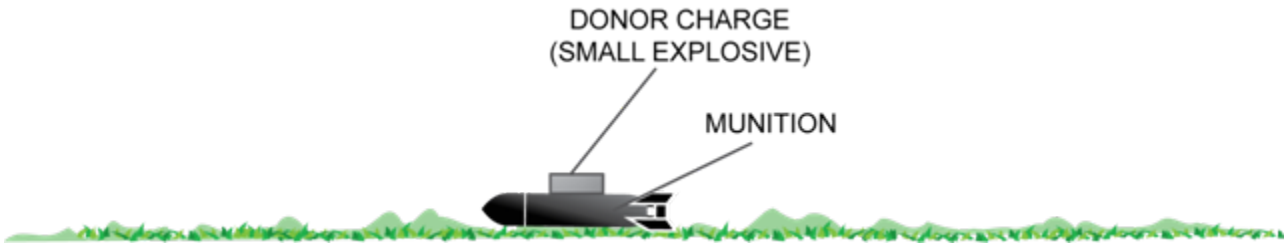
- We have looked at the emissions from the BIPs by two methods:
  - Air monitoring for the BIP emissions
  - Dispersion modeling for the BIP emissions

BIP Monitoring Approach

- Understand the BIP process
- Identify possible emissions
- Develop action levels for those compounds in air
- Identify monitoring equipment, analysis methods and appropriate locations for the equipment
- Operate and optimize the monitoring equipment

Understanding the BIP process

- **A small explosive donor charge is used to break open the case of the item and ignite the explosive inside.**



Understanding the BIP process

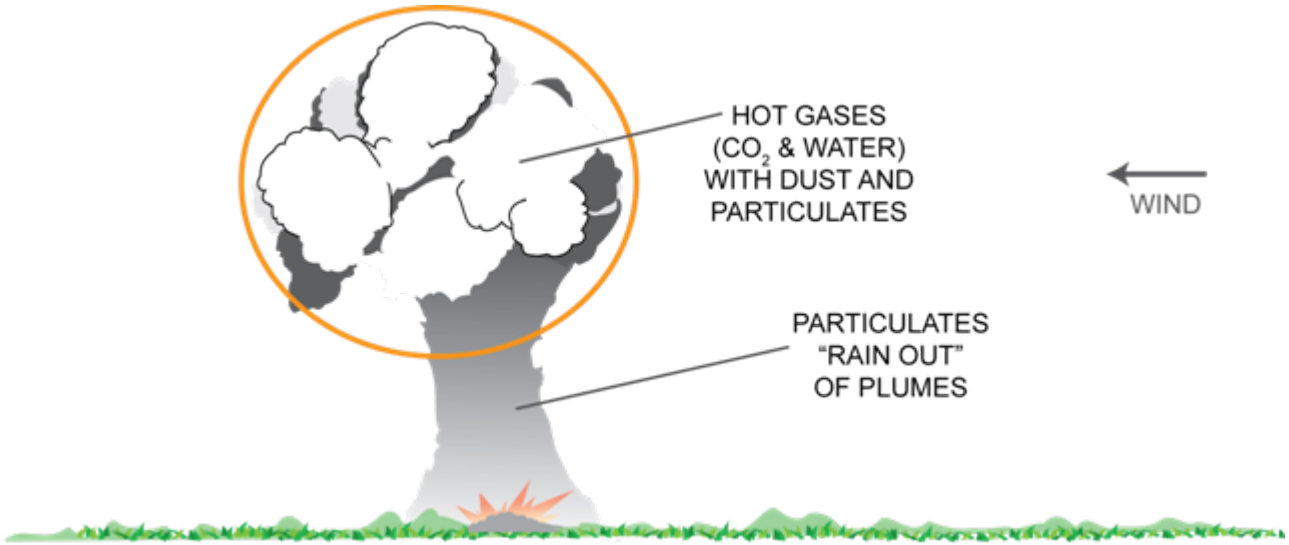
- **The explosive inside then burns and splits the case (usually iron) into fragments.**

- **The case fragments are large enough to quickly fall to the ground.**

Understanding the BIP process

- **The burning explosive forms a visible cloud mostly of water vapor, carbon dioxide, and dust.**

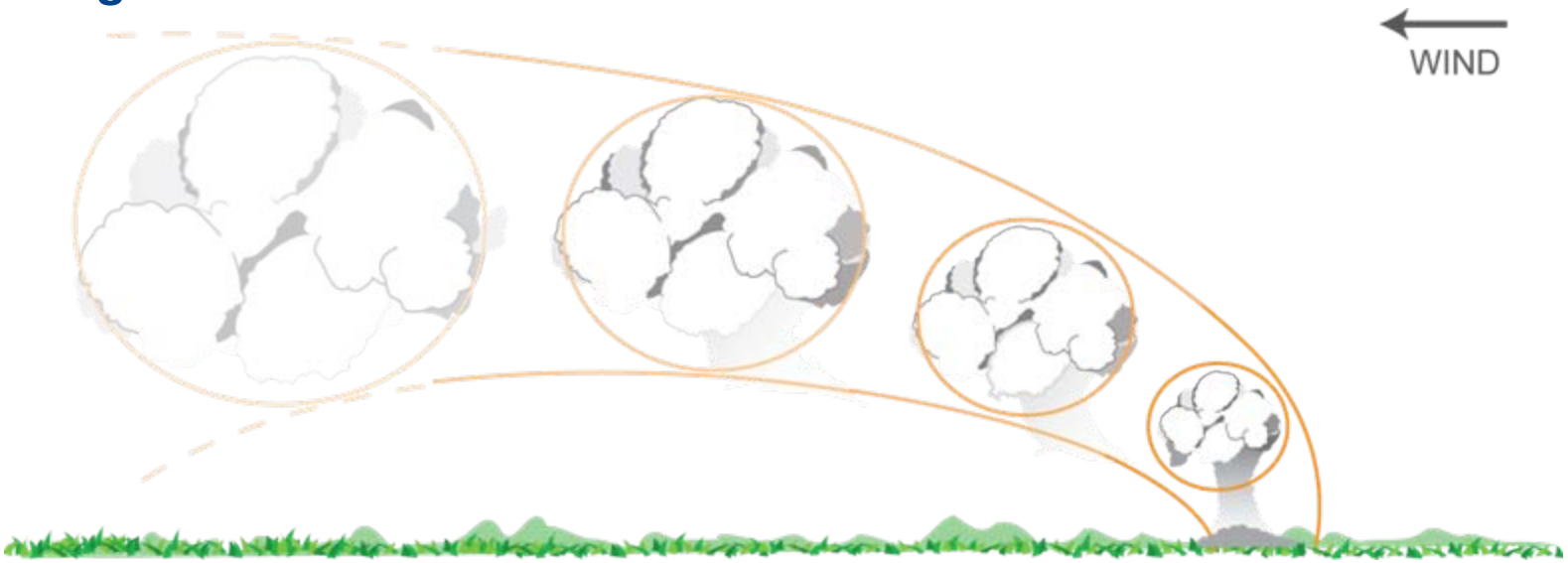
- **There can also be very small residues of explosives and traces of metals in the cloud (plume); these compounds are what we monitor for.**



Understanding the BIP process

- As the plume moves with the wind, it expands and is diluted by air which makes the concentrations of anything in the plume decrease

- During the same time, the particulates and dust fall to the ground



Understanding the BIP process

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Identify Possible BIP Emissions

- List of items actually destroyed at site was used as basis of estimate
- Potential air emissions identified for items destroyed (examples: particulates, lead, TNT, etc.)

Requirements: Equipment, Methods, and Locations for Monitoring

- **Sampling Equipment**
  - Particulates (PM10) by recognized method
  - Time intervals consistent with operations and Action Levels (8 hrs, not 24 hrs for some compounds)
  - Address multiple Compounds of Concern
  - Unattended operation
- **Explosives/Metals Analysis Methods**
  - Sensitive enough to measure concentrations to below action levels
- **Location**
  - Get as close as possible to the BIPs to measure the highest possible concentrations

BIP Monitoring Stations

- **E-BAM particulate monitor**
  - **Same principle as Equivalent method, used in USFS and EPA studies**
  - **Operates on solar power; unattended & continuous**
  - **Collects 8 hour samples on tape**
  - **Tape is analyzed for metals and explosives using EPA methods**

- **Located on ridge along SIA-LIA boundary**
- **New location near community as requested by community and approved by EQB**

Identify Action Levels

- Action levels are the concentrations in air for a given compound where we do additional analysis to see if there are concerns for health and if we should have additional restrictions
- Standard EPA guidance levels were used if available (e.g. NAAQS for PM10 & lead)
- If EPA guidance was not available for a compound of concern, the most reasonably protective action levels were developed
  - Action levels were developed using EPA accepted methods and data for all HHRAs and ERAs developed in the US
  - Action levels were based on people being exposed 350 days per year for 30 years
  - Action levels that were developed are based on the most sensitive population groups

Compounds for BIP Monitoring

Explosives/Energetics

Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX
Nitrobenzene	NB
1,3-Dinitrobenzene	1,3-DNB
1,3,5-Trinitrobenzene	1,3,5-TNB
2,4-Dinitrotoluene	2,4,DNT
2,6-Dinitrotoluene	2,6-DNT
2,4,6-Trinitrotoluene	TNT

Metals

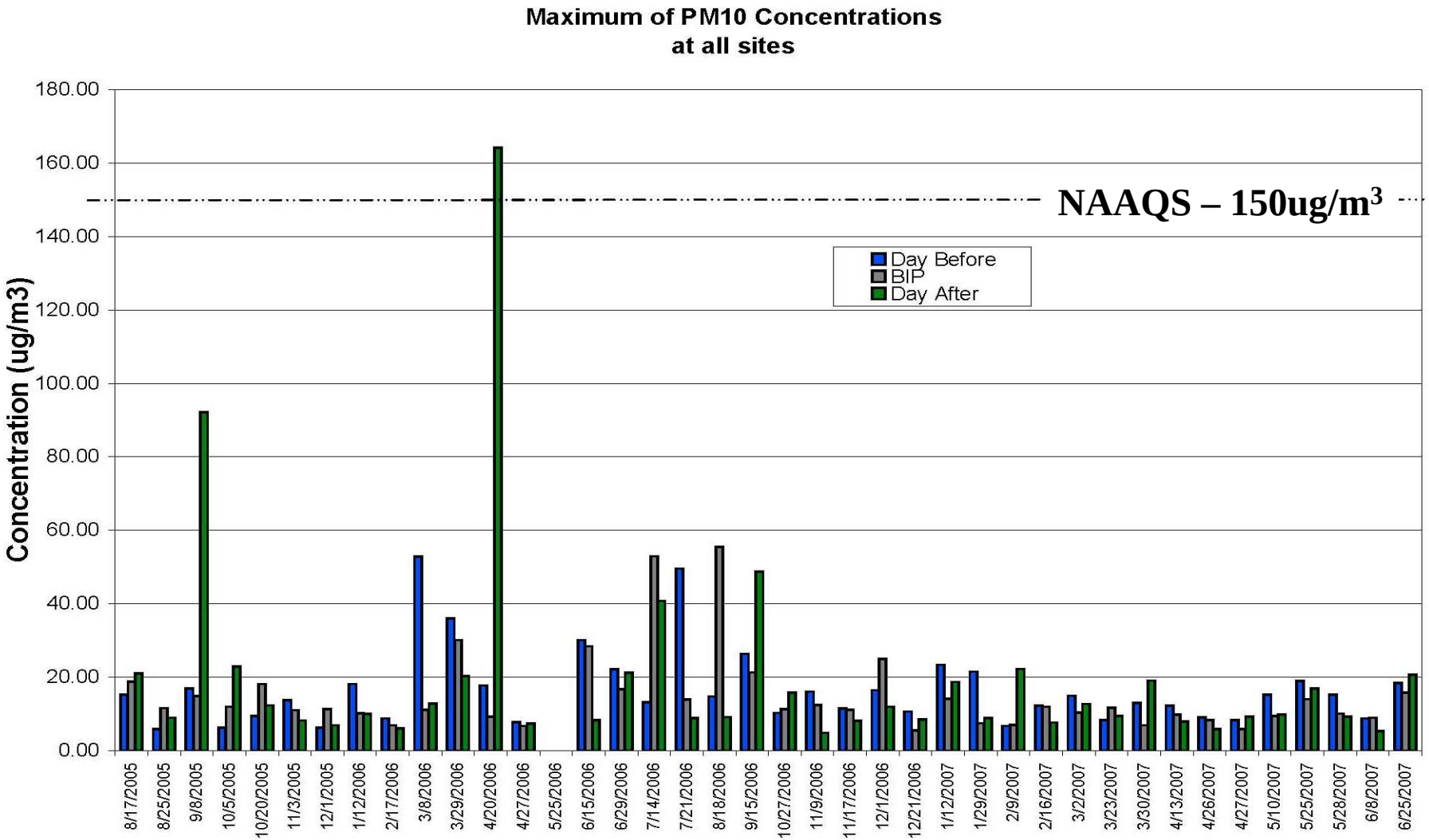
Phosphorus	P
Chromium	Cr
Iron*	Fe
Nickel*	Ni
Copper*	Cu
Arsenic	As
Cadmium	Cd
Tin	Sn
Mercury	Hg
Lead	Pb

*** detected during monitoring**

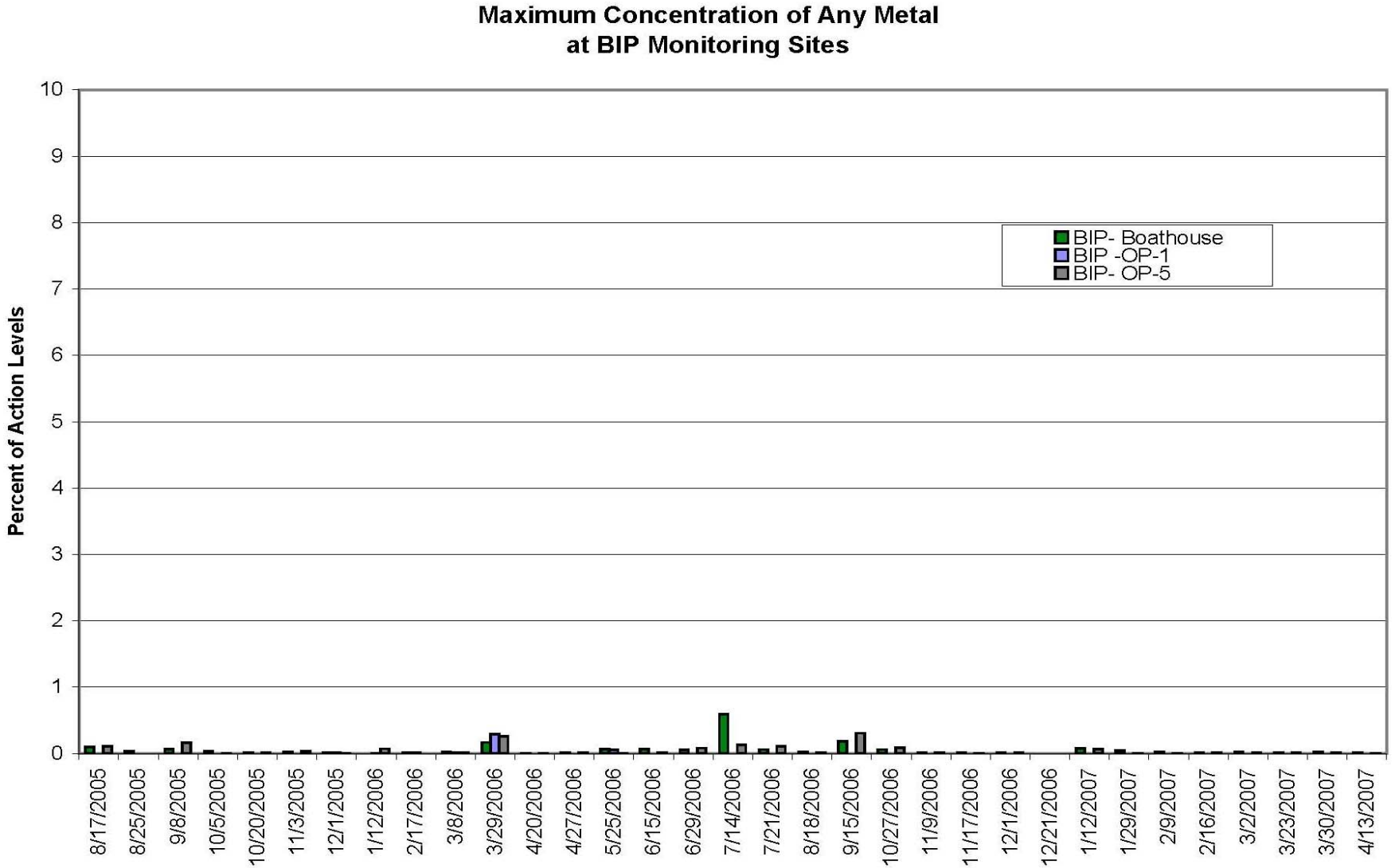
BIP Air Monitoring Summary

- **Air monitoring data available since August 2005**
  - **39 BIP events**
- **No explosives have been detected in air**
- **Some metal concentrations (iron, copper, nickel) were detected; <1% of action levels.**
- **On one occasion, particulate levels on the SIA-LIA boundary slightly exceeded regulatory criteria**
  - **Associated with brush fire following detonations**
  - **Not likely to impact the populated areas – the plume undergoes significant dilution before reaching public access areas (>90 % reduction)**
- **Based on the results of air monitoring, air emissions from BIP detonations do not have a negative impact on the ambient air quality in or around the populated areas of Vieques.**
  - Here are the data:

BIP Air Monitoring Results – Particulates



BIP Air Monitoring Results – Metals

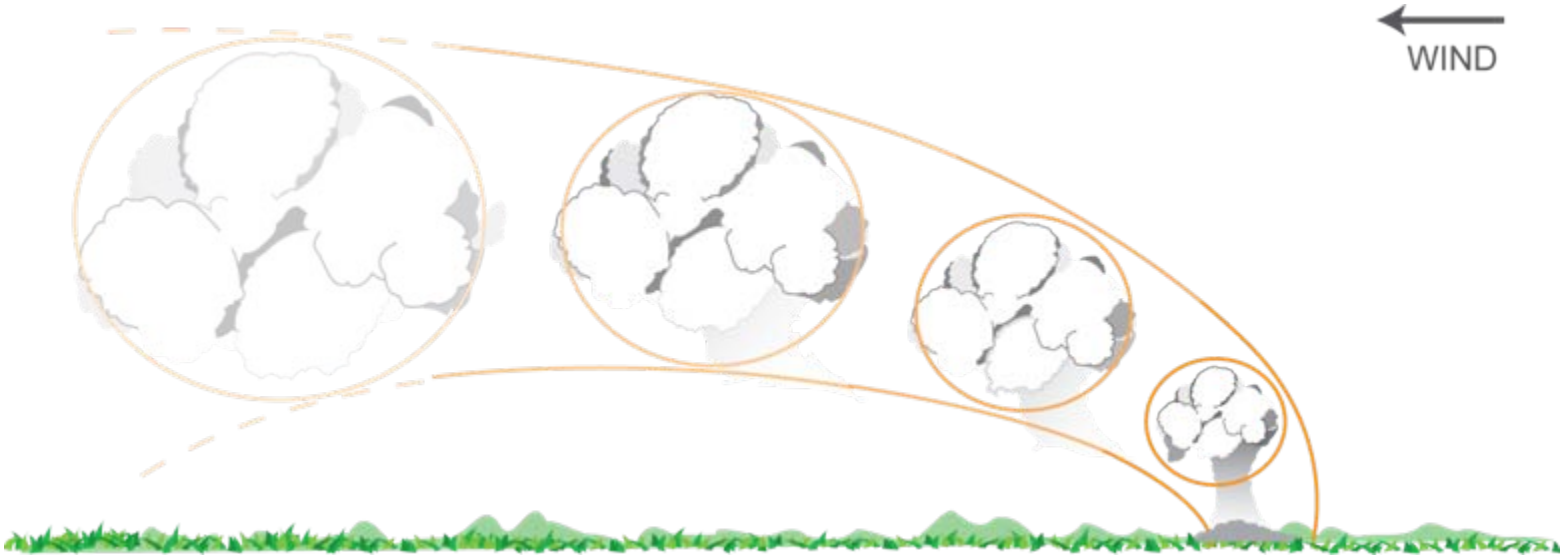


BIP Modeling Approach

- Understand the BIP process
- Estimate possible emissions
- Choose the appropriate dispersion model and weather data for the area
- Run the model using the weather data
- Compare the results to action levels or regulatory thresholds

BIP Dispersion Modeling

- The plume from a BIP is diluted and disperses as it travels with the wind
- The predominant wind directions are from the easterly quadrant



Estimating BIP Emissions

- List of items actually destroyed at site was used as basis of estimate

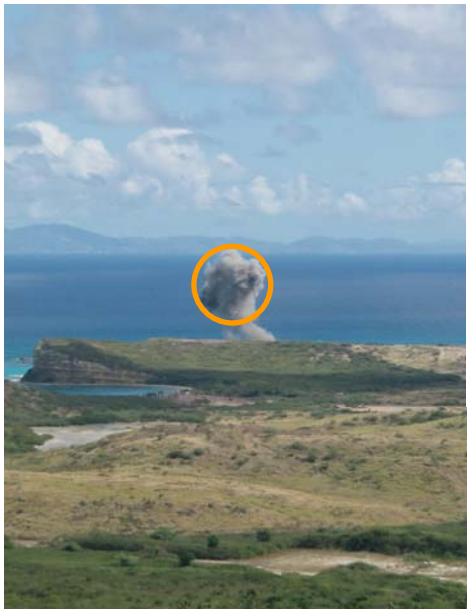
- Emission factors for the most significant compounds were identified for each item destroyed
  - Some emission factors were developed experimentally by blowing up a munition item in a closed chamber (at a research facility) and sampling the air inside
  - Some emission factors are developed by modeling the combustion of the explosive

BIP Model & Weather Data

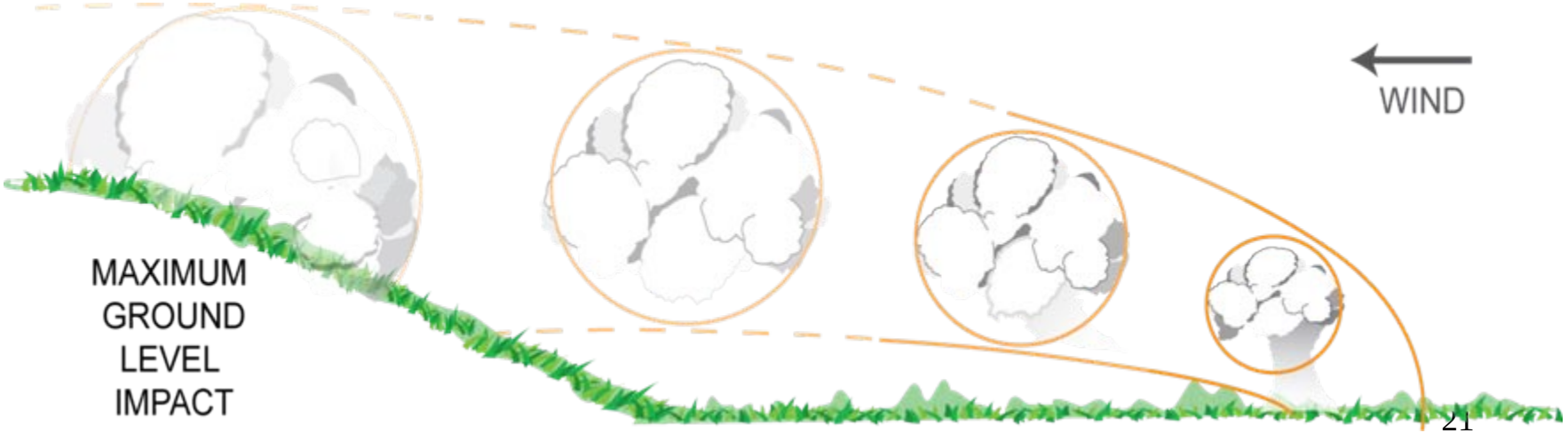
The OBODM dispersion model was chosen because:

- **It is a commonly used model for open detonations, developed at Dugway Proving Grounds**
- **OBODM is accepted by the EPA**
- **It has been used in many regulatory applications across the US**
- **It is a very conservative (or protective) model**
- **OBODM can use weather data from a single local source (data from Camp Garcia was used)**

BIP Modeling Assumptions



- **To be even more protective, it was assumed that small particles do not 'rain out' of the plume even though we know they do fall out of the plume**



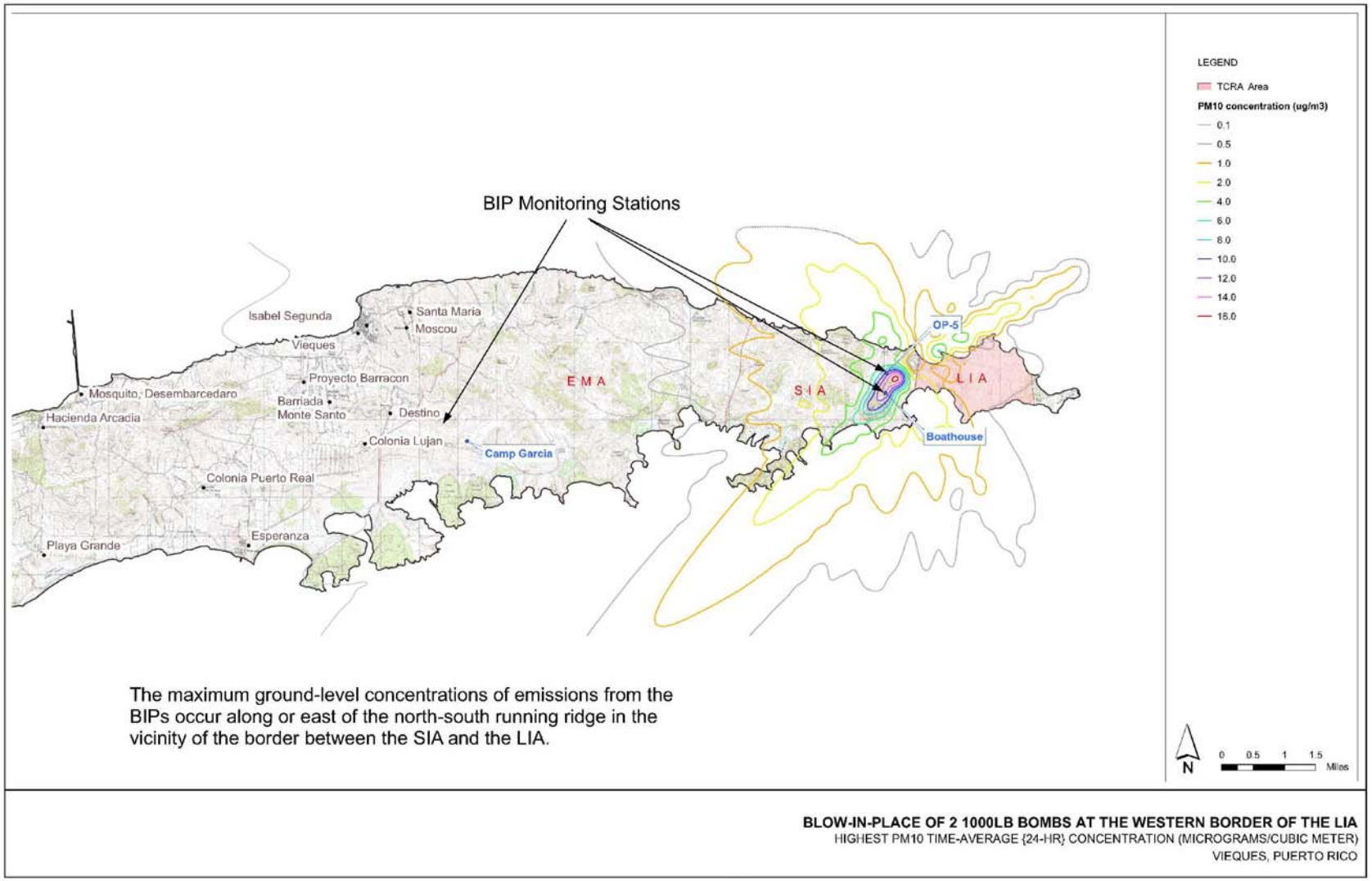
BIP Dispersion Modeling Results

- **The BIP modeling was designed to be conservative and significantly over-estimates the actual average downwind concentrations of emissions.**

- **The maximum ground-level concentrations of emissions from the BIPs occur in or near the LIA.**

- **All Compounds of Concern are predicted to be well below regulatory standards or action levels – even at the maximum ground level impact areas.**

BIP Modeling Results; PM_{10}



BIP Air Modeling Summary

- **BIP modeling completed**
  - **Shows that the highest air emission concentrations would occur in close proximity to the BIPs – on the LIA or SIA**
  - **Demonstrates that particulate or dust (PM10) levels detected on the LIA would decrease to well below NAAQS before reaching the populated areas.**

- **Based on the results of air modeling, air emissions from BIP detonations do not have a negative impact on the ambient air quality in or around the populated areas of Vieques.**

BIP Conclusions

- Air Monitoring has shown that the particulates from the BIPs do not exceed regulatory standards
- Air Monitoring has shown that the Metal concentrations from the BIPs do not exceed action levels
- Air Monitoring has shown that there are no detectible levels of explosives in the air

- Dispersion Modeling has shown that the particulate emissions from the BIPs should not exceed regulatory standards
- Dispersion Modeling has shown that emissions from the BIPs should not exceed action levels

- BIP Modeling and Monitoring agree with each other