

EPA's Next Generation Compliance Strategy and the Role of the Citizen Scientist

NEMC 2016
Citizen Science Session

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Presentation Objectives

1. Define Citizen Science
2. Explore Citizen Science Models
3. Examine Citizen Science Drivers and Enablers
4. Review Two Key Areas of Citizen Science Engagement
5. Outline a Strategy for Working with Citizen Scientists

Oxford Dictionary Definitions of Citizen Science

- **Citizen Science:**

Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions.

- **Citizen Scientist:**

A member of the general public who engages in scientific work, often in collaboration with or under the direction of professional scientists and scientific institutions.

or

A scientist whose work is characterized by a sense of responsibility to serve the best interests of the wider community.

History of Citizen Science

- Early scientists were for the most part citizen scientists, undertaking studies without formal support.
- Science research shifted to universities and government agencies in the mid-1900s.
- Citizen science is growing due to affordable computing power, affordable measurement instrumentation, Web-based collaboration tools, government support, and regulations.
- What is the concern?
  - Enabling programs create “Citizen Deputies” instead of “Citizen Scientists”

Three Ideal Models for Citizen Science Programs

Contributory Projects	• Projects designed by professional scientists • Participants collect, process, or analyze data
Collaborative Projects	• Projects designed by professional scientists • Participants have a larger role – framing questions, reporting outcomes
Co-Created Projects	• Projects are designed by both professional and avocational scientists • Much broader participation and contribution by the citizen scientists

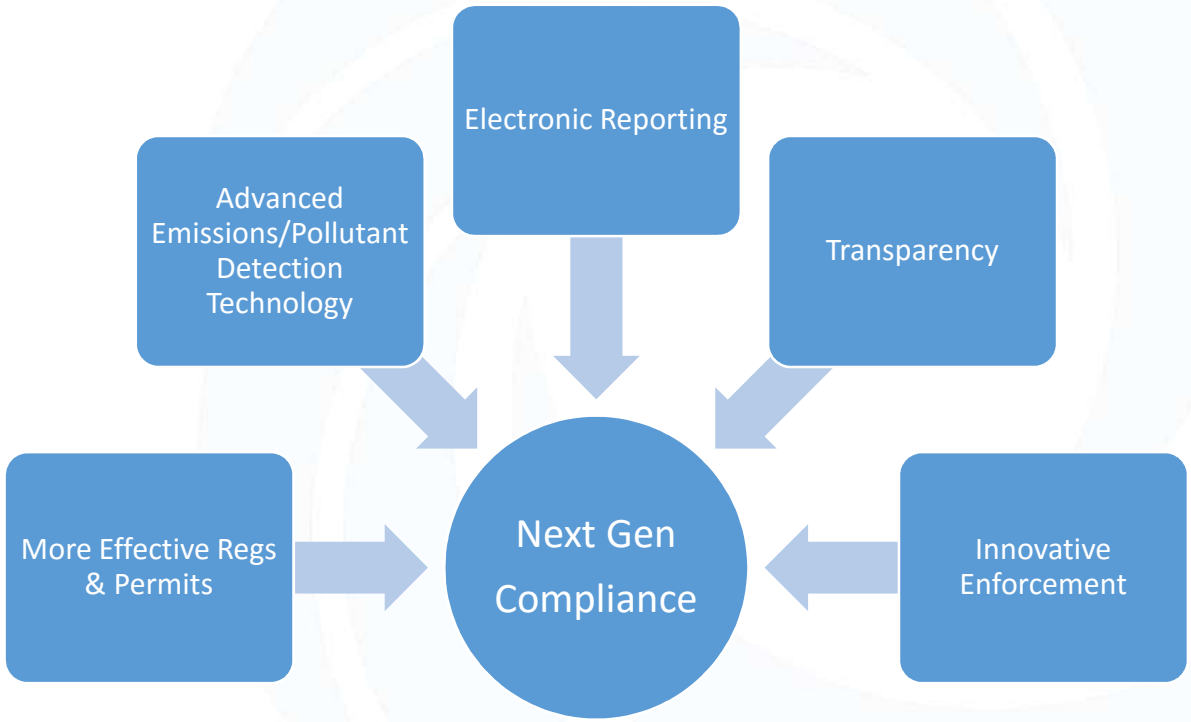
Attributes of a Successful Citizen Science Program

- Project objectives are clear and understood.
- Project team has the appropriate expertise in all required project areas – design, measurement, analysis, reporting.
- Small scale trials are undertaken to test the approach with potential participants.
- Motivations and skillsets of all parties are understood.
- Quality of the scientific data generated is measurable.

Several Factors Drive Citizen Science Involvement in the Environmental Area

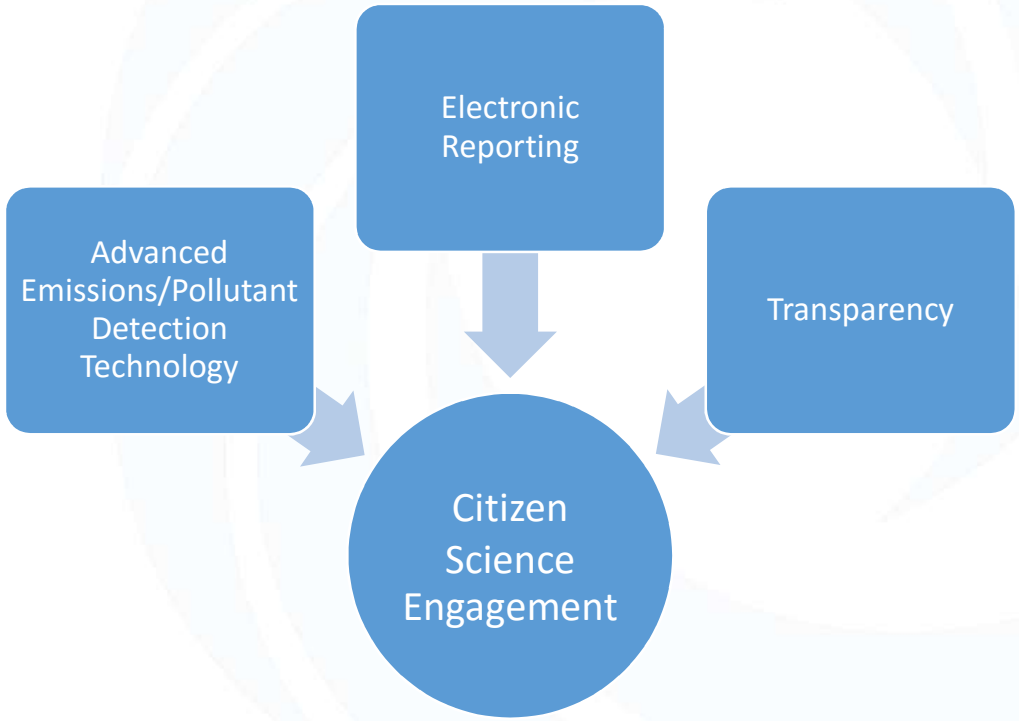
- Public interest in environmental or ecological areas coupled with enabling technology
- Environmental Justice/Community Concerns
- Office of Science and Technology Policy
- University Citizen Science Programs
- EPA Programs
  - *The Changing Paradigm of Air Pollution Monitoring*
- EPA's Next Generation Compliance Strategic Plan

Five Elements Define EPA's Next Generation Compliance Strategy



Explained in Next Generation Compliance Strategy: 2014-2017 dated October 2014.

Three Elements of Next Gen Compliance Engage the Citizen Science Community



Next Gen Compliance Strategy is Underway

- Coal Combustion Residuals Rule
  - Includes a requirement for a fugitive dust management plan and maintenance of a public website
- Petroleum Refinery Sector Rule
  - Includes requirements for fenceline monitoring and electronic reporting via EPA's Central Data Exchange (CDX)
- Electronic Reporting and Recordkeeping Requirements for New Source Performance Standards (Proposed)
  - Will require use of ERT for all NSPS
- NPDES Electronic Reporting Tool
  - Promulgated 9/15 with a five-year phase-in period

EPA Enables the Citizen Scientist in Two Ways

1. Data Generation

   EPA recognizes and advances emerging measurement technologies that are deployable by citizen scientists.

2. Data Mining

   EPA maintains various electronic reporting tools and databases that are publically accessible.

EPA is Enabling Citizen Scientists to Participate in Air Quality Measurement Activities

- https://www.epa.gov/air-research/air-sensor-toolbox-citizen-scientists

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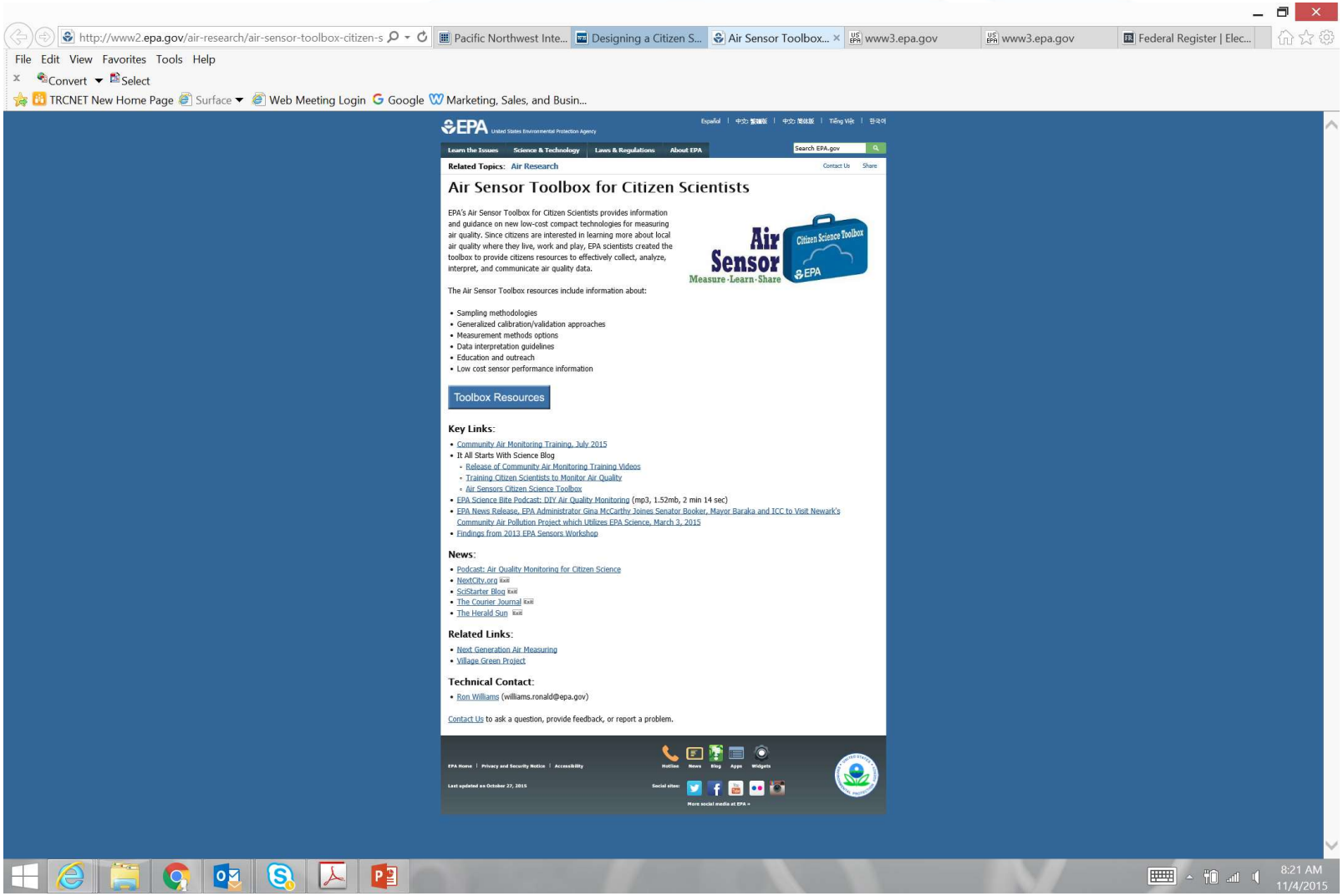
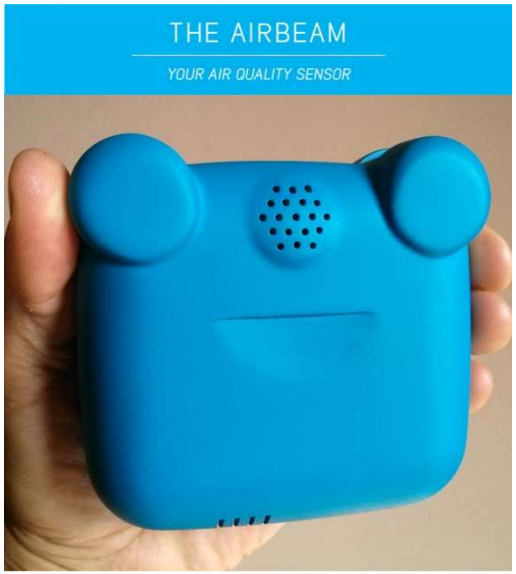


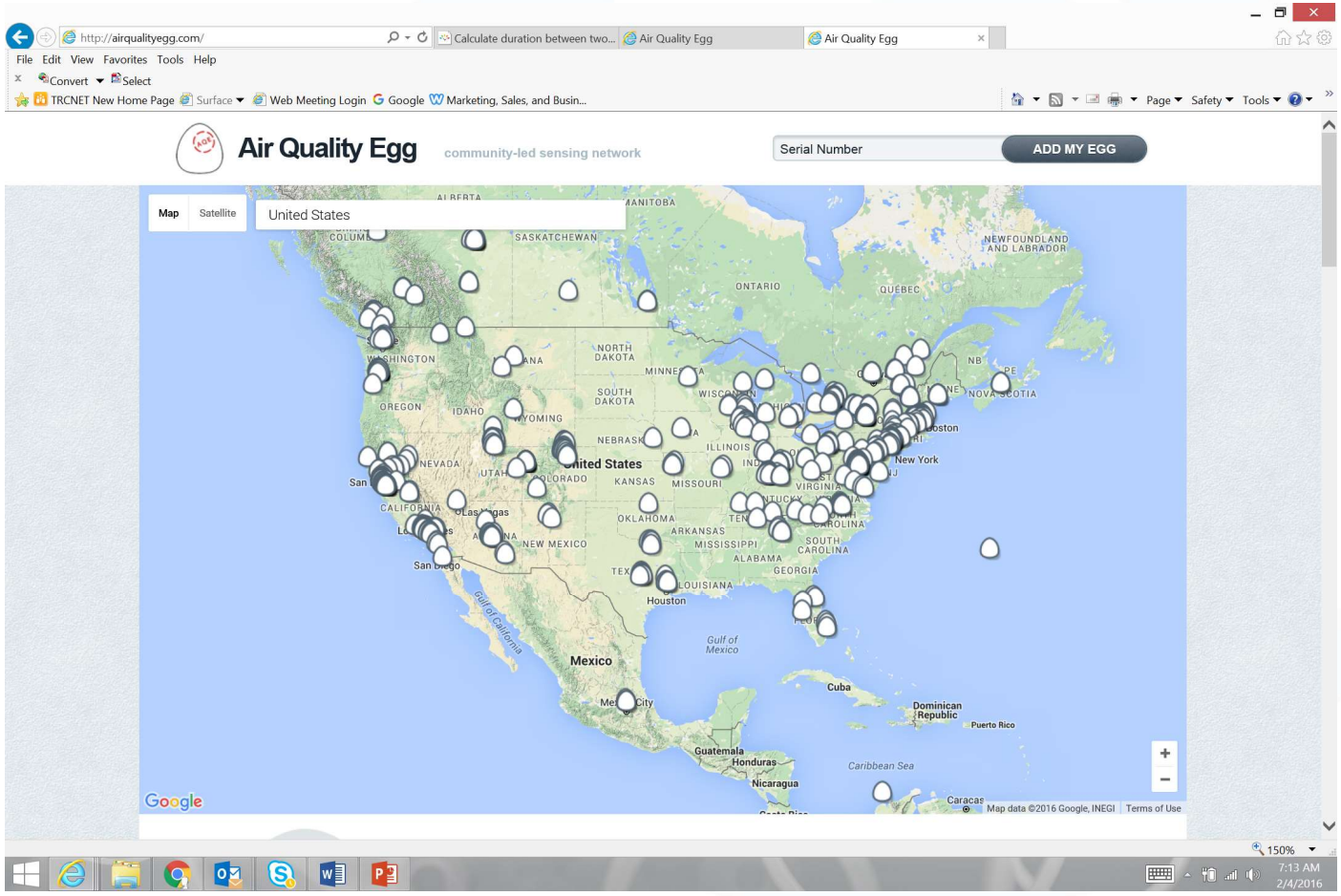
Monitoring Programs Vary in Sophistication

- Air Quality Egg
  - Community-led sensing network for NO_2 and CO contained in the Air Quality Egg ($240)
- AirCasting
  - Airbeam ($250) measures $PM_{2.5}$
- Village Green Project (EPA)
  - Bench (~$60,000) measures O_3, $PM_{2.5}$, Temperature, Humidity, and Wind Speed with real-time reporting

Sample Measurement Technologies



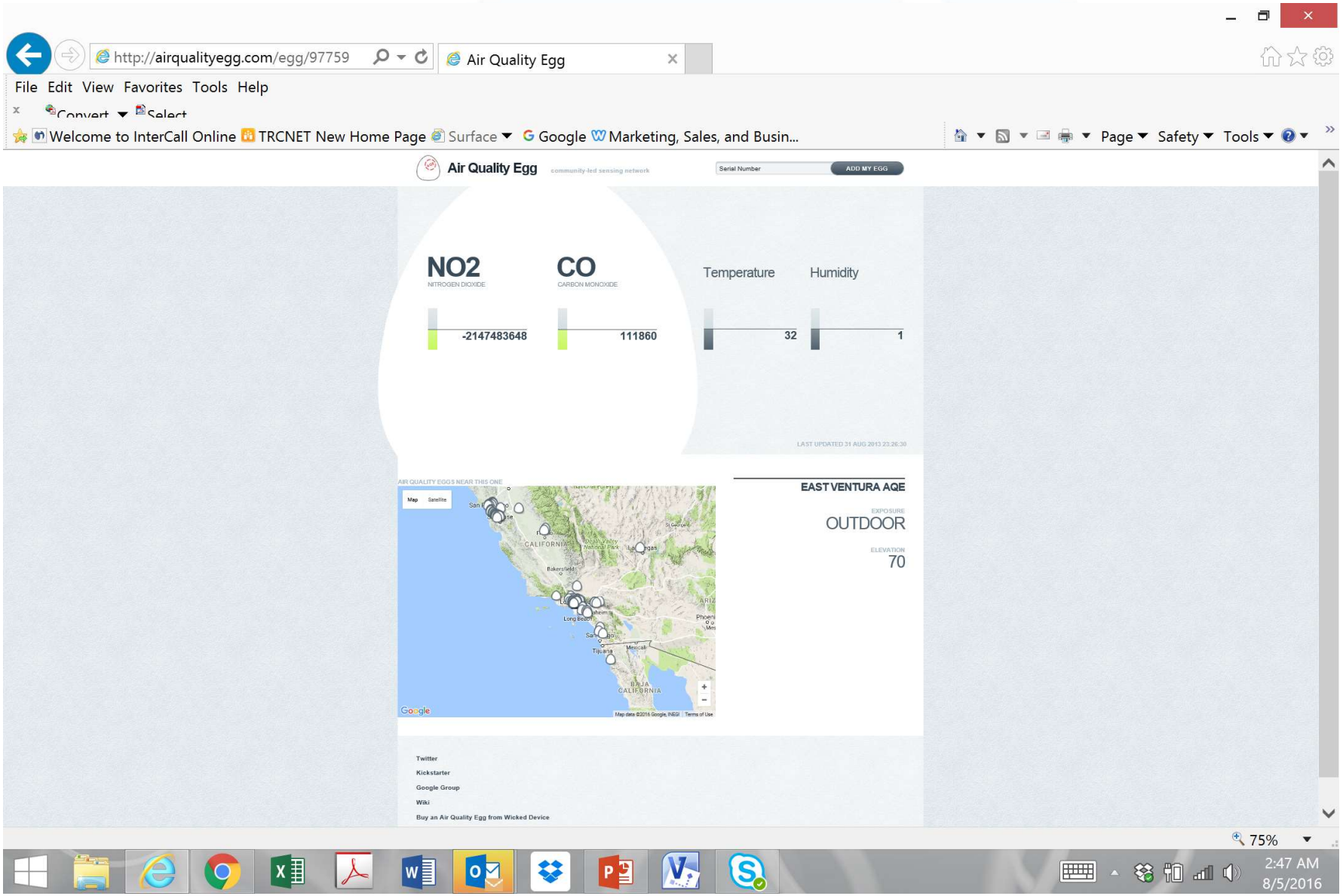
Air Quality Egg Network Screenshot



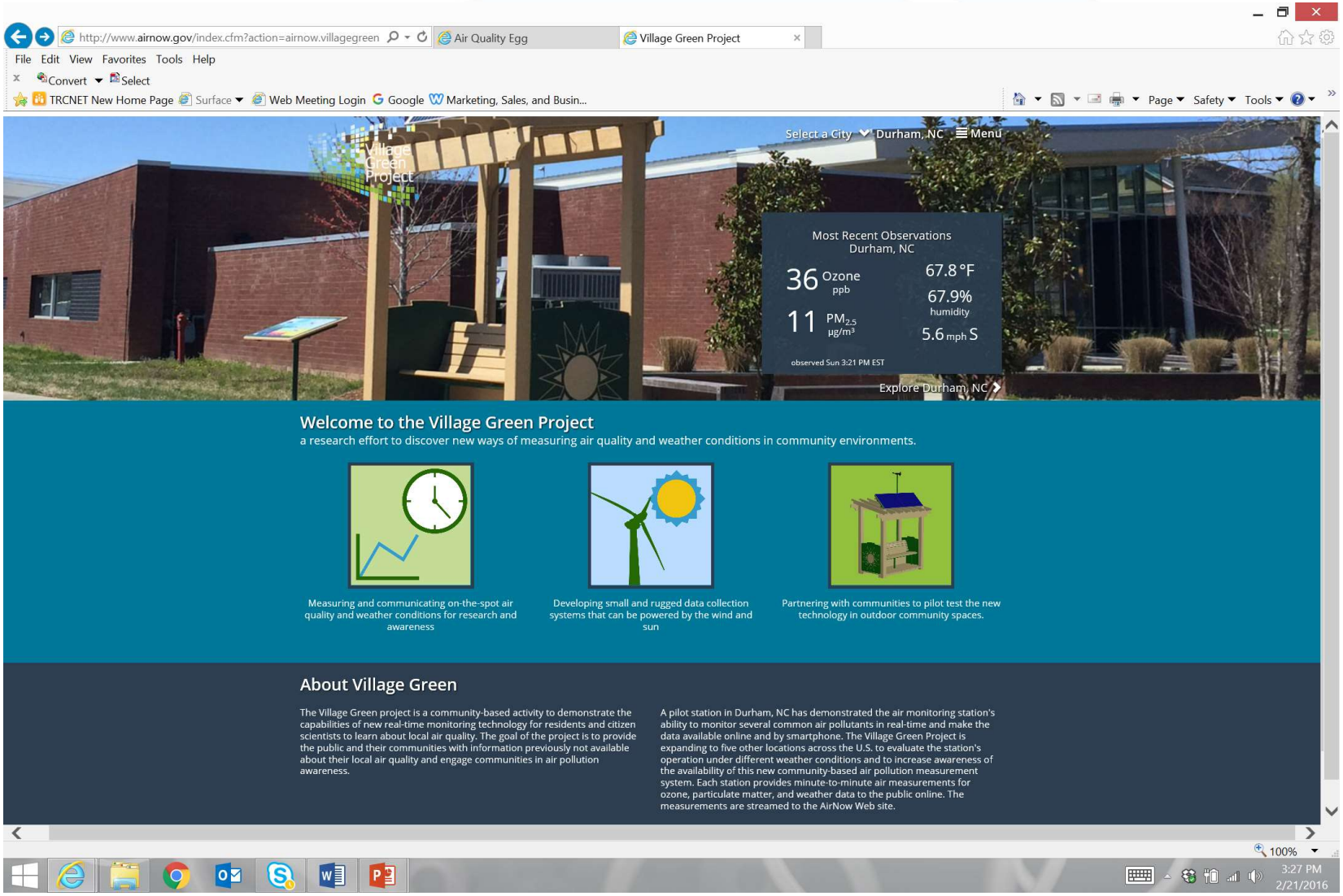
Los Angeles Area Air Quality Egg Data

http://airqualityegg.com/egg/97759

Los Angeles Area Air Quality Egg Data



Durham Village Green Park Bench Data (1/2)

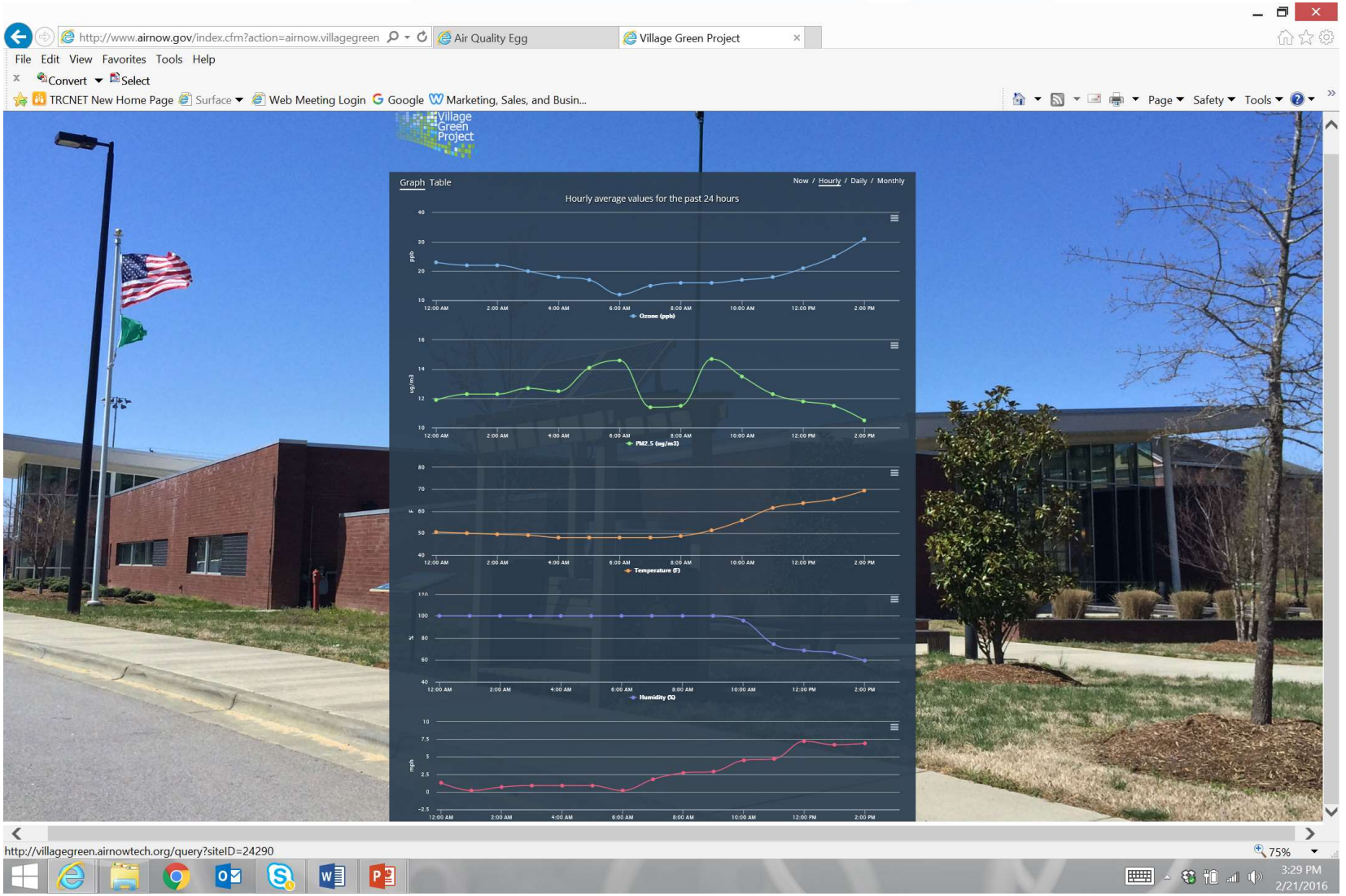


Durham Village Green Park Bench Data (2/2)

- Live Feed:

- https://villagegreen.airnowtech.org/welcome?siteID=24290

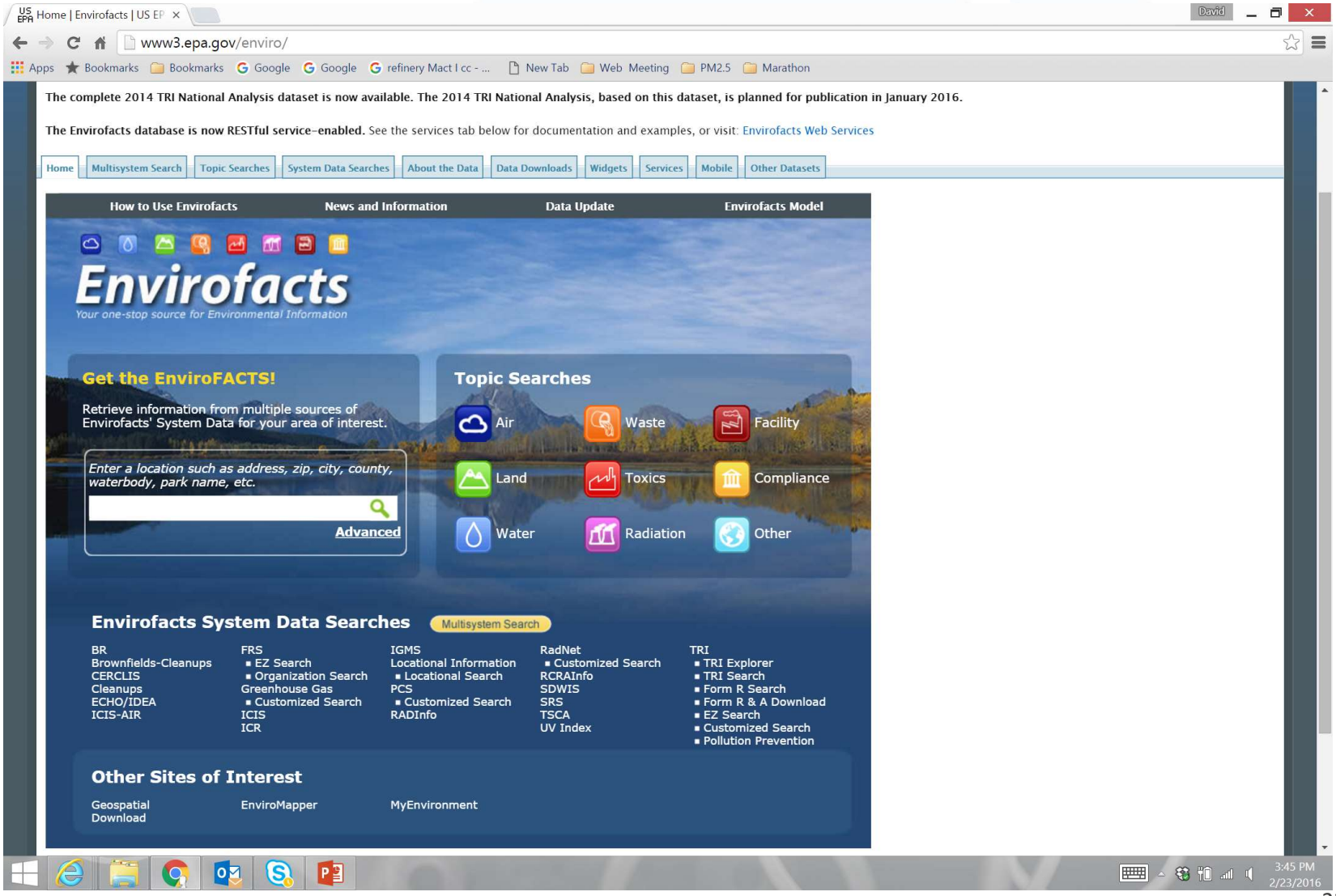
Durham Village Green Park Bench Data (2/2)



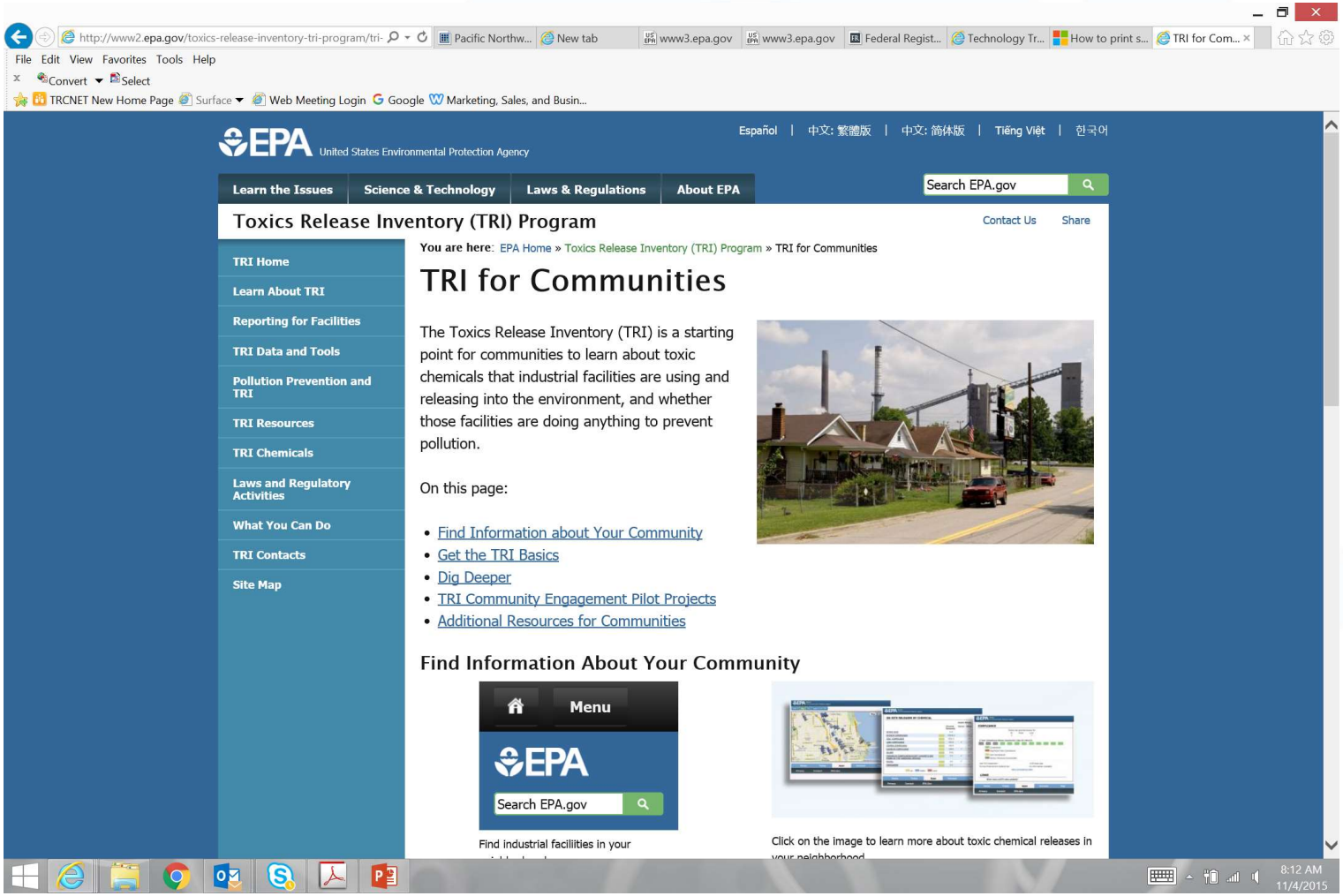
Several CDX Systems Provide Public Access to Reported Information

- CEDRI: Compliance and Emissions Data Reporting Interface
- NeT: NPDES eReporting Tool
- TRIMEweb: Toxic Release Inventory Made Easy Web
- ENVIROFACTS: Portal for Several Databases
- ECHO: Enforcement & Compliance History Online
- EJSCREEN: Environmental Justice Screening Tool

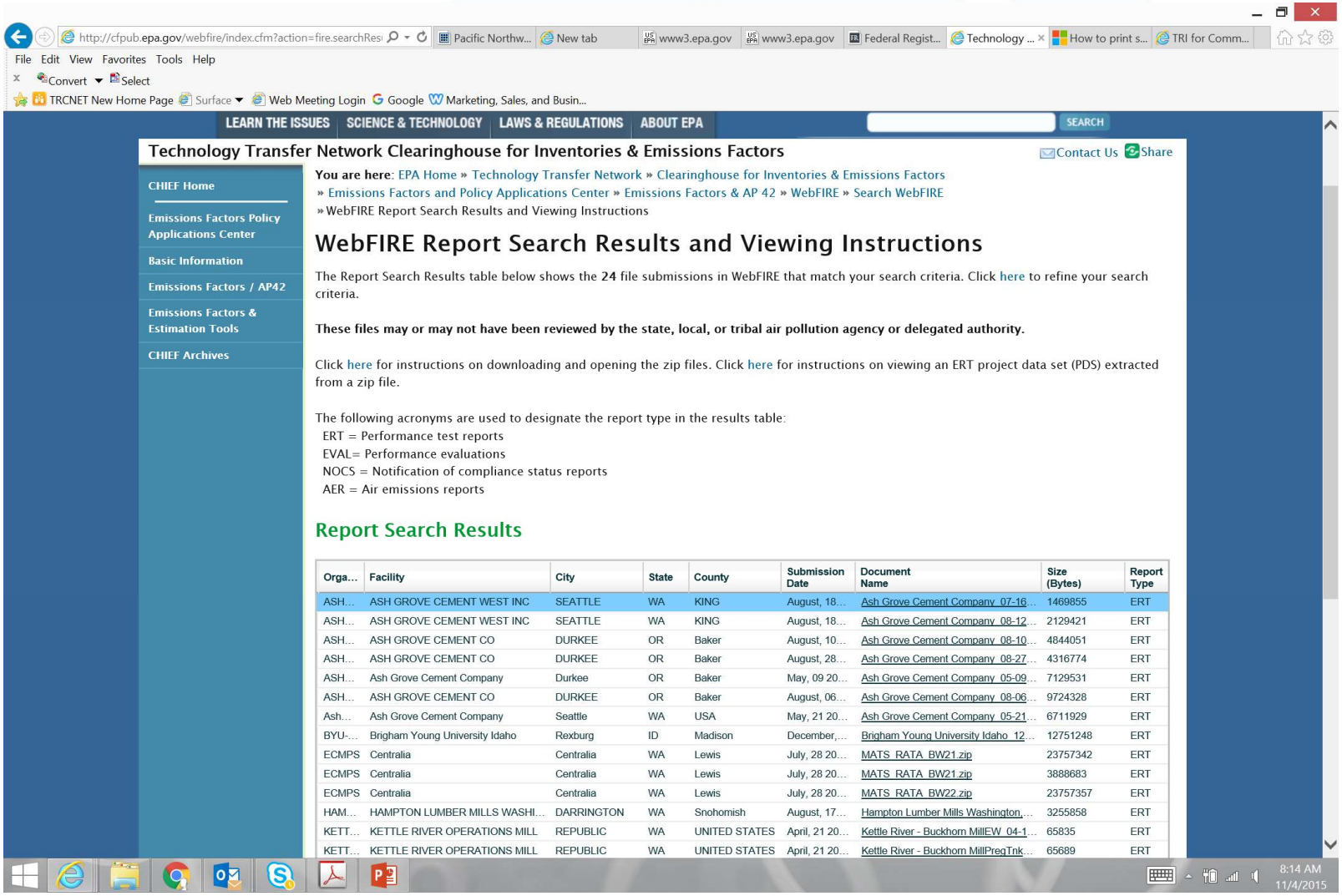
Envirofacts Provides Easy Access to Multiple Databases



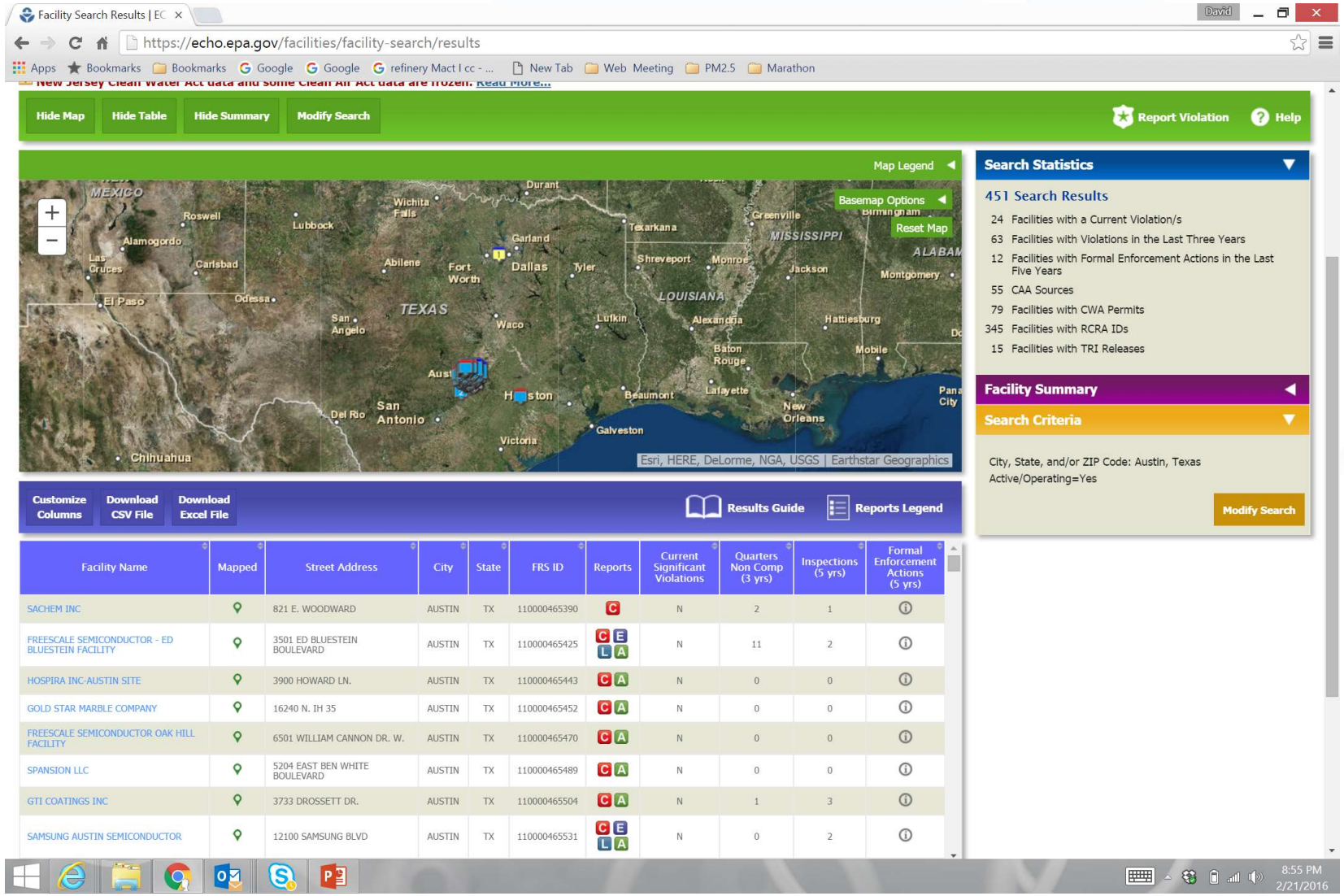
TRI Reporting Is Designed to Empower Citizen Scientists



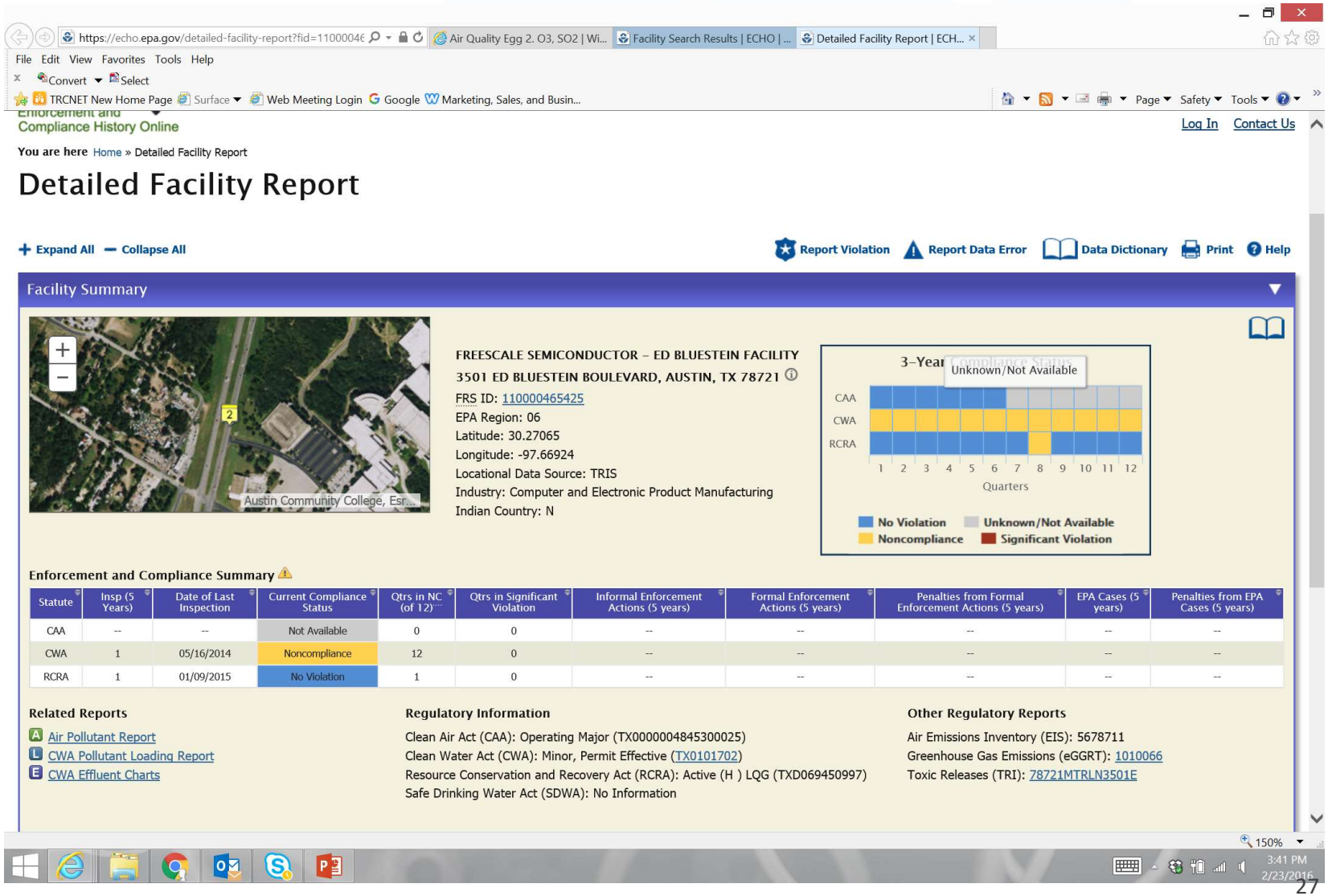
ERT Data Are Available and Ready for Citizen Scientist Analysis



ECHO Provides an Easy Entry Point for the Citizen Scientist



Selecting a Facility Returns an ECHO Dashboard



Guidelines for Successful Engagement with the Citizen Science Community

1. Don't dismiss the citizen science community.
2. Promote effective citizen science models.
3. Understand the government resources that engage the citizen science community.
4. Work with the citizen science community and enabling organizations to help advance foundational concepts regarding program design, data quality, and data analysis.

   "Data quality is a key issue since data of poor or unknown quality is less useful than no data since it can lead to wrong decisions."
5. Understand the broader implications of monitoring plans, electronic reporting, and databases.
6. Prepare for increased electronic reporting and public review.

Questions?

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