



Monitoring Solutions in a Mobile World
INPO/NSA Innovation Expo

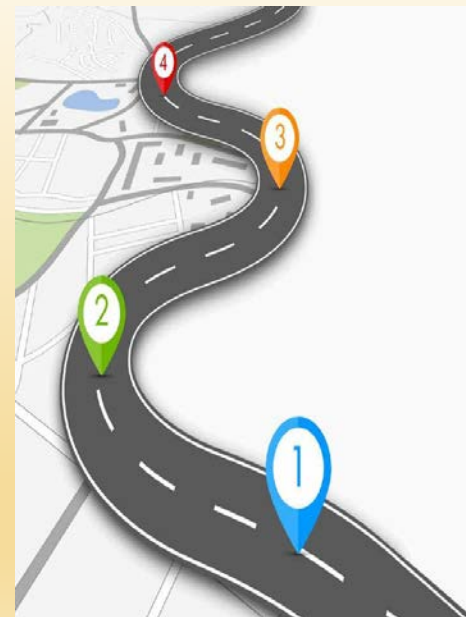
Rich Palatine
5/22/18

Monitoring Solutions in a Mobile World

- Monitoring Solutions in US Nuclear Industry: Past/Present/Future
- **Thermo Fisher's Approach in RP/ALARA and EP**
 - Portable Sensors
 - Communication Hardware Review
 - Monitoring Systems ---Choices

Reviewing Industry Examples and Customer Uses

- Questions?????



RP Monitoring Solutions In the Past

Client/Server S/w
Systems

Local Field Viewing on
Laptops

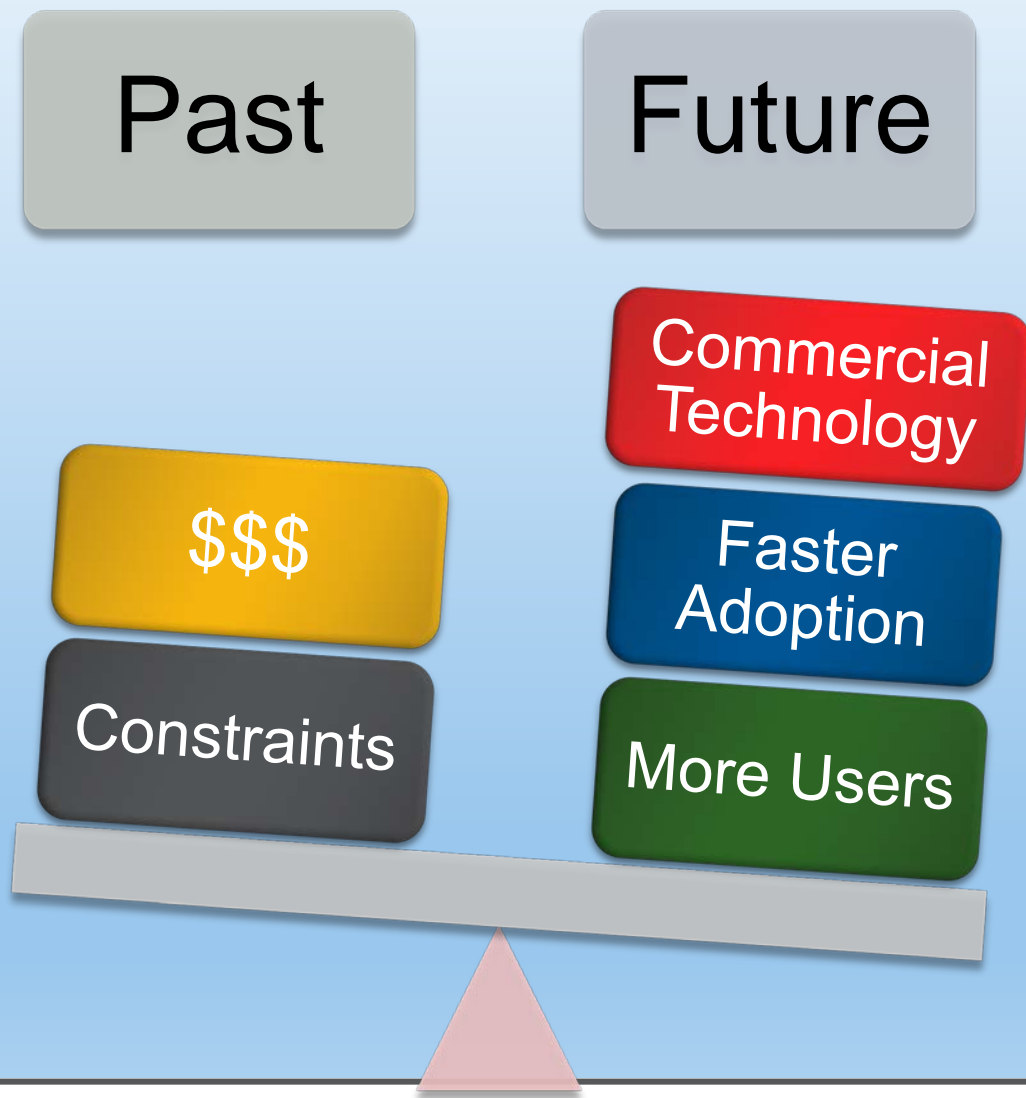
Results in an \$\$,
high maintenance/IT
dependent system

Centralized Monitoring
Hub/Command Center

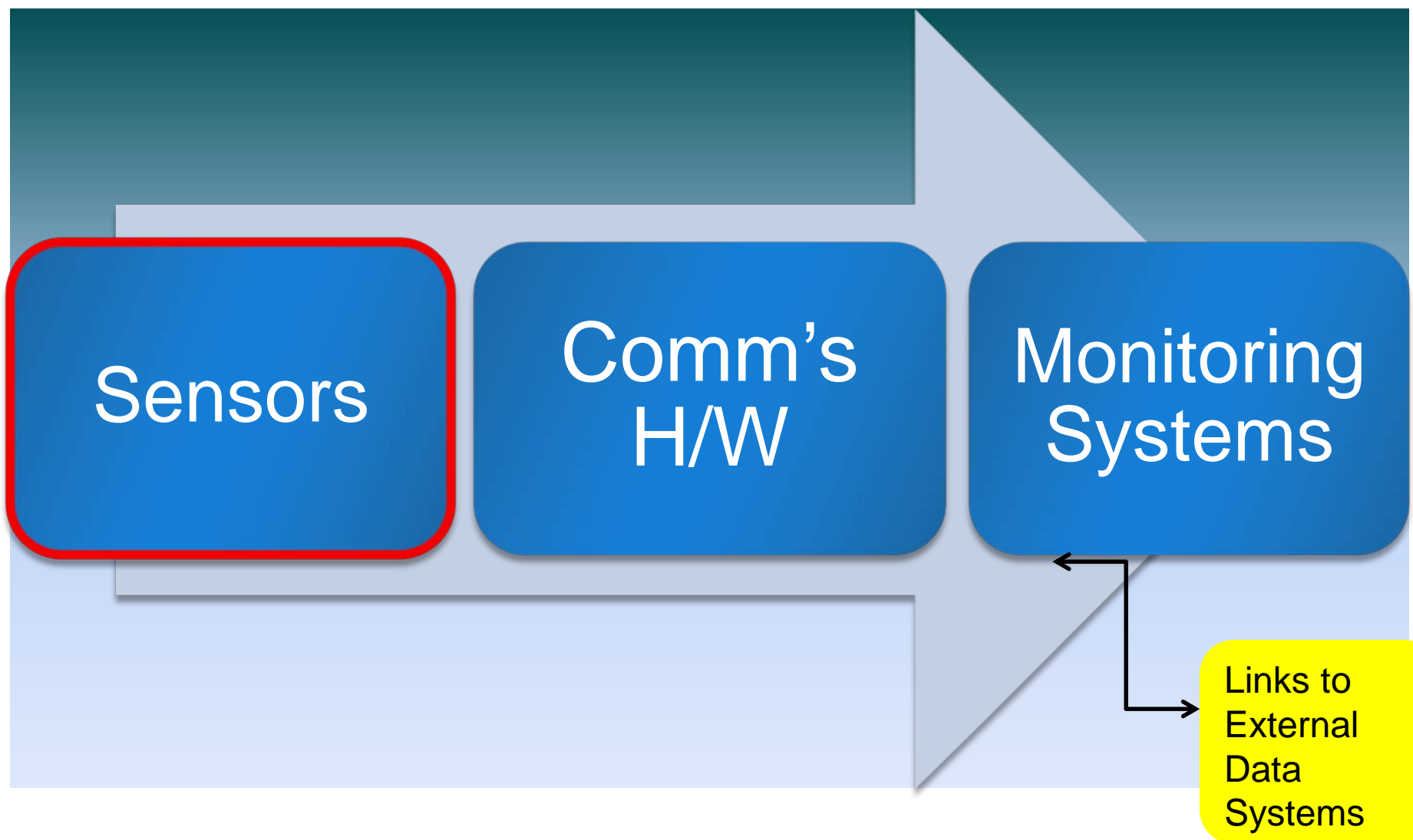
Data Confined to Limited
Set of Users (RP)

Present/Future of Monitoring Solutions at NPP's

Leverage Same Technology as use in our 'Everyday Lives'



Monitoring Solution Platform --Starts w/ Game Changing Sensors



'Game Changing' Characteristics

- Beta/Gamma readings; one instrument; Dual Function: Dose Rate and Contam
- Light Weight, Transport on belt
- Bluetooth Comm's, Leverage the App or Plant Wifi
- Vehicle Surveys on Pole



Benefits

- Save Major Capital \$\$\$, one instrument takes place of two!
- Eliminate Large Service Budgets as Reliability and Ease of Calibration Save \$\$\$
- Multiple Departmental uses: EP, RP, Rad Waste



Feedback:

- ✓ Great Acceptance with Rad. Tech's –cite portability, one-handed use
- ✓ Instrument Support; minimal, no significant repairs to speak of
- ✓ Reduce # of instruments in inventory
- ✓ Assign to each technician; personal responsibility



TVA Sequoyah B20 ER Decisive Points



“We chose the B20 because of the size, technology, and its use of the H10 filter.

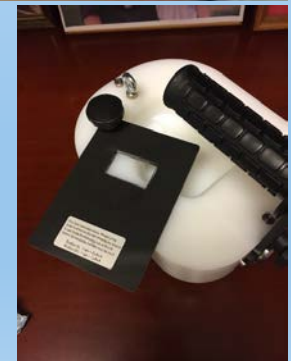
One of the reasons our managers chose this meter is the 2 in 1 function ---- It is a dose rate meter and a frisker.”

---Daniel Portwood ---Sequoyah RP Instrumentation Department



Game Changing Neutron Monitoring: Rad Eye (NL)

- PORTABILITY AND SAFETY DRIVERS Much Lighter than traditional Rem Ball N meters; Eliminate Safety Hazard of climbing, etc!
- Add Rad Eye G and get N and Gamma readings w/ 1 Hand!
- Easy to Calibrate; H3 Detector
- Easy to use Neutron Moderator; Boron Moderator Disc and Cover Plate to minimize effect of lower energy scattered neutrons
- ~98% accuracy from straight on position; ~90% accuracy from sides
- Same size and weight as traditional RadEyes



Duke Power Neutron Instrumentation Test Cart at CR3 ISFSI



Duke Power Neutron Instrumentation Test Cart in front of ISFSI



Neutron Instrumentation Cart w/ CR 3 ISFSI in Background

• i



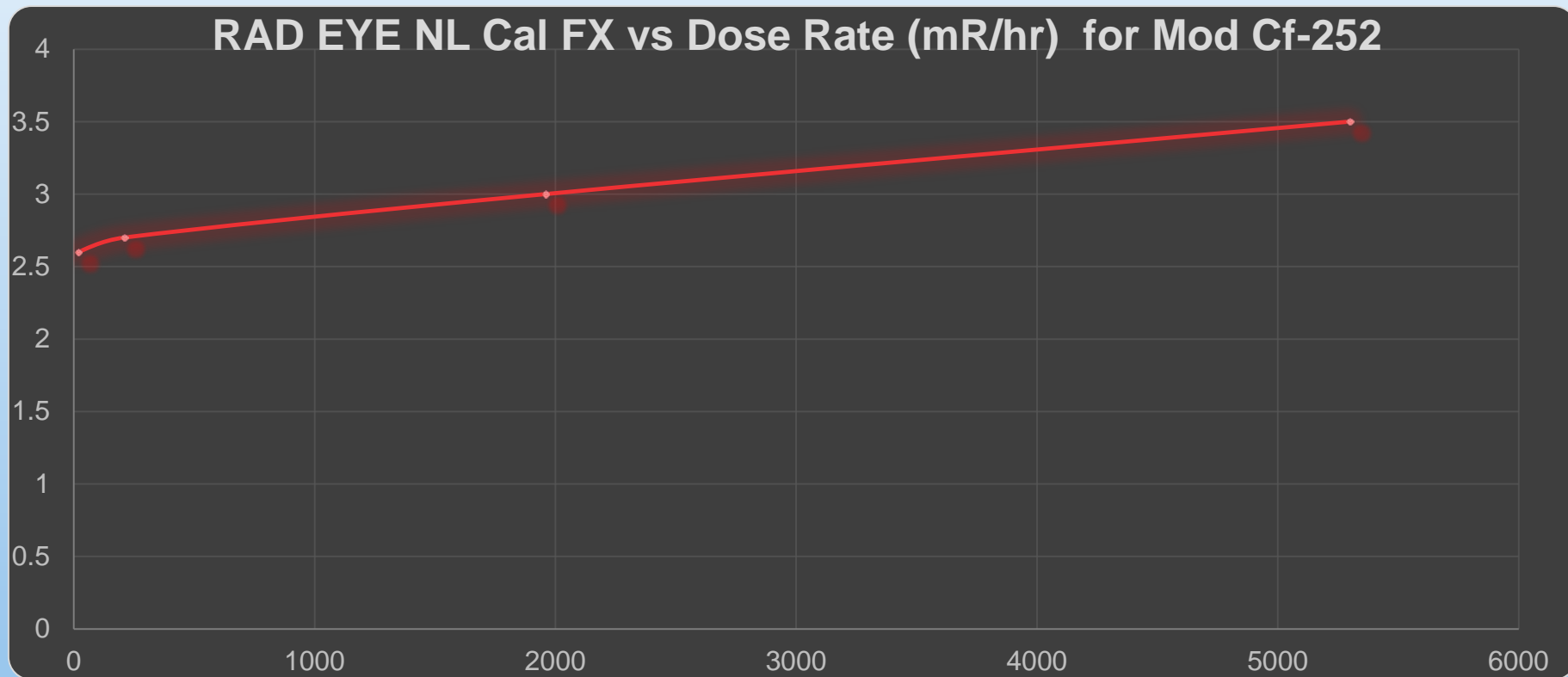
Duke Power Rad Eye NL Study Conclusion



Device	Neutron DR - $\mu\text{rem/h}$
Nested Neutron Spectrometer (NNS)	35
REM500	39 (2-hr integration)
DMC2000GN	31 (6.5-hr integration)
Thermo Rad Eye (CF 0.35) (mRem/hr/cps)	40
TLD average	35 (6.5-hr integration)

Reproducible, Fast Response, Simple, Mobile, & Response Mimics Moderated Cf (Stable)

Rad Eye NL Cal FX vs Dose Rate for Mod Cf Source



NEW STATE of ART TECHNOLOGY; Rad Eye Isotopic (GN)



Many Users in Security WorldLooking for NPP's to Demo

- Uses NEW CLYC (Cesium/Lithium/Yttrium, Chloride) Detector for Gamma + Neutron
- Full Isotope Identification capability
- Count rate, Dose Rate or Isotopic Mode

Mobile, Portable Solution for WHY is the Contam Monitor Alarming????

EP (...and RP OPS) Portable Gamma ID Rad Halo:

- 2 Models: Remote (RDP) and Fixed Boundary
- Portable (Mobile) or Permanent Mounting (Perimeter/ fence line Monitoring)
- Wide Range Gamma Dose Rate Detection:
 - -5 uR/hr to 1000 R/hr
- Rapid Gamma Isotopic Analysis; Large Library: Verify Mix/Assumptions
- Weatherized and Waterproof; Rugged
- Long Battery Life: ~60 hours of charge
- GPS Location
- 'Comm's Friendly': GSM, 2.4 GHz, Wifi, LAN
- Multiple S/w interfaces to match need/use



Simple, robust and flexible environmental monitoring tool

Rad Halo NPP Industry Users

- ✓ 2 State Agencies using Multiple Deployed Rad Halos
- ✓ AZ (Palo Verde) and Delaware (Salem HC)
- ✓ Using w/ Remote DNA Monitoring S/w for NPP EP
- ✓ Provides **MOBILE** SMART Device compatibility AND Command & Control Monitoring



Nuclear plants' danger zones overlap in New Castle County



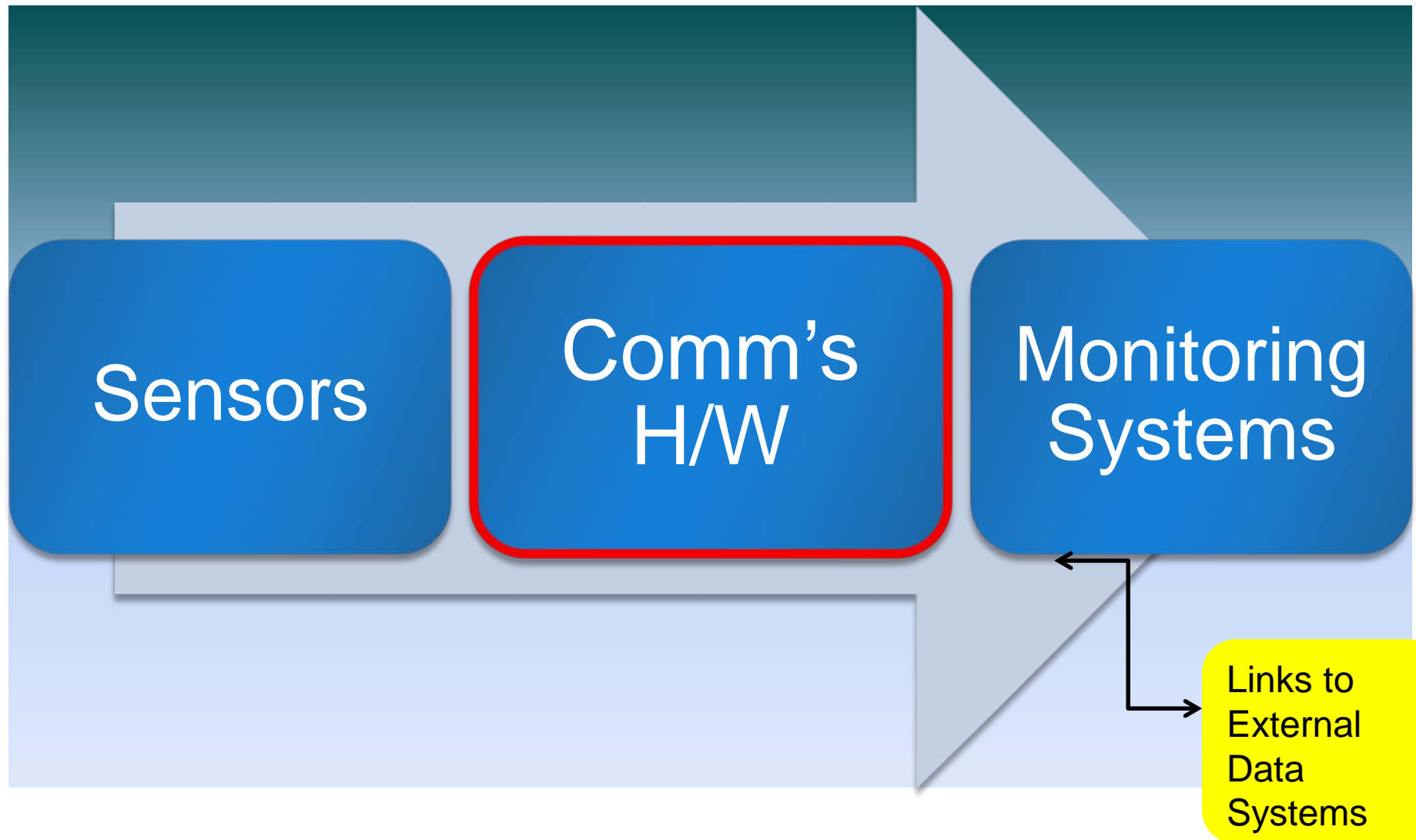
Roughly 1.25 million people live in census blocks all or partially inside the area where the 50-mile emergency zones overlap for Salem, Limerick and Peach Bottom, according to Census Bureau records.

Sources: State of Delaware, U.S. Census

The News Journal



Monitoring Solution Platform –Getting Data from A to B!



Use Commercially Available *Comm's* Technologies to Xfer Data

- “The statistic depicts the mobile phone user penetration in the United States from 2012 to 2018. In 2016, the mobile phone user penetration rate in the United States was at **80.9 percent**. The number of mobile phone users in the United States stood at more than **260 million** in 2016” ---- Google 2018

- “**85%** of companies have made **WiFi networks** a key focus area over the last 12 months.
.....*Wi-Fi hotspots will be key for the development of data applications and services*”
- ----*World WiFi 2018*



NPP Sequoyah Rad Eye APP: Bluetooth Update to Phone

- Rad Eye Fitted with Bluetooth Update to Windows Phone/Tablet
- Utilize Bluetooth Back + Phone/tablet
- IOS and Android App now available
- Reachback/Telemetry back to Software via GSM Cell Phone
- Compatibility with I Watch



Feedback/Value Propositions

“The functionality of the application on the phone is great”;

- ✓ Like the readout and the event log
- ✓ Store data/look back at when taking the survey (historical)
- ✓ The watch is an added bonus now!!!
- ✓ Watch Alerts you when there is an alarm/event on the meter;
- ✓ Subtle improvements still, but Thermo’s got it close to what we need! ----*Daniel Portwood*



Link 2 Display Controller (SMART VDU)

- ✓ Live-time data displayed on any sized display (HDMI)
- ✓ Data 'Boxes' or Map
- ✓ Interface with Thermo Wireless (VP SAT, CNET) and Mirion (WRM) wireless platforms
- ✓ Direct/wired options
- ✓ Integrated Wi-Fi, and Bluetooth Connectivity
- ✓ 110 V AC Power
- ✓ Color-coded Alarms



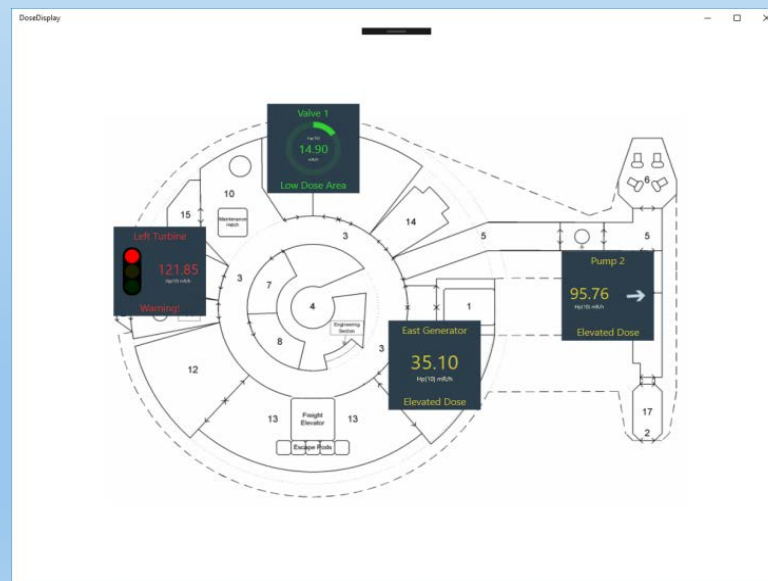
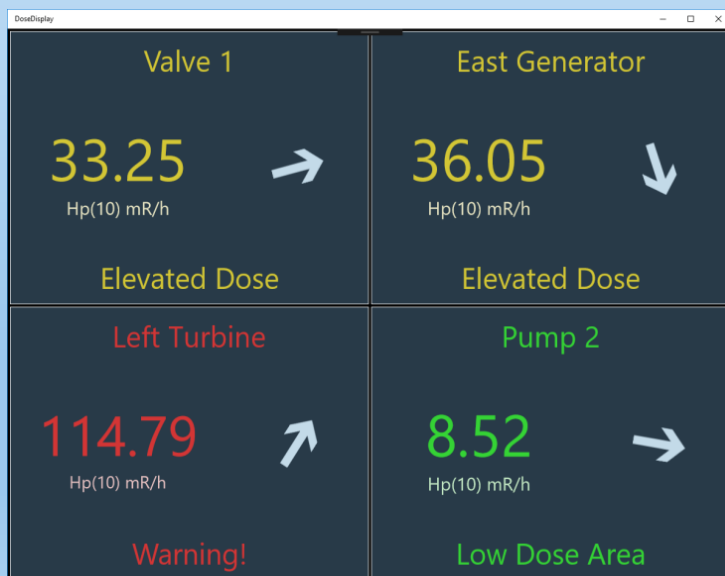
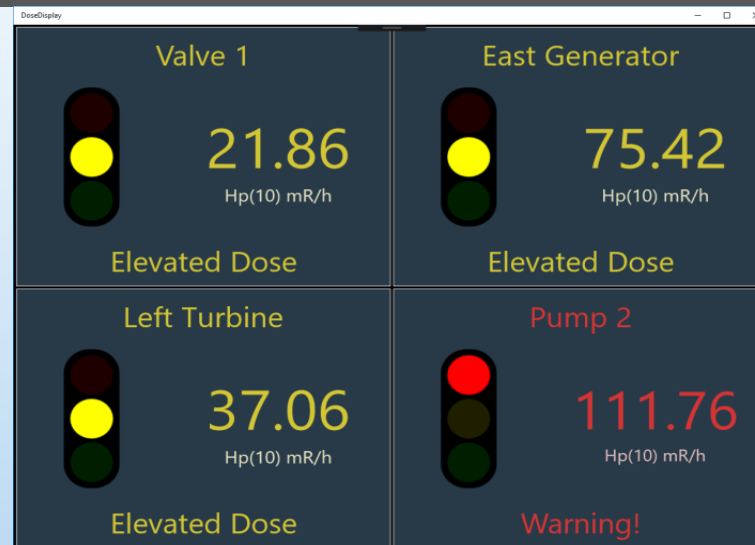
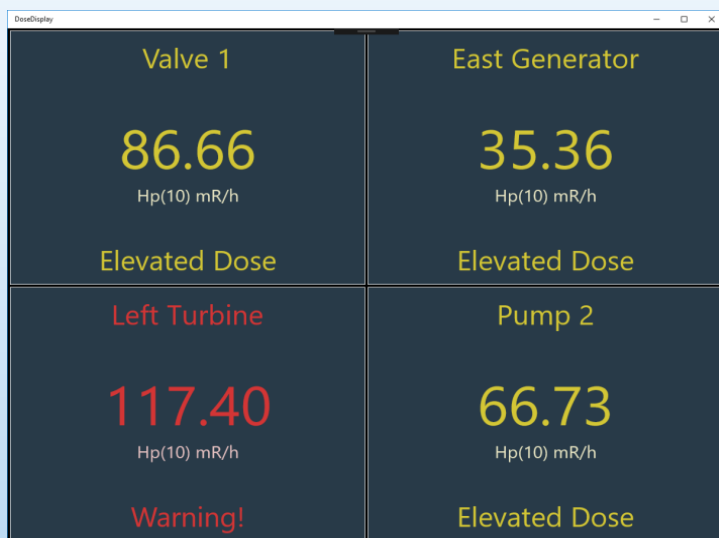
US Navy Deploys Smart VDU (Norfolk, Puget Sound NSY's)

Feedback/Value Propositions



- ✓ Able to set up FAST/LOCAL (non-IT needed) ALARA Data Displays
- ✓ Workers and Management View Data Easily
- ✓ Large Screens at Low Dose Staging Areas (64" monitors)
- ✓ Inexpensive (<\$1500/unit)
- ✓ Monitor EPD's + WAM Area Monitors
- ✓ Maps and Data Displayed
- ✓ **REQUIRES NO IT!**

Link 2 Display Controller (Smart VDU) – Display Options



Monitoring Solution Platform: The Power (VALUE) is in UI!

Use Systems that use Mobile Access (phones, tablets)
DRAMATICLY DRIVE VALUE!!



TVA Sequoyah's View/Vision of Mobile User Interface

- Use Phone App to provide data read out and Alarm/Event log
- Capable of Storing Data on phone
- I Watch is an 'Upside' bonus

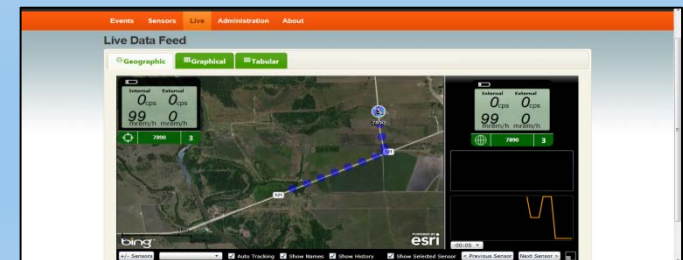
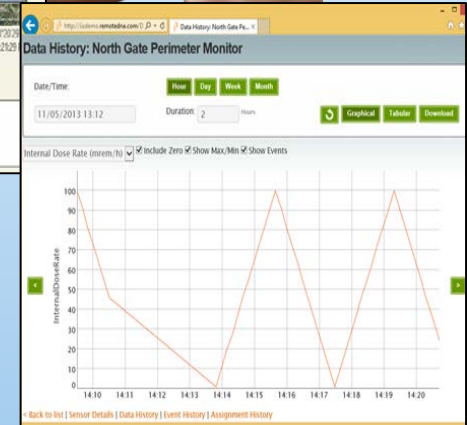
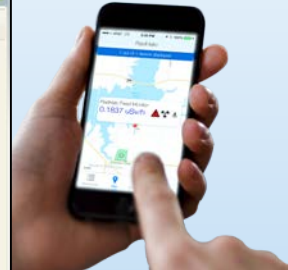
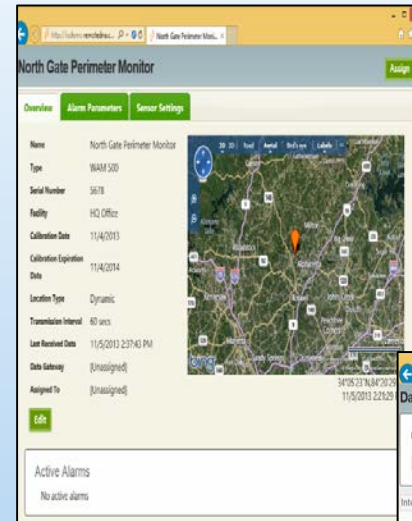
The future of User Interfaces/Monitoring Platforms



...”The next phase would be storage of the data to a cloud or our survey data system (VSDS)”.

Remote DNA Software

- Web-based; or Site hosted; Secure Data Management
- Easily Monitor Specific Data (sensors) both Live Time and Historically
- Monitor Remote Sites across large geographic areas (country/world) from remote location
- Able to Customize Screens
- Configurable ALARMS
- SMS, E-mail updates via any mobile device
- Remotely view from any Mobile Device
- Integrates to Dose Assessment S/w



Screen Shot of Remote DNA: Dashboard

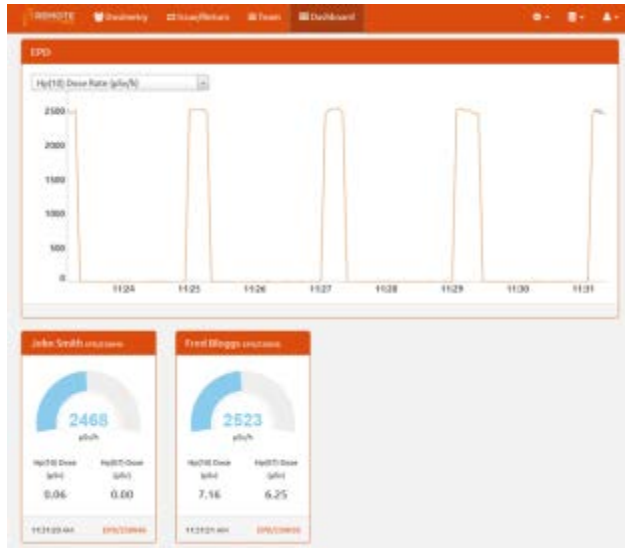
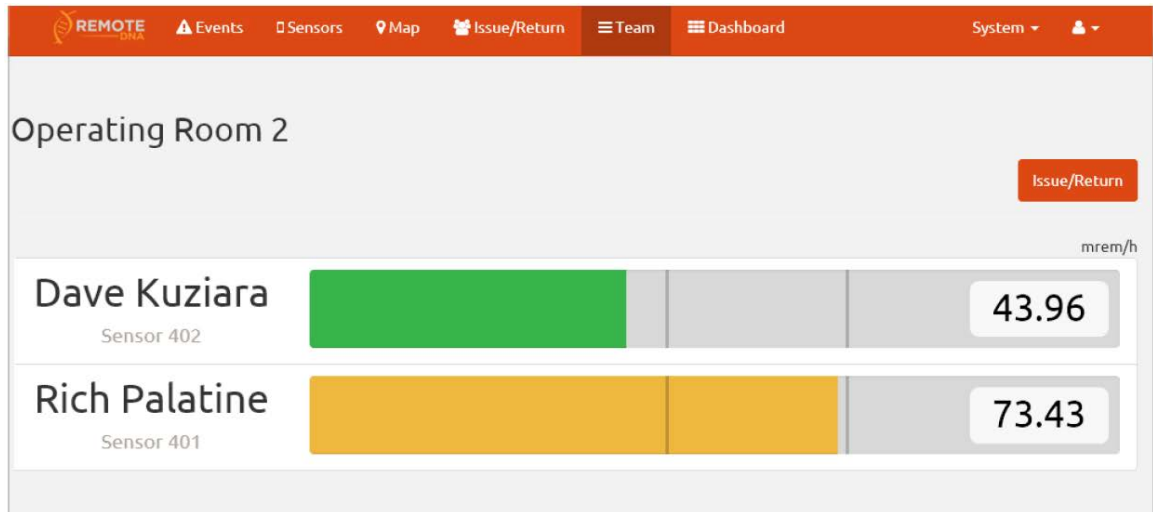
The screenshot shows a web browser window displaying the Remote DNA dashboard. The browser's address bar shows the URL `http://radhalo.remotedna.com/#//Dashboard/Index`. The dashboard has a navigation bar with 'Events', 'Map', and 'Dashboard' (selected) tabs, along with 'Settings', 'System', and a user profile 'thermo@remotedna.com'. The main content area features three monitoring panels, each with a radiation level gauge and a table of detector counts.

Panel Name	Neutron	GM-Tube γ	Nal γ
Oakwood FM	0	0	173
RDP Demo-150702993	1	0	158
Vehicle Monitor Left - SM	0	0	187

Each panel also displays a radiation level in mrem/h (0.003 for Oakwood FM and RDP Demo, 0.004 for Vehicle Monitor) and a timestamp with the RadHalo ID.

Viewing Options

- Simple bar charts
- Gauges
- Real-time graphs
- Audible alerts



Screen Shot of Remote DNA: Device Details

REMOTE DNA Events Map Dashboard System thermo@remotedna.com

Oakwood FM RadHalo/141001002

Oakwood

Type	RadHalo
Serial No.	141001002
Name	Oakwood FM
Location Type	Dynamic
Offline Timeout	00:01:00
Last Calibrated	
Calibration Due	

Edit

Oakwood FM

0.003 mrem/h

Neutron	GM-Tube γ	Nal γ
0	0 cps	168

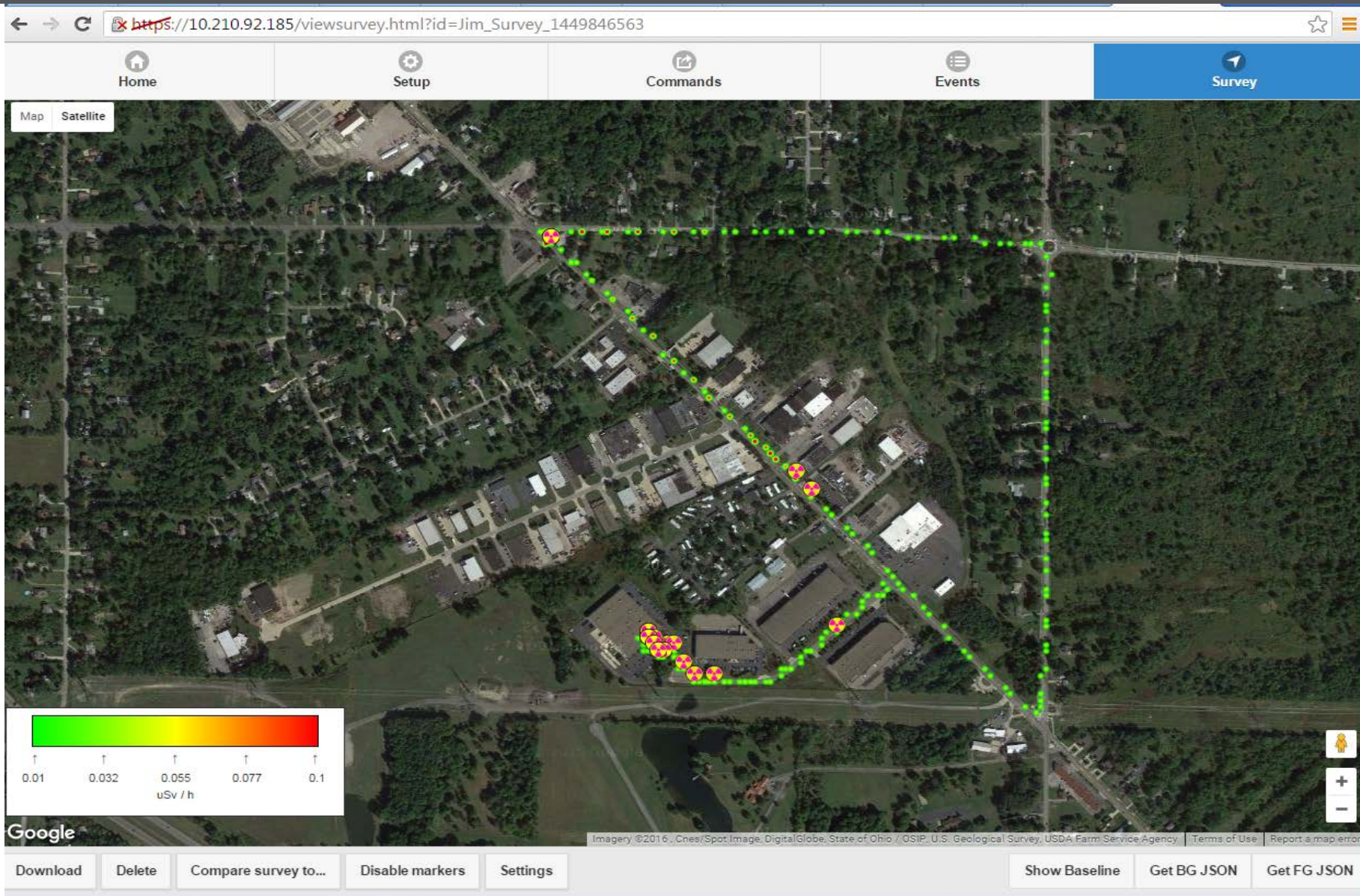
10:21:46 AM RadHalo/141001002

Data History

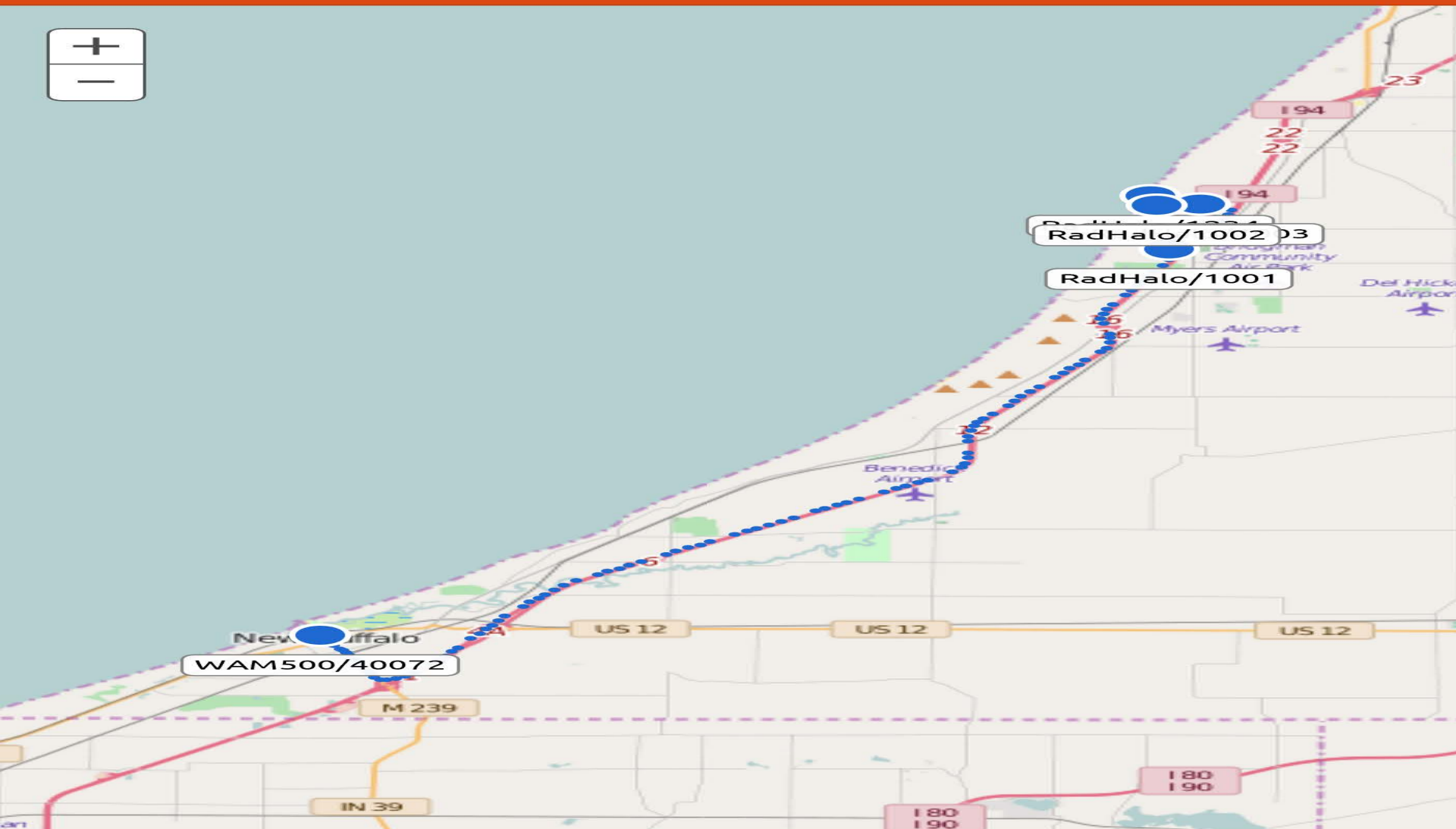
Dose Rate (mrem/h)

10:19 10:19:30 10:20 10:20:30 10:21 10:21:30

Rad Halo Dose Rate Gradient + GPS coordinates on Map



DC Cook Mobile Tracking of Rad Halo and WAM in vehicle



demo.remotedna.co.uk/#/Map/Home/Inde:



- Survey Mapping Systems (VSDS, etc.)
- Live-Time Plant Parameters: PIE system (equivalent) interfacing to real-time monitoring
- Emergency Planning; Plume tracking (MIDAS) taking inputs from RM System



Plume Tracking/Dose Assessment Interfaces to Remote DNA

AEP COOK 41° 58' 31.5"N 86° 33' 54.7"W Version:1.5.17.032817

Site: AEP COOK
 Title: FIELD MONITOR GAMMA DOSE RATE
 Time: At 0.25 Hour Projection

Menu: b Enhanced Dose Projection
 Model: Projected Plume Segment
 Report Date/Time: 06/06/17 23:22
 Start Date of Run: 05/06/17 08:40
 -Met data @ 05/06/2017 08:45
 Grnd: WS (mph): 5.0 WD (from): 270 ST: D
 Elev: WS (mph): na WD (from): na ST: na

End Date of 15 Minute Rate
 Computation: 05/06/17 08:53
 Start of Release: 05/06/17 08:39
 End of Release: 05/06/17 08:53
 -Manual Entry of Monitor data @ 05/06/17 08:45
 Current Release Rate (Ci/sec): 1.2E+02
 Total Ci: NG: 9.9E+04 I: 2.6E+03 P: 5.4E+01

Peak values
 Peak Gamma (mrem/hr): 4.6E+02
 Dir (to): E Dist (miles): 0.8

Contour Legend	Clsd Win (mR/hr)	Frisker (cpm)
1	1.0E+03	1.5E+07
2	5.0E+02	7.5E+06
3	1.0E+02	1.5E+06
4	5.0E+01	7.5E+05
5	1.0E+01	1.5E+05
6	5.0E+00	7.5E+04
7	1.0E+00	1.5E+04
8	1.0E-01	1.5E+03

41° 58' 22.6"N 86° 33' 4.21"W 0 Thornton Dr

1800 feet

End Run POI TEDE Thyroid CDE EDE Field Monitors Population Dose Plume Tracks Special R
 Map Features Zoom Out Dose Rate Exposure at 0.25 hr Graphic Closed window GPS_Tracks Sensors State

USB Device Not Recognized
 One of the USB devices attached to this computer has malfunctioned, and Windows does not recognize it. For assistance in solving this problem, click this message.

16 Miles Confirm

11:22 PM 6/6/2017

Monitoring Solutions in Mobile World -----Summary

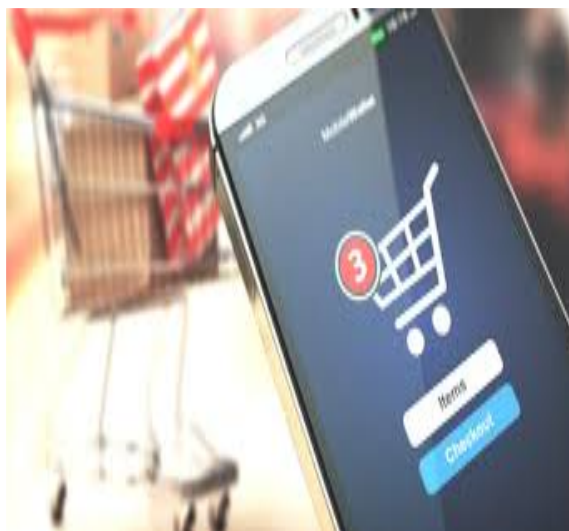


SW/UI: The more accessible, the faster adopted, ↑↑ \$\$ Savings

Comm's: Leverage 'common' technology

Sensors: Rad Eyes + Others

Final Quiz: What is being illustrated???



ANSWER.....'Commercial/Everyday Technology used in Industry'

Questions ???

