APHA 2009 Session 199413:
Improving situational awareness on a budget
Real experience integrating reportable disease and water-related events
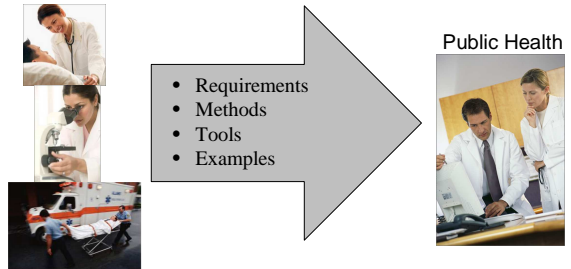November 10, 2009

Introduction

Integrating reportable disease and water-related events

Public Health

- Requirements
- Methods
- Tools
- Examples

Requirements

- Electronic Data
  - Need to eliminate paper data!
- Information Technology expertise (internal or consultant)
  - Moving or reorganizing the bits and bytes can present challenges in certain scenarios
- Motivation for Collaboration
  - Leveraging existing data reduces costs and increases sustainability to support situational awareness
  - Automated analyses reduces costs and improves situational awareness

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Methods

- Get the data
- Standardize the data
- Filter (and Reuse) the data
- Analyze the data
- Review the analysis
- Take Action

Get the Data

- Tap into any electronic data stream available, especially those that are nearly real-time, in order to support situational awareness
- Target any data stream that is a by-product of normal operations (911 call records, EMS run records, HIS communications, school or employer absenteeism) before adding to the front line work load
- Collaborate with data sources to refine normal operations to support increased data usage

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Standardize the Data

- Standardized data equals actionable data
- Common vocabulary and format are necessary
  - M = Male, F = Female
  - Dates in YYYYMMDD format, Times in hhmmss format
  - "cardiac" syndrome maps to all first responder assessment codes, ICD-9 codes, and key chief complaint phrases for cardiac-related conditions

Unify the Data

- Standardized identifiers (source data providers, care providers, patients, incidents/visits) provide better tracking
  - UUID / GUID:
    - 550e8400-e29b-41d4-a716-446655440000
  - Statistically unlikely to duplicate in 100 years
  - Controlled assignment by source provides longitudinal tracking by recipient without HIPAA concerns

Filter the Data

- Eliminate the potential noise in the analysis results by restricting what is analyzed
  - First responder incidents involving GSW or MVA are irrelevant for water contamination surveillance regarding chemical or biological agents
  - Elective procedures and drug scans are irrelevant for public health disease reporting and surveillance
  - Billing codes are rarely useful for disease or syndromic surveillance: usually delayed and "up-coded"

Reuse the Data

- Collect a given data element only once
- Once standardized and unified, apply appropriate filters
- Distribute data to all relevant recipients based on the filters (0:N)
  - This approach does require more work in the early stages of a project, but yields huge benefits for all processes or projects downstream

Analyze the Data

- Define data profile (timeliness, geospatial relations, etc.) in order to select appropriate analysis methods to support situational awareness
- Leverage in-house tools as appropriate
- Leverage free tools to fill gaps
- Leverage automation to reduce manual work load

Review the Analysis

- Review data analysis results as part of daily operations – situation can change quickly!
- Timeliness of optimal review $\propto$ timeliness of data and its analysis cycle
  - Identify "alert conditions" within the analysis results with automated monitoring to provide "look at me" notices for prioritization

Take Action

- Near-term examples:
  - Investigation and documentation of reportable disease condition
  - Research and collaborate with water utility if increased gastrointestinal illness rate is identified in particular geographic area
- Long-term examples:
  - Refine filters, adjust analysis parameters, or alter alert conditions to reduce "noise" or "false alarms"

Tools

- Cluster Identification
- Syndromic Profile Changes
- Geo-spatial Representation

Cluster Identification

- SaTScan^{TM}
- www.satscan.org
- Supports spatial, temporal, and space-time analyses and is free to install (Windows or Linux; limited support for Mac and Solaris)
- Can be used with very few data elements:
  - Incident identifier and date
  - Incident GPS coordinates
  - Incident "affected population" count

Syndromic Profile Changes

- CDC EARS (Early Aberration Reporting System)
- www.bt.cdc.gov/surveillance/ears/
- Useful for EMS, 911, public health, and school systems and is free to install (currently requires MS Excel or SAS availability)
- Can be used with very few data elements:
  - Incident identifier and date
  - Incident syndrome or complaint
  - Optional Incident location (city, school, zip, etc.)

Geo-spatial Representation

- Google Earth
- earth.google.com
- KML files can be imported from or exported to external systems, including ESRI environments, and is free to install (Windows, Linux, Mac)
- Interactive (users can plot points or draw polygons, export session details for later use)

Examples

- Community Surveillance and Disease Reporting
- Water Contamination Surveillance

Community Surveillance

- Capture encounter and lab results in hospital environment in real-time
- Filter for reportable disease criteria, deliver electronic notifications to hospital Infection Control and Local Public Health departments
- ICPs submit case reports to LPH through electronic work flow
- LPH can manage data by person (disease report), time (EARS analysis profile), and place (Google Earth display of EARS results summarized by zip code)
- All information available through web browser and Google Earth (automated KML import)

Community Surveillance (screens)

Community Surveillance — Local PHD

Public Health
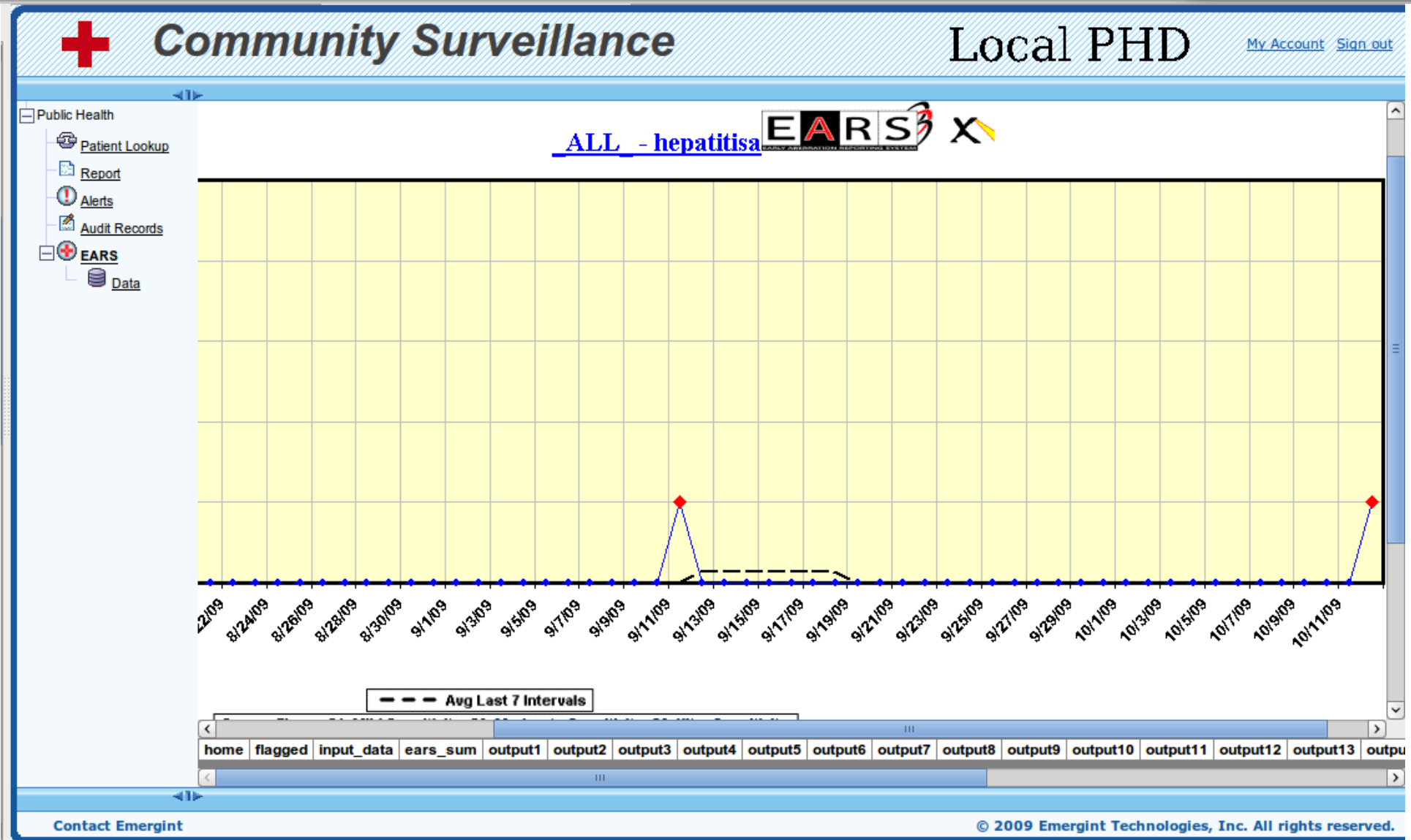- Patient Lookup
- Report
- Alerts
- Audit Records
- EARS
  - Data

10/13/2009 03:43 PM EARS Summary

Location	Syndrome	Date	C1	C2	C3	Event Ct	Max Ct
ALL	hepatitisa	10/12/2009	1	1	1	1	1
41030	hepatitisa	10/12/2009	1	1	1	1	1
ALL	campylobacter	10/11/2009	1	1	1	1	1
41017	campylobacter	10/11/2009	1	1	1	1	1
41015	shigella	10/11/2009	1	1	1	1	1
ALL	chlamydia	10/10/2009	1	1	1	1	1
ALL	gonorrhea	10/10/2009	1	1	1	1	1
41014	chlamydia	10/10/2009	1	1	1	1	1
41014	gonorrhea	10/10/2009	1	1	1	1	1
ALL	streptococcusA	10/08/2009	1	1	1	1	1
41017	streptococcusA	10/08/2009	1	1	1	1	1
ALL	pertussis	10/08/2009	1	1	1	1	1
41030	pertussis	10/08/2009	1	1	1	1	1
ALL	streptococcus	10/07/2009	1	1	1	1	1
41014	streptococcus	10/07/2009	1	1	1	1	1

Launch GoogleEarth

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Community Surveillance (screens)

Community Surveillance — Local PHD

My Account   Sign out

Public Health
- Patient Lookup
- Report
- Alerts
- Audit Records
- EARS
  - Data

Click here to jump to the Home Tab

Stratification - Event
NOTE: Click a cell below to jump to the associated chart

* Red Indicates New Max

Stratification - Event	Date *	C1flag	C2flag	C3flag	Count *	Current Max Count *	Date of the Max Count *	Current Total Count
ALL - hepatitisa	10/12/09	1	1	1	1	1	8/12/09	3
41030 - hepatitisa	10/12/09	1	1	1	1	1	8/12/09	3
ALL - camp... [Click here to go to the _ALL_ - hepatitisa]	10/11/09	1	1	1	1	1	8/11/09	3
41017 - campylobacter	10/11/09	1	1	1	1	1	8/11/09	3
41015 - shigella	10/11/09	1	1	1	1	1	8/11/09	3
ALL - chlamydia	10/10/09	1	1	1	1	1	8/10/09	3
ALL - gonorrhea	10/10/09	1	1	1	1	1	8/10/09	3
41014 - chlamydia	10/10/09	1	1	1	1	1	8/10/09	3
41014 - gonorrhea	10/10/09	1	1	1	1	1	8/10/09	3
ALL - streptococcusA	10/8/09	1	1	1	1	1	6/30/09	6
41017 - streptococcusA	10/8/09	1	1	1	1	1	6/30/09	6
ALL - pertussis	10/8/09	1	1	1	1	1	8/8/09	3
41030 - pertussis	10/8/09	1	1	1	1	1	8/8/09	3
ALL - streptococcus	10/7/09	1	1	1	1	1	8/7/09	3
41014 - streptococcus	10/7/09	1	1	1	1	1	8/7/09	3
ALL - shigella	10/4/09	1	1	1	1	1	8/4/09	5
41017 - shigella	10/4/09	1	1	1	1	1	8/4/09	3
ALL - salmonella	10/1/09	1	1	1	1	1	8/1/09	3
41073 - salmonella	10/1/09	1	1	1	1	1	8/1/09	3
ALL - hepatitisa	9/11/09	1	1	1	1	1	8/12/09	2
41030 - hepatitisa	9/11/09	1	1	1	1	1	8/12/09	2
ALL - campylobacter	9/10/09	1	1	1	1	1	8/11/09	2

home | flagged | input_data | ears_sum | output1 | output2 | output3 | output4 | output5 | output6 | output7 | output8 | output9 | output10 | output11 | output12 | output13 | outpu...

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Community Surveillance (screens)

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Community Surveillance (screens)

Water Contamination Surveillance

- Capture closed 911 calls and closed EMS runs in real-time
- Filter for codes associated with possible water-related health event
- Analyze 911 calls for space-time clusters
- Analyze EMS runs for syndromic profiles
- Evaluate results of each analysis stream against business rules for alerting
- Present alerts and supporting geo-spatial detail to Local Public Health and Water Utility personnel for evaluation against additional surveillance sources (water quality monitors, poison control centers, consumer complaints, etc.)
- All information available through web browser and Google Earth (automated KML import)

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Water Contamination Surveillance (screens)

City of Cincinnati
Water Security Contamination Warning System

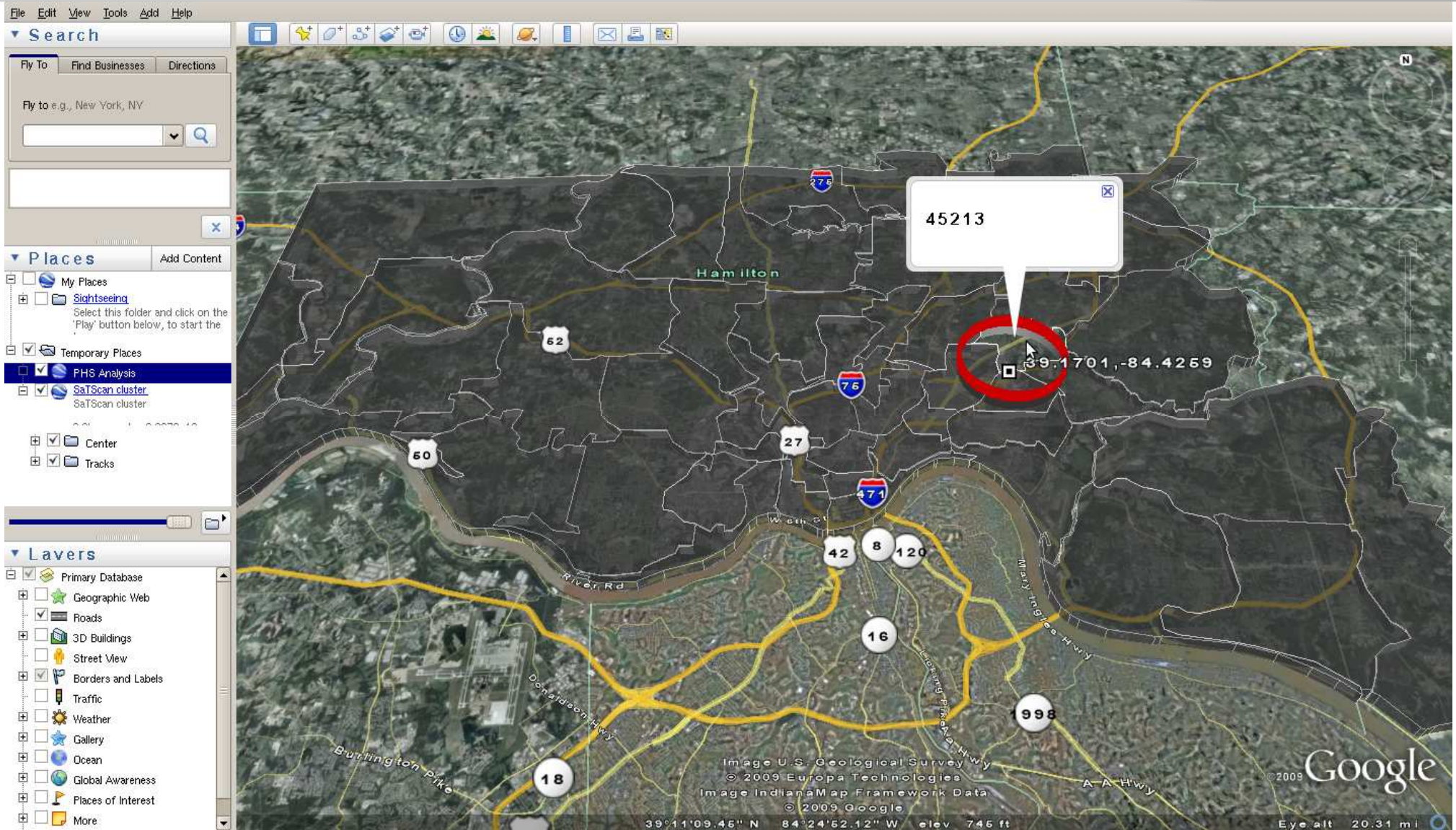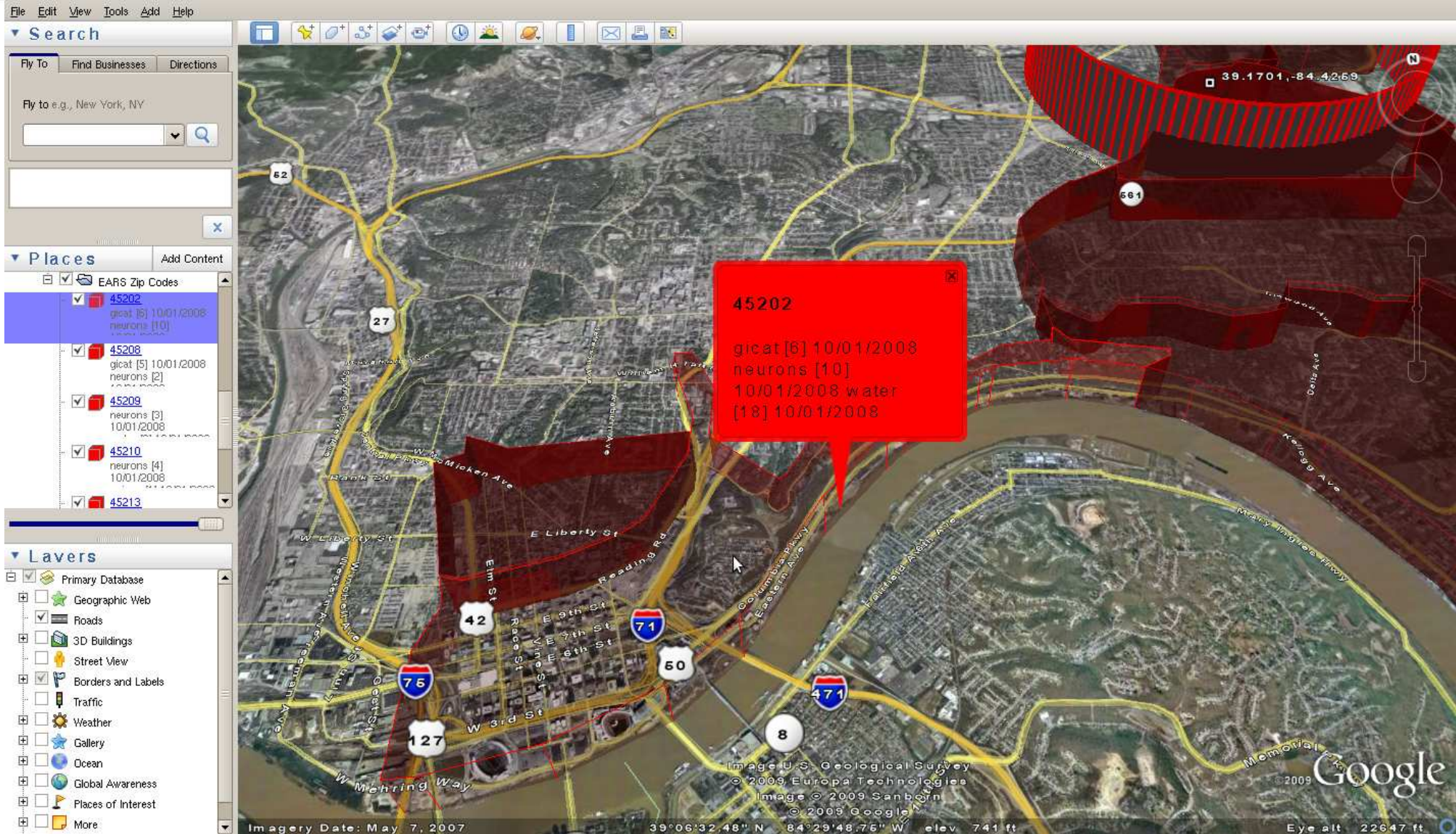EARS Data   WSDR Data   EARS Results   GIS   Help

10/01/2008 01:00 PM   **EARS Summary**   10/01/2008 12:30 PM   **SaTScan Summary**

Location	Syndrome	Date	C1	C2	C3	Event Ct	Max Ct
45205	upperresp	10/01/2008	1	1	1	1	2
45208	neurons	10/01/2008	1	1	1	2	2
45209	neurons	10/01/2008	1	1	1	3	3
45209	water	10/01/2008	1	1	1	3	3
45210	poison	10/01/2008	1	1	1	1	1
45213	neurons	10/01/2008	0	1	1	2	2
45224	gicat	10/01/2008	1	0	0	1	2
45224	unexplained	10/01/2008	0	0	1	1	6
45224	water	10/01/2008	0	1	1	1	3
45226	neurons	10/01/2008	1	1	1	1	1
ALL	cardiaccat	09/30/2008	0	0	1	13	13
11111	neurons	09/30/2008	1	1	1	1	1
45202	cardiaccat	09/30/2008	1	0	0	2	5
45202	psychcat	09/30/2008	0	0	1	2	2
45211	neurons	09/30/2008	1	0	0	1	2
45213	neurons	09/30/2008	0	0	1	1	2
45214	cardiaccat	09/30/2008	0	1	1	2	3
45216	upperresp	09/30/2008	1	1	1	1	2
45219	gicat	09/30/2008	1	1	1	1	2
45219	water	09/30/2008	0	0	1	1	3
45220	cardiaccat	09/30/2008	0	1	1	1	2
45220	psychcat	09/30/2008	0	1	1	1	1
45220	upperresp	09/30/2008	1	1	1	1	2

Lat / Lng	Start Date	End Date	Radius	P-Value	Observed Cases	Observed / Expected
39.1072 / -84.5967	10/01/2008	10/01/2008	2.08	0.66700	9	3.36

10/01/2008 12:30 PM   **SaTScan Alert History**

No History to report at this time

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On a Budget…

Consider scope of any Legal Agreements widely

Define an integration strategy

Leverage existing investments and relationships if they exist

Utilize Open Source Software Components

Small Iterations with measurable solutions

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Questions

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