C-10 Research & Education Foundation
C-10
Safe Sustainable Energy

C-10 Envisions
A Clean, Safe,
Sustainable Energy Future

44 MERRIMAC STREET
NEWBURYPORT, MA 01950
TEL: 978-465-6646
FAX: 978-465-5916
E-MAIL: INFO@C-10.ORG

C-10 Radiation Monitoring Network

Table of Contents

C-10 Foundation History

The C-10 Research & Education Foundation was established in 1991 to address the health and safety issues related to the Seabrook nuclear power plant. The C-10 Foundation is a non-profit 501 c(3) organization.

C-10 Mission & Goals

- Monitor off-site radiological emissions from the Seabrook nuclear power plant for use in assessing the impact on health and the environment
- Goals
  - Enhance the collection & analysis of airborne and marine radiological and weather related data
  - Increase the number of monitoring sites in public places, including expansion into New Hampshire
  - Make the monitoring data more broadly available to the public and the scientific community

History of C-10 Citizens' Radiological Monitoring Network

- Based in Newburyport, Massachusetts
- Started in 1991 when the Seabrook nuclear power plant went into operation
- CRMN, the most sophisticated near real-time monitoring system available, is under contract with the Massachusetts Department of Public Health
- Tracks radiation levels in Massachusetts and New Hampshire communities within the Emergency Planning Zone (EPZ) of the Seabrook nuclear power plant
- Have continuously monitored airborne emissions since the Seabrook plant went into operation and is the only citizens' environmental organization in the country with available data from the moment a nuclear plant generated electricity
- CRMN serves as a model for organizations throughout the world that are initiating programs to monitor nuclear reactors independent of the nuclear industry
- After the Three-Mile Island (TMI) accident, President Carter's Kemeny Commission recommended Dan Sythe, President of International Medcom, to establish the first citizens' off-site radiological monitoring system for the TMI surrounding communities
- International Medcom, a Northern California firm, is the manufacturer and developer of the C-10 Radiological Monitoring Network. International Medcom has provided high quality radiation detection instruments since 1986.

C-10 Radiation Monitoring Network (CRMN)

- **Offsite** – anonymous, in private homes, schools, and businesses
- **Continuous** – 24/7, minute by minute data logging of beta, gamma, wind speed & wind direction
- **Near real time** – every 15 minutes data is uploaded to the C-10 central repository & GIS map. After midnight, a complete data file of the previous day is uploaded to the C-10 central repository hosted at a secure FTP site
- **Alerts** – 3 times normal background data immediately updates C-10 central repository & GIS map
- **Notification** –Alerts are sent via short message service (SMS) to email addresses and/or cell phone numbers
- **Data Access** – Alert data is available immediately via text message to email address or cell phone. All other data is available via internet access at secure FTP site.

CRMN System Architecture

- Radiation Sensors – Iospectra 1320-AO
  beta & gamma sensors in a single enclosure
- Wind monitor – R.M. Young MA 05106
- Laptop
- Data collection & graphical display - Radalert
- Web based central repository
- GIS Map server – geographical display of monitoring sites with color coding

CRMN System Architecture

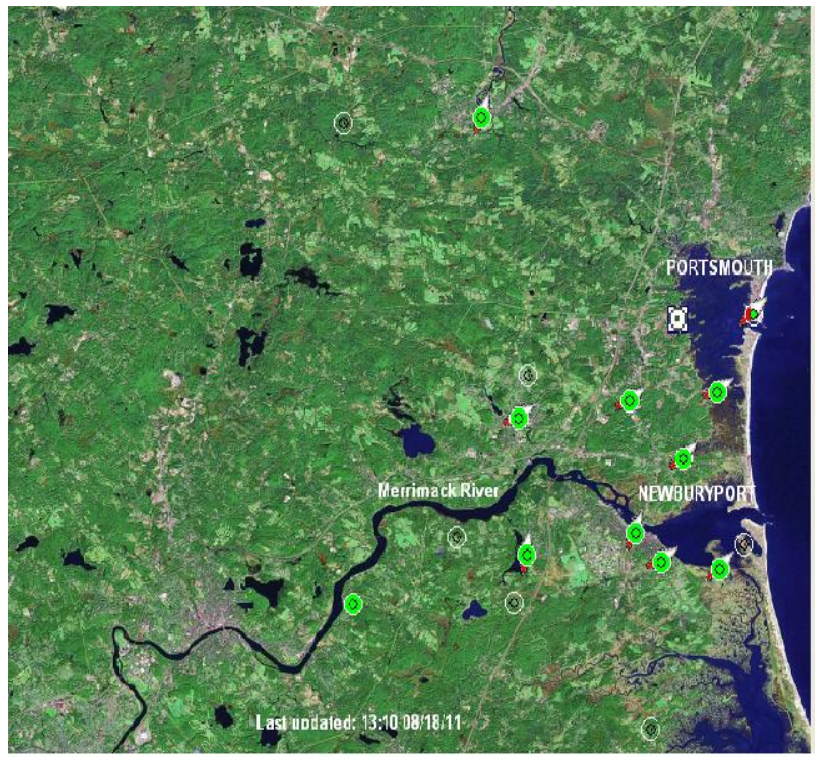
Iospectra 1320 AO Sensor

R.M. YOUNG Wind Monitor MA 05106

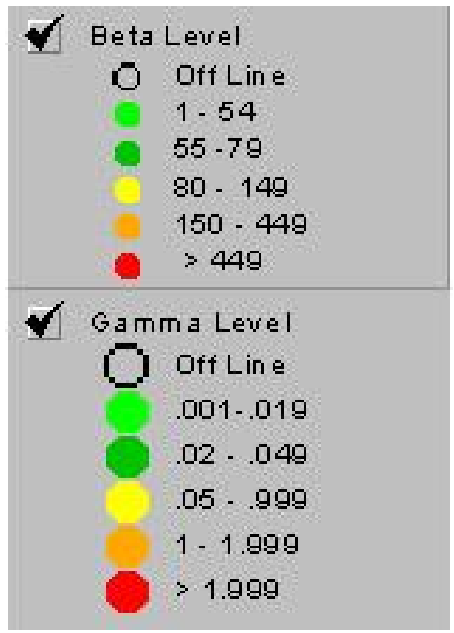
CRMN System Architecture

Monitoring Station

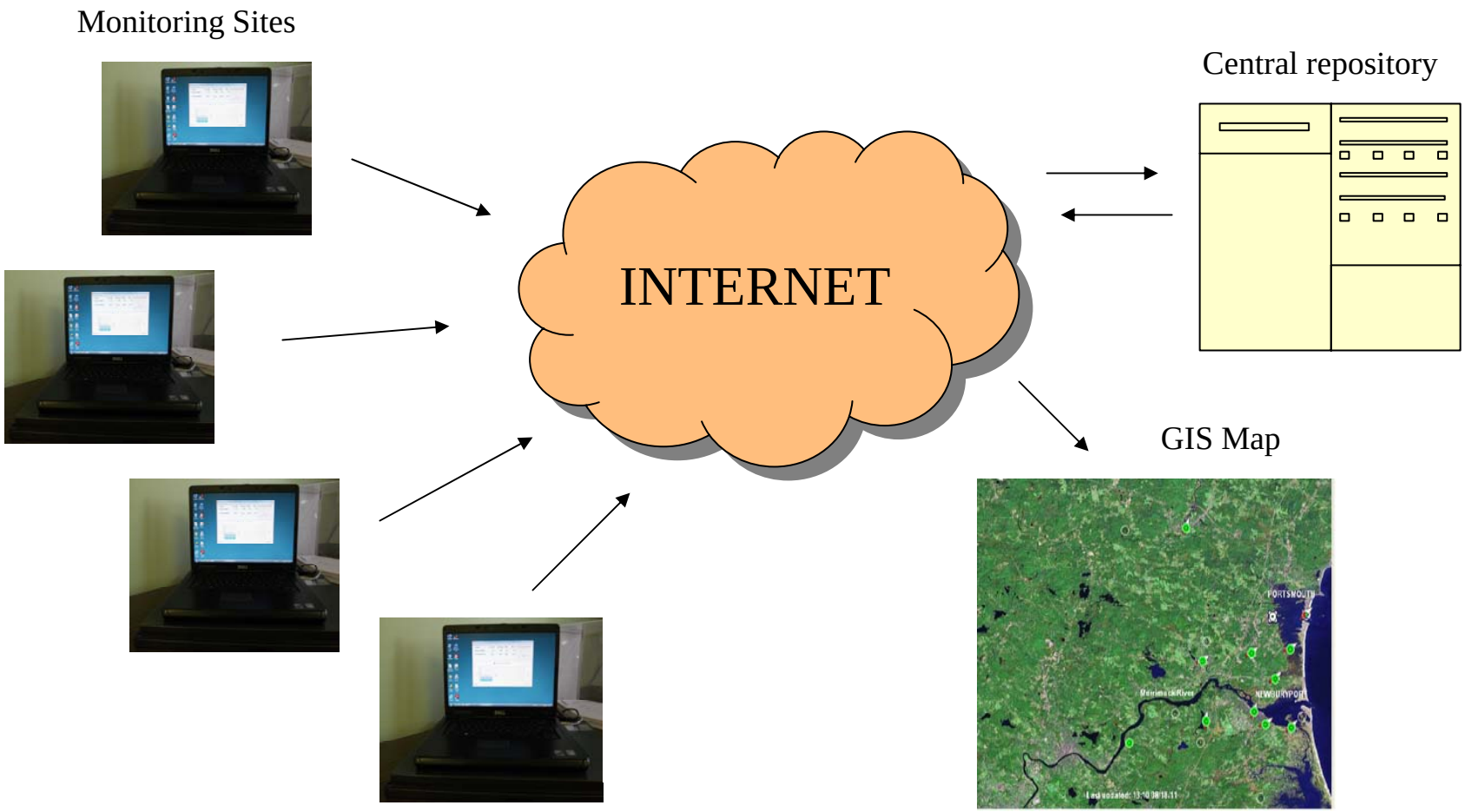
C-10 GIS Map



CRMN System Architecture



CRMN System Architecture



Iospectra 1320-AO Tech Specs

- **Detector 1:** Halogen-quenched “pancake” Geiger-Müeller tube (LND 73126). Effective diameter 1.75" (45 mm). Mica window density 1.5-2.0 mg/cm2
- **Gamma Sensitivity:** 3500 CPM/mR/hr referenced to Cs-137
- **Beta Efficiency (for 4Π at contact):**
  14C: 49 keV avg., 156 keV max., 5.3%
  210Bi: 390 keV avg., 1.2 MeV max., 32%
  90Sr: 546 keV avg., 2.3 MeV max, 38%
  32P: 693 keV avg., 1.7 MeV max., 33%
  Measurement Range: 0 to 5 mR/hr or 0 to 18,000 CPM calibration check, typical maximum 10 mR/hr or 35,000 CPM
- **Window Shield:** NCR2/2 Mylar laminated to a copper beryllium screen

Iospectra 1320-AO Tech Specs (continued)

- **Detector 2:** Halogen-quenched energy compensated Geiger-Müeller tube (LND 7128). Effective diameter .36" (9.1 mm)
- **Gamma Sensitivity:** 1000 CPM/mR/hr referenced to Cs-137
- **Measurement Range:** 0 to 5 mR/hr calibration check, typical maximum 10 mR/hr or 10,000 CPM
- **Temperature Range:** -20° to 85°C (-4° to 185°F)
- **Power Requirement:** 3.0 to 15 V DC
- **Current Drain:** <1 mA (typical) to 20 mA (max) @ 12 V DC
- **Probe Weight:** 21.1 oz. (599 gr.) With Bracket: 25.6 oz. (726 gr.)

Iospectra 1320-AO Tech Specs (continued)

- **Probe Housing:** Anodized aluminum and polycarbonate. Water resistant.
- **Cable:** Waterproof. RFI-shielded. UV-resistant jacket. 10 meter length.
- **Connector:** M12 Euro. Waterproof. RFI-shielded.
- **Computer Interface:** Optional cable with RS-232 or USB 2.0 interface.
- **Lightning Surge Protection:** to 600 W for 1 ms
- **ESD Protection:** up to 16 kV
- **Size (L x W x H):** 6.25" x 3.15" x 2.35" (157 mm x 78 mm x 60 mm). Connector adds 0.6" to length.
- **L-Bracket:** 6.25" x 3.25" x 2.25" (157 mm x 83 mm x 57 mm). Thickness 0.1" (2.54 mm).

Iospectra 1320-AO Tech Specs (continued)

- **Probe Weight:** 21.1 oz. (599 gr.) With Bracket: 25.6 oz. (726 gr.)
- **Probe Housing:** Anodized aluminum and polycarbonate. Water resistant.
- **Cable:** Waterproof. RFI-shielded. UV-resistant jacket. 10 meter length.
- **Connector:** M12 Euro. Waterproof. RFI-shielded.
- **Computer Interface:** Optional cable with RS-232 or USB 2.0 interface.
- **Options & Accessories:** replacement window shield, window screen w/o mylar, RS-232 or USB 2.0 cable kit, quick-release pole-mount adaptor, USB data acquisition adapter, calibration fixture

C-10 CRMN Site Selection

- Funding sources introduce constraints on siting – external funding to be used in MA only
- Additional constraints introduced by locations of houses/structures; availability of electricity and communications
- Owners of selected sites are anonymous, unless established in public places such as schools, businesses, or fire stations
- C-10's objective is to get an even spatial distribution of sites within the 10 mile EPZ radius
- Even spatial distribution means all directions from Seabrook – local wind regime is complex

CRMN System Integrity

- Initial calibration of Iospectra 1320-AO sensors and R.M. Young MA 05106 wind monitors are performed by manufacturer
- Routine scheduled calibrations
- Hardware & software maintenance as needed
- Ongoing communication with equipment manufacturers and software developers
- Technology updates

CRMN Reporting

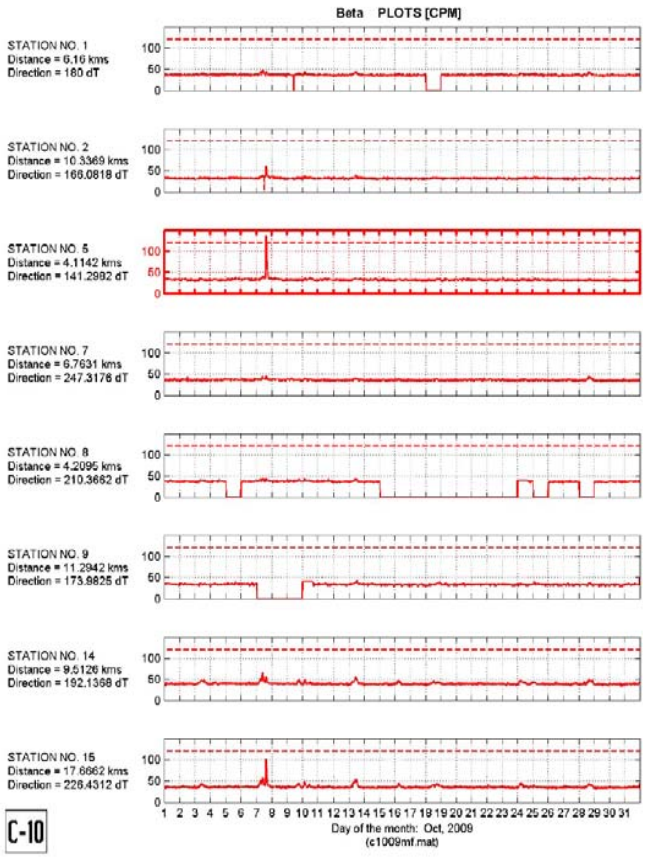
- Alerts - > 3 times normal background radiation

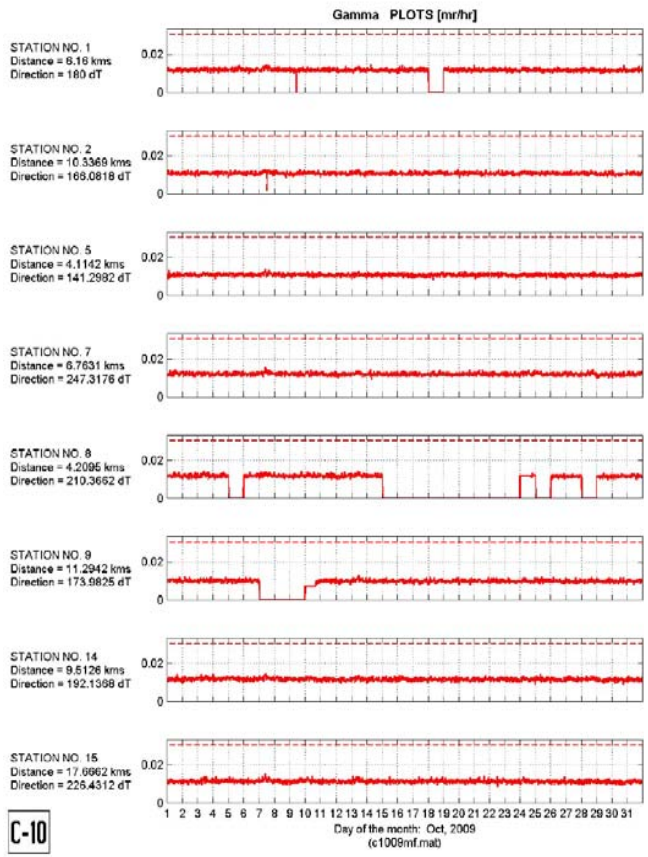
  Beta - 120 CPM

  Gamma - .03 mR/hr
- Notification
  - DPH contact is notified immediately
  - Resident inspector at Seabrook nuclear power plant is consulted
- Monthly

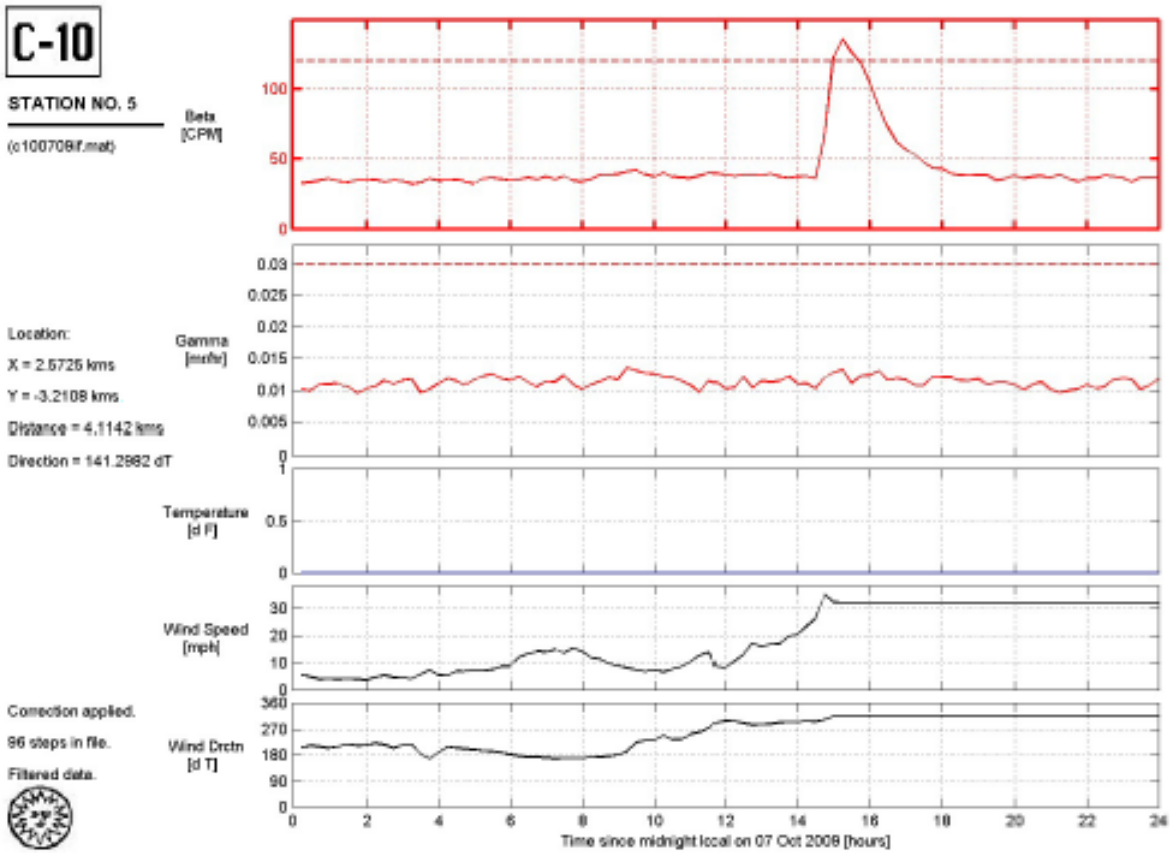
  Data is compiled, and graphs are emailed to MA Dept of Public Health Radiation Control Lab and Massachusetts Emergency Management Agency contacts

CRMN Reporting





CRMN Reporting



CRMN Vision for the Future

- Social Network
- Isotope Identification technology
- Intelligent radiation sensors with built-in Ethernet & remote access capability
- Remote sensor diagnostics

NRC Offsite Radiological Monitoring Requirement

- The NRC requires nuclear power plants, in cooperation with participating states, to operate a network of small passive detectors called thermo luminescent dosimeters (TLDs)
- TLD networks consist of 40-50 stations in two concentric rings extending to 5 miles from the nuclear power plant
- TLD Network Objective
  - Serves as a means of providing post-accident estimates of population exposure
  - NOT a means for measuring gaseous effluent from routine emissions
  - TLDs are collected & read every 3 months. The date & time of short duration spike in data will be unknown
  - TLDs are not sensitive to noble gases, the primary effluent gaseous releases from nuclear reactors
  - See NRC documents: NUREG-0837 and NUREG/CR-3775

C-10 Foundation Technical Support

Richard W. Clapp, PhD, Professor Emeritus (retired)
Department of Environmental Health
Boston University School of Public Health
Boston, MA 02215
Currently:
Lowell Center for Sustainable Production
University of Massachusetts Lowell
One University Avenue, Lowell, MA 01854
978-934-4942
Richard.Clapp@uml.edu

Dr. Sam Miller, Associate Professor of Meteorology
Plymouth State University
MSC 48 – 17 High Street, Plymouth, NH 03264
Office: 603-535-2811 Mobil: 603-726-0457
stmiller@mail.plymouth.edu

Daniel Sythe, President
International Medcom, Inc.
6871 Abbott Avenue
Sebastopol, CA 95472-4204
707-823-0336
dan@iospectra.com

Bernadette Leonard, Monitoring Administrator
C-10 Research & Education Foundation, Inc.
44 Merrimac Street, Newburyport, MA 01950
978-465-5916
berniel@c-10.org