

SAFECAST

Innovative Engineering for Citizen-based Radiation Measurement

Joe Moross

Bariloche, January 2016

SAFECAST:

Tool for public information
and engagement during and
after nuclear emergencies

Azby Brown

RICOMET 2015
BRDO Castle, Slovenia
June 15, 2015



March 11, 2011

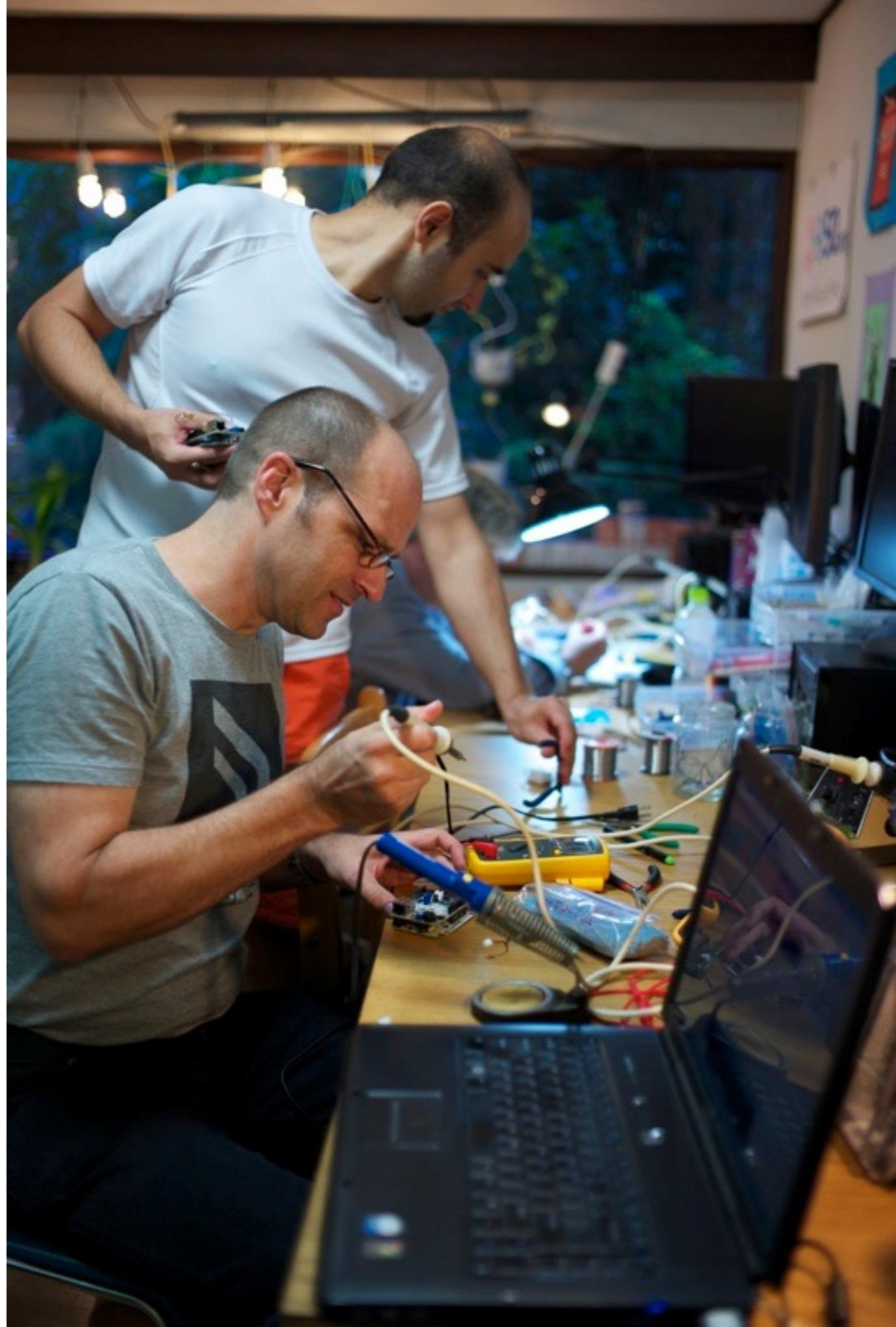
From the point of view of average citizens:

After March 11, 2011:

- Fear, need to decide soon whether to flee
- Information vacuum
- Official sources deemed untrustworthy
- Social media paints more dire picture
- Even knowledgeable people can't find enough reliable and useful data

In Response:

- We developed devices**
- We made a mapping system**
- We built a community of motivated citizen-scientists who want to measure radiation.**



Evolving according to needs:

Early Phase: “Reality Check”

Transitional Phase: “Enablement”

Long-term: “Alternatives”

SAFECAST today:

- International, ad-hoc volunteer network
- Non-hierarchical (but with “centers of gravity”)
- Includes radiation experts, hardware designers, software designers, academics, tinkerers, hackers, entrepreneurs, housewives, drivers, students, etc.
- “Brain Trust” : Leaders in their fields
- We are neither pro- nor anti-nuclear.

We are Pro-Data !

Funding:

- Individual donations
- Crowdfunding: Global Giving
- Kickstarter campaigns
- Support from private foundations
- In-kind support from manufacturers, etc.
- Most importantly, people donate their time

-Topic 1: The technical side

-Topic 2: The human side



Our first systems were bulky, but worked.



Current workhorse:

bGeigie Nano

- 7th-generation mobile detector
- Rugged
- Arduino-based
- GPS and data-logging
- LND 7317 2" pancake sensor
- OLED display
- Bluetooth and WiFi capable
- Open-source, open hardware, open data
- Designed to be sold as a kit, anyone can build it and upload data

Devices:

- Primarily mobile to maximize coverage
- New fixed sensor network to log changes over time
- Iterative design, “agile and lean” development
- Open-source, open hardware, open data
- 7+ generations of devices in 2 1/2 years
- GPS, data-logging, tied to our API
- Emphasize ease of use, consistency, ruggedness, speed of deployment, cost-effectiveness
- Industry-standard 2” pancake GM tube (LND 7317) in most devices

Deployment



Automobile



Bicycle

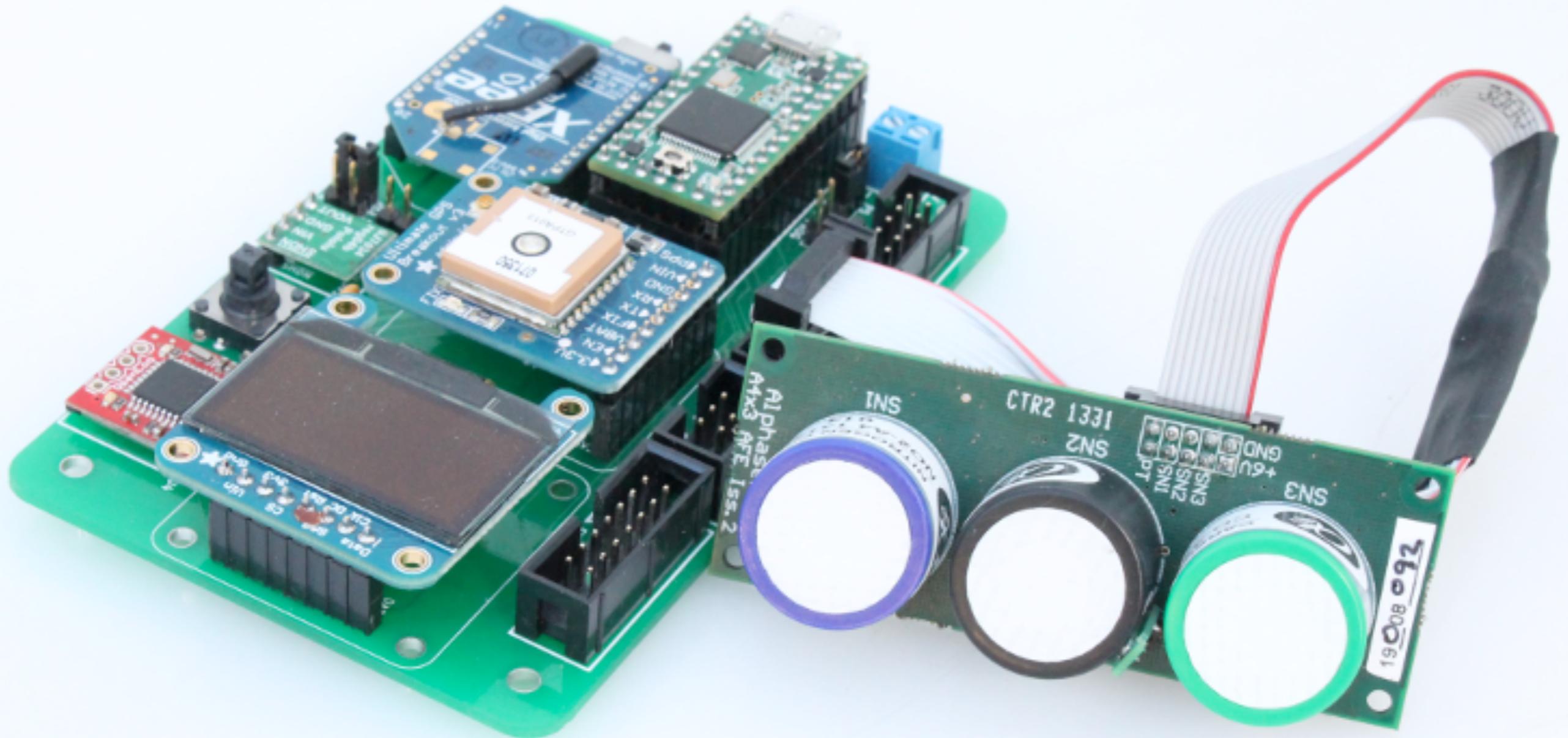


Hand-carry

Aerial drone
(under development)



SAFECAST Air



Prototype, 2015

iOS



OS X

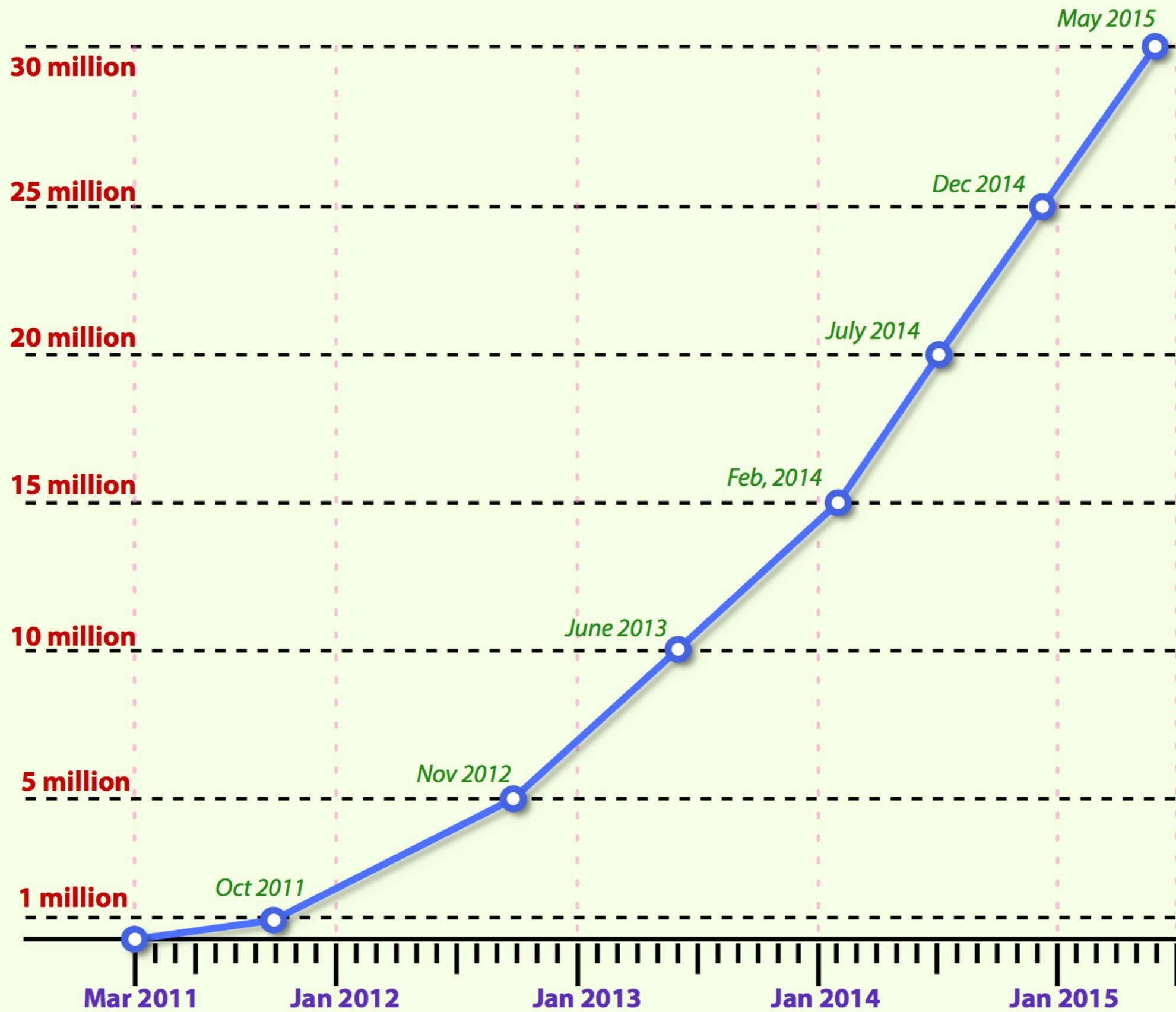


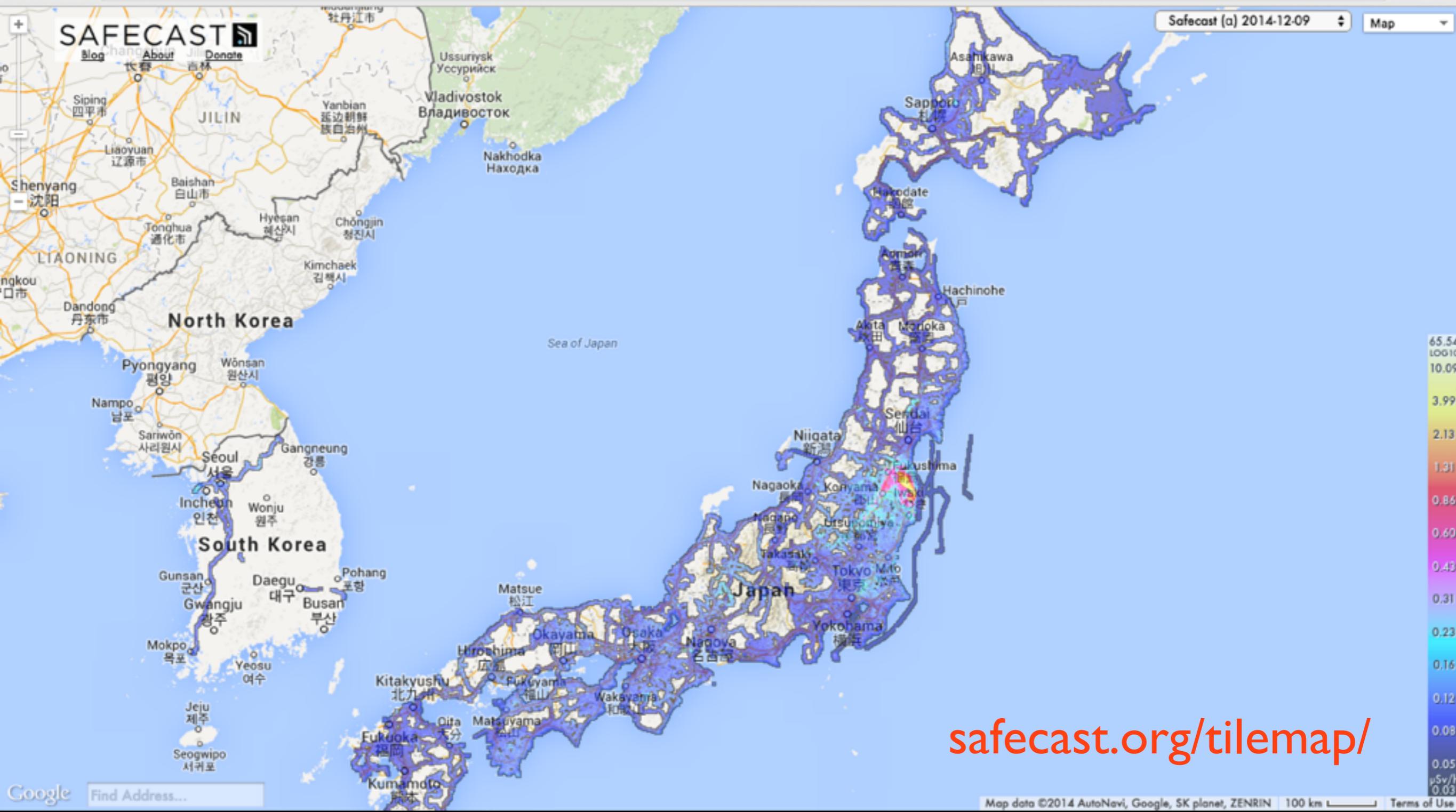
Web

Map system:

- Database updated daily, now approx 10GB
- Both server-fed webmaps and smart-client iOS and OSX apps
- API with query/filtering by time, location, device, etc.
- Approx 360 volunteers have uploaded data.
But 90% is contributed by the most active 10%.
- Data and system are open-source (Creative Commons CC0 license). Anyone can download the data, and we encourage independent efforts based on our dataset.

Growth of SAFECAST dataset



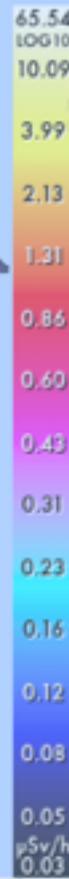
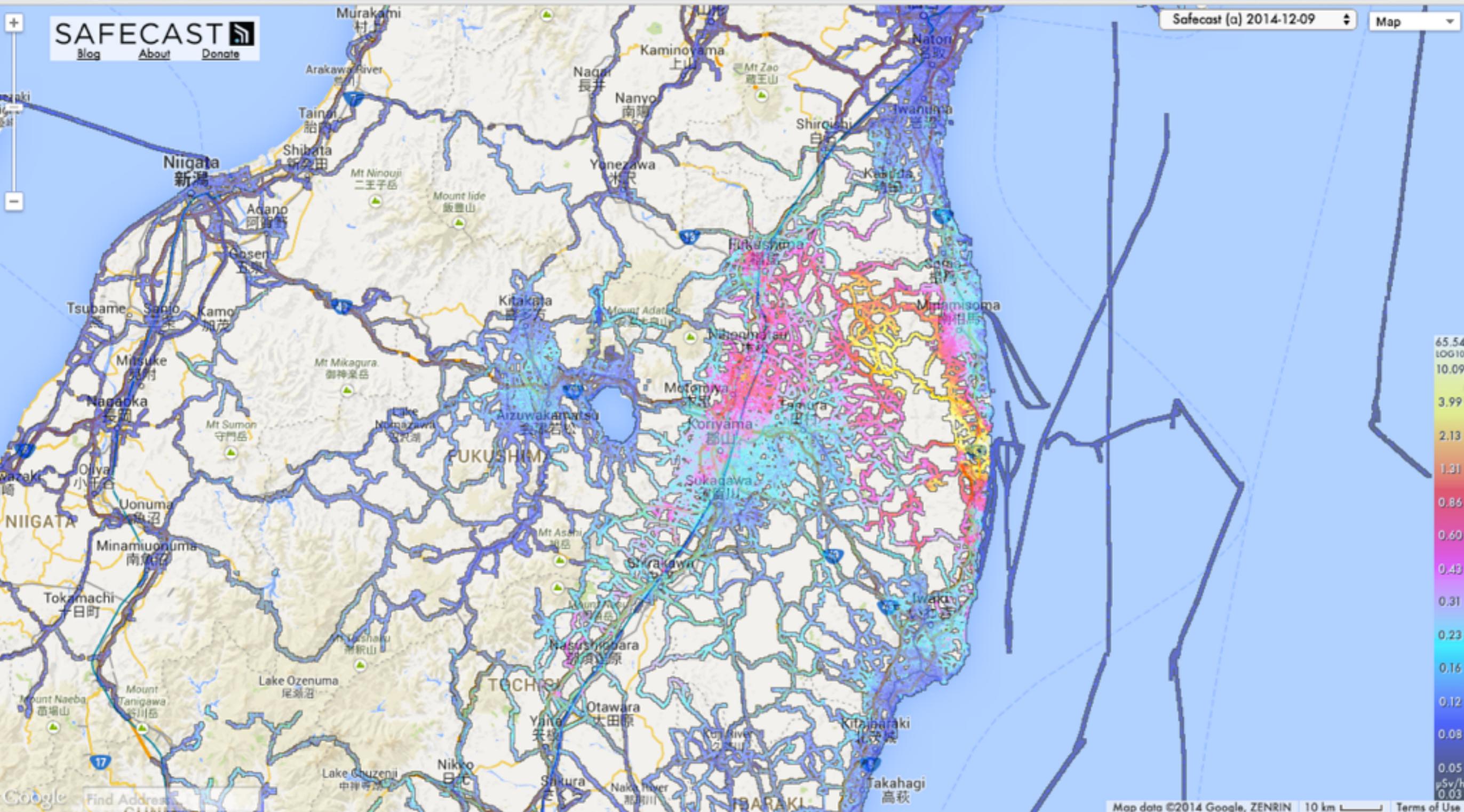


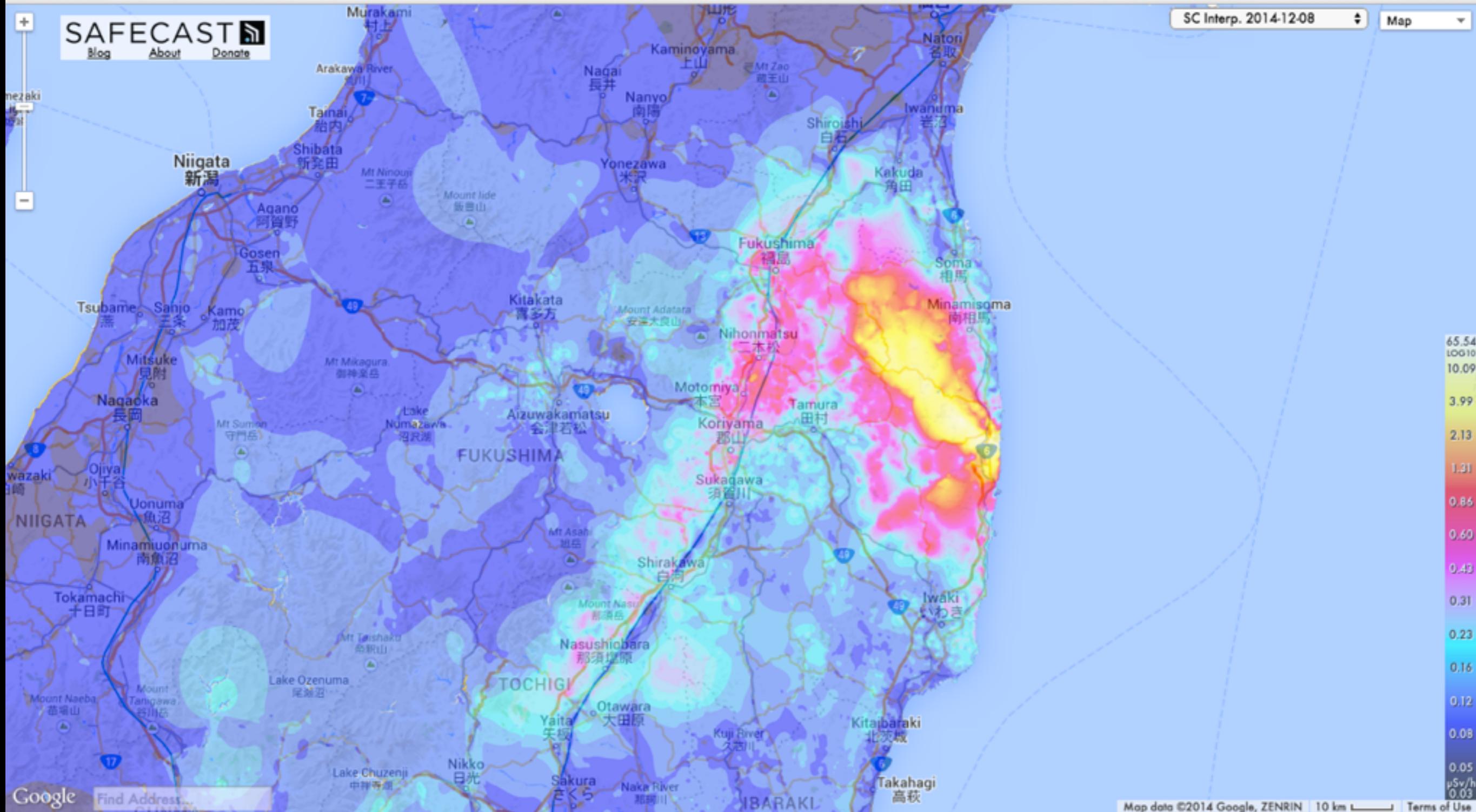
safecast.org/tilemap/

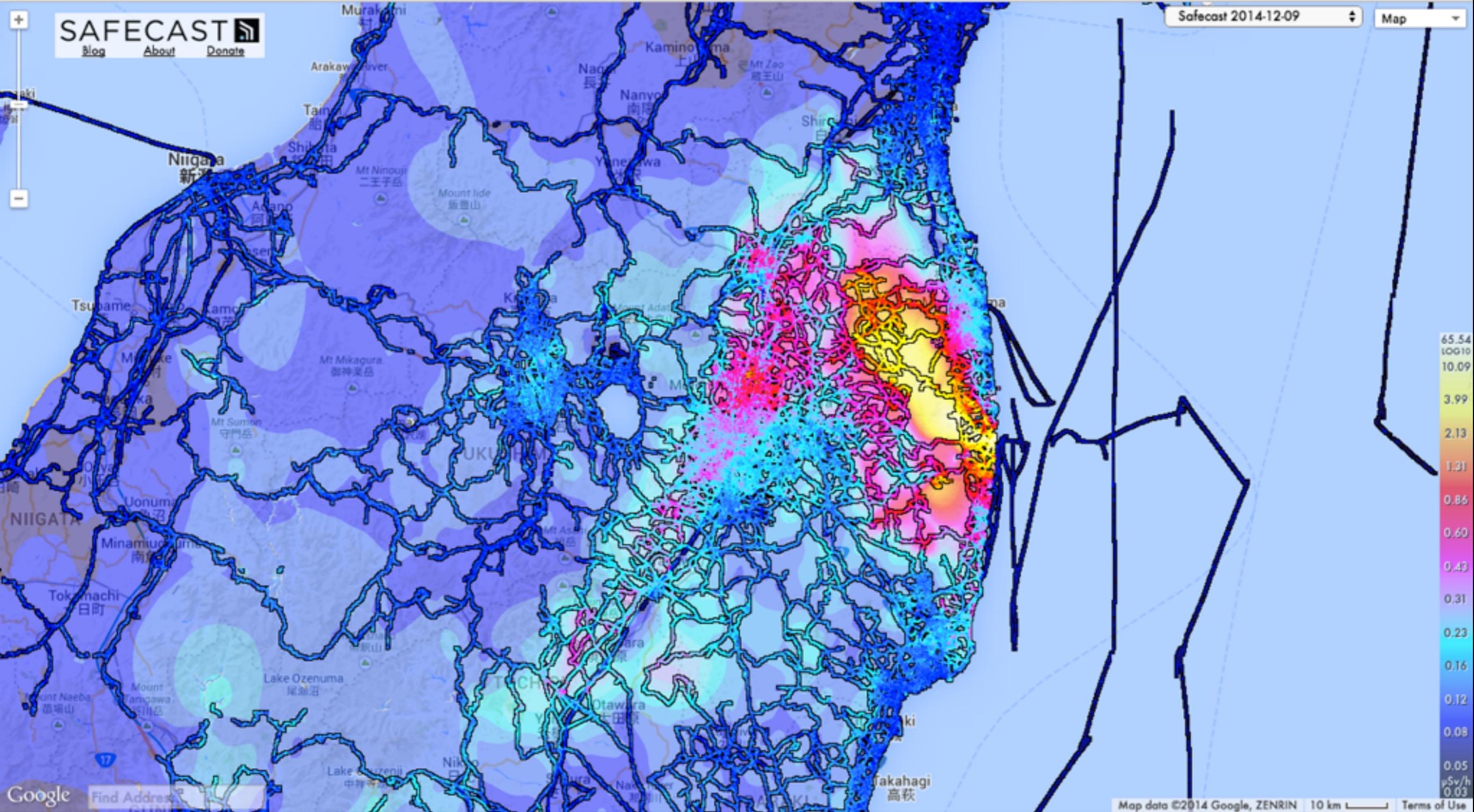
SAFECAST
Blog About Donate

Safecast (a) 2014-12-09

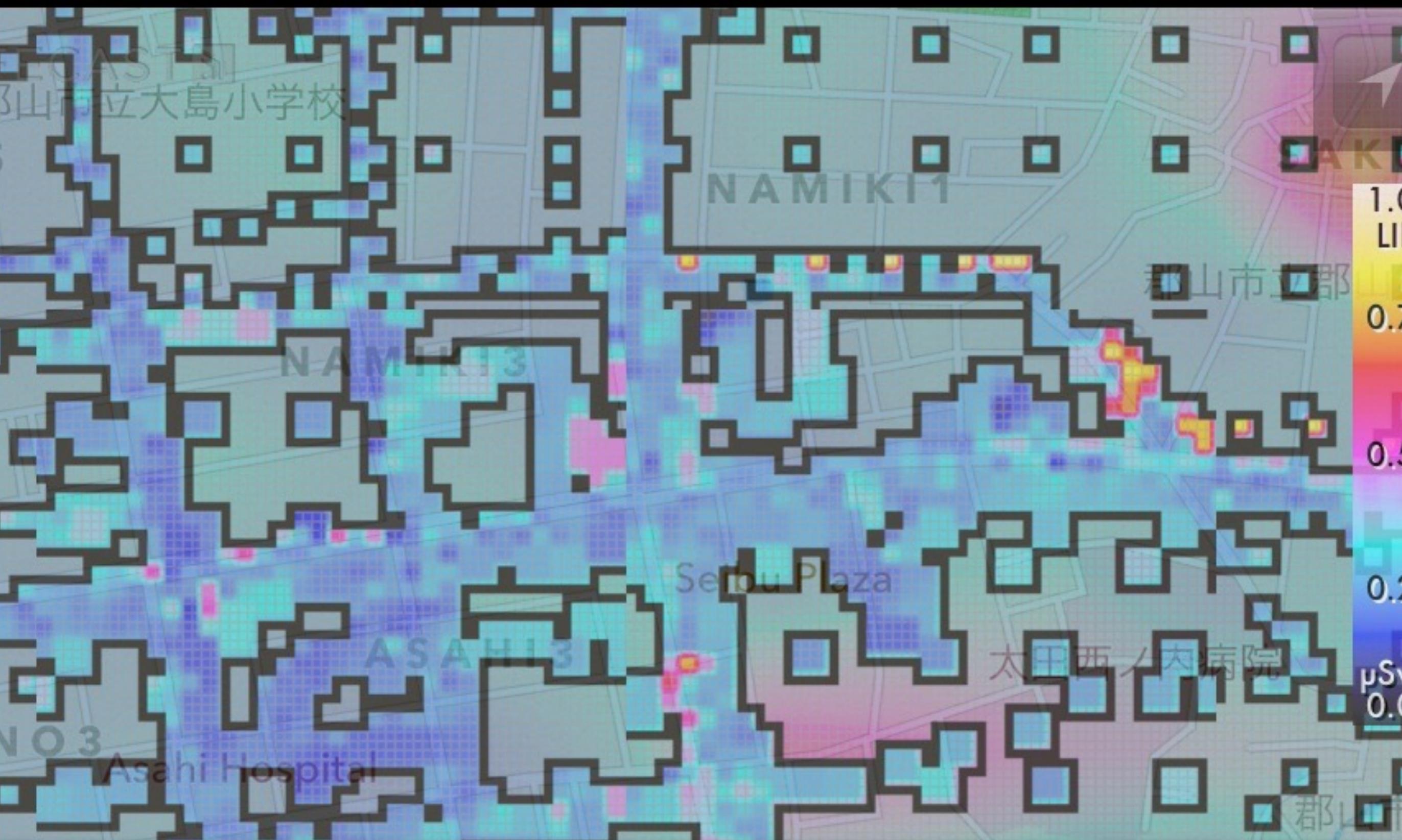
Map









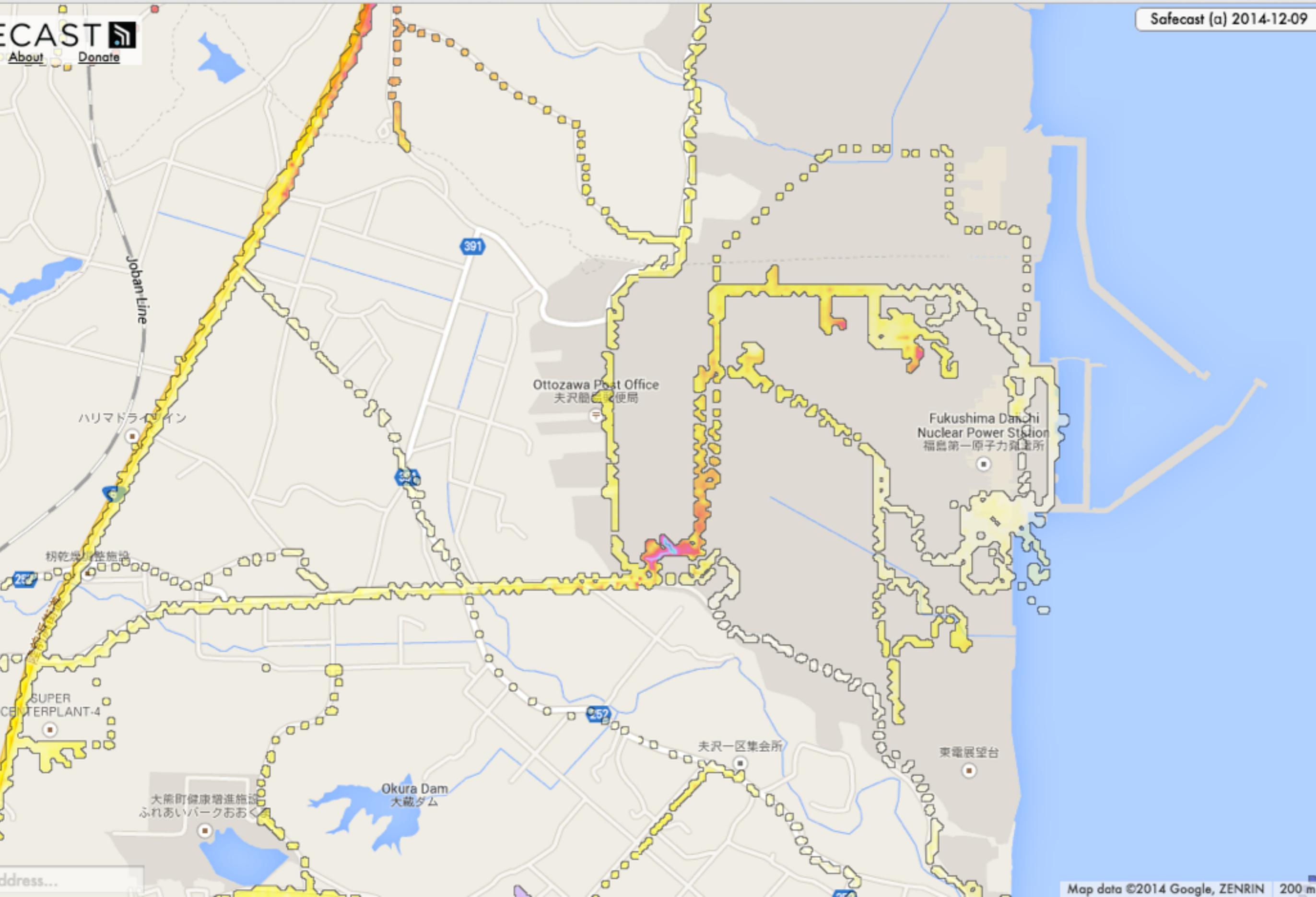




Safecast 2014-12-09



Address...





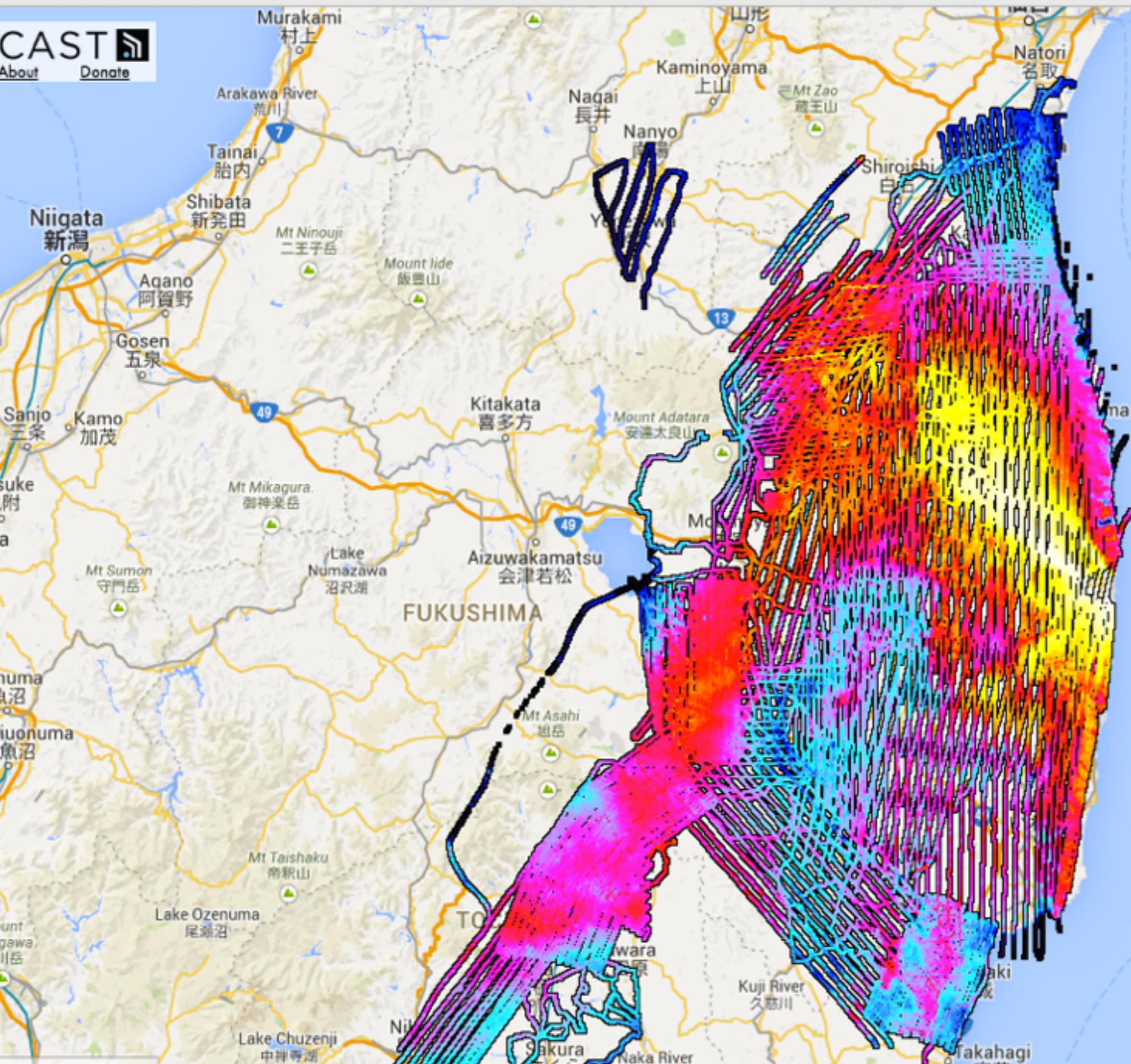


SAFECAST 

[Blog](#) [About](#) [Donate](#)

Safecast 2015-06-14 Map





Dashboard

Safecast Api

Users

Measurements

bGeigle Imports

Devices

The Safecast API

Query and add to the Safecast dataset with your own application.

API Endpoint

<https://api.safecast.org/en-US>

GET <https://api.safecast.org/.json>

JSON

HTML

Available Resources

- [Users](#) Add and view user accounts
- [Measurements](#) Add and view measurements
- [bGeigle Imports](#) Add and view bGeigle Imports
- [Devices](#) Add and view Devices

Users

- Get a list of Safecast users [GET /users.json](#)
- Add a new user [POST /users.json](#)
- View a user [GET /users/334.json](#)

Measurements

- Get a list of Measurements [GET /measurements.json](#)
- Add a new measurement [POST /measurements.json](#)
- View a measurement [GET /measurements/22684490.json](#)

api.safecast.org

- Dashboard
- Safecast Api
- Users
- Measurements
- bGeigie Imports
- Devices

Bgeigie Import #019-1112.LOG Processed

[Download Original File](#)

If you don't see the map, please manually reload the page.

- 1. Uploaded
- 2. Processed
- 3. Metadata Added
- 4. Submitted
- 5. Approved
- 6. Live

- Metadata
- Process Log
- [Edit Details](#)

Uploaded By
KM.AIZU

Filename
019-1112.LOG

Number Of Lines
6079

Number Of Measurements
6079

Metadata

Title	Route6 2014/11/12
Description	Route 6 Return difficult district
Credits	Aizu radioactivity information center
Height	1.3m
Orientation	Facing Left
Cities	Koriyama,Hirata,Ono,Iwaki,Hirono, Naraha,Tomioka,Okuma,Futaba,Namie Minamisoma,Iitate,Kawamata,Fukushimaa, Nihonmatsu,Motomiya,Inawashiro,Aizuwakamatsu

[Delete this Import](#)

MEASUREMENT

Captured At
2014-11-12T10:27:28Z

Latitude 37.4701

Longitude 140.3621

CPM 72



- Dashboard
- Safecast Api
- Users
- Measurements
- bGeigie Imports
- Devices

Bgeigie Import #019-1112.LOG Processed

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MEASUREMENT

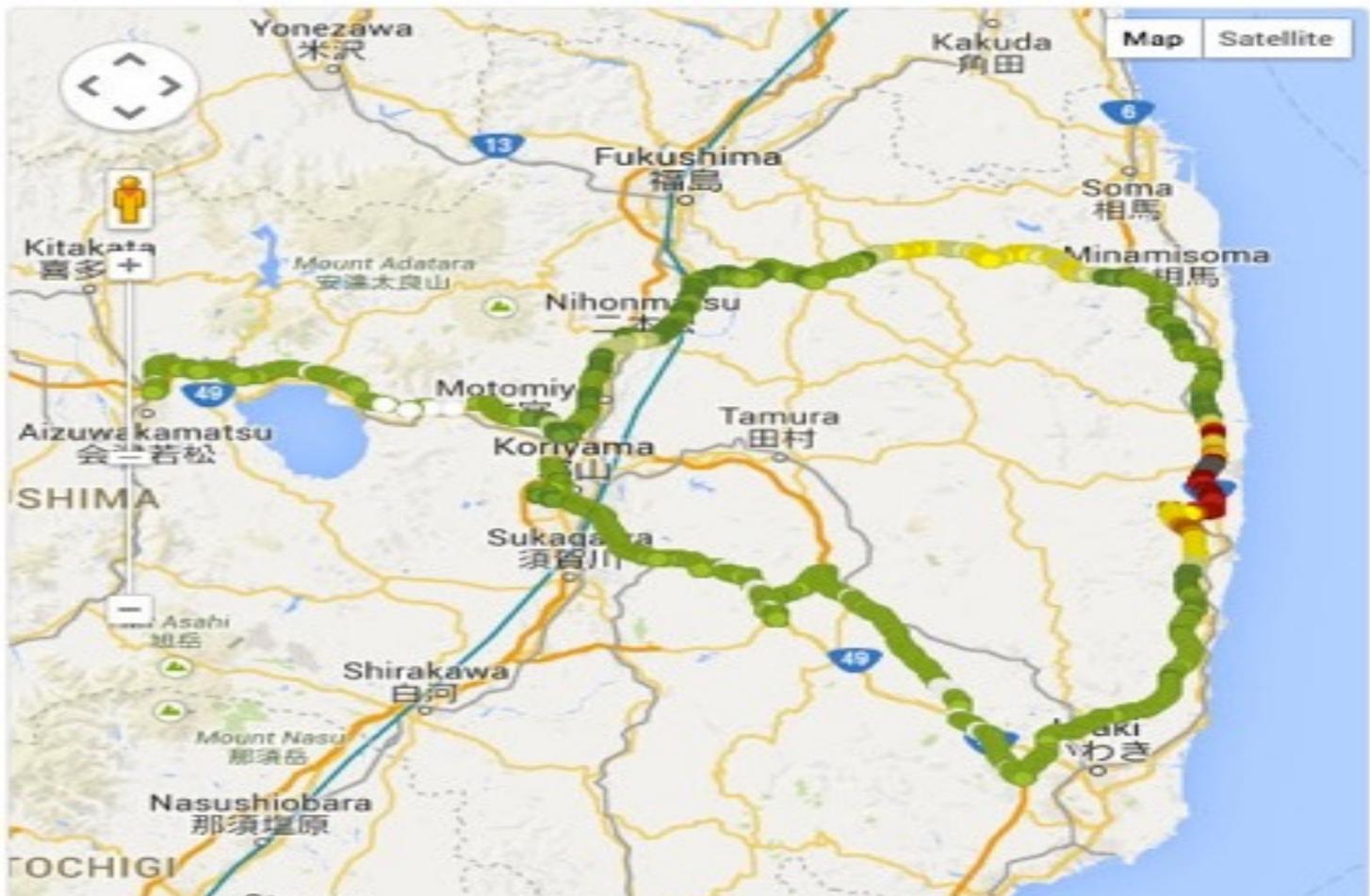
Captured At
2014-11-12T10:27:28Z

Latitude 37.4701

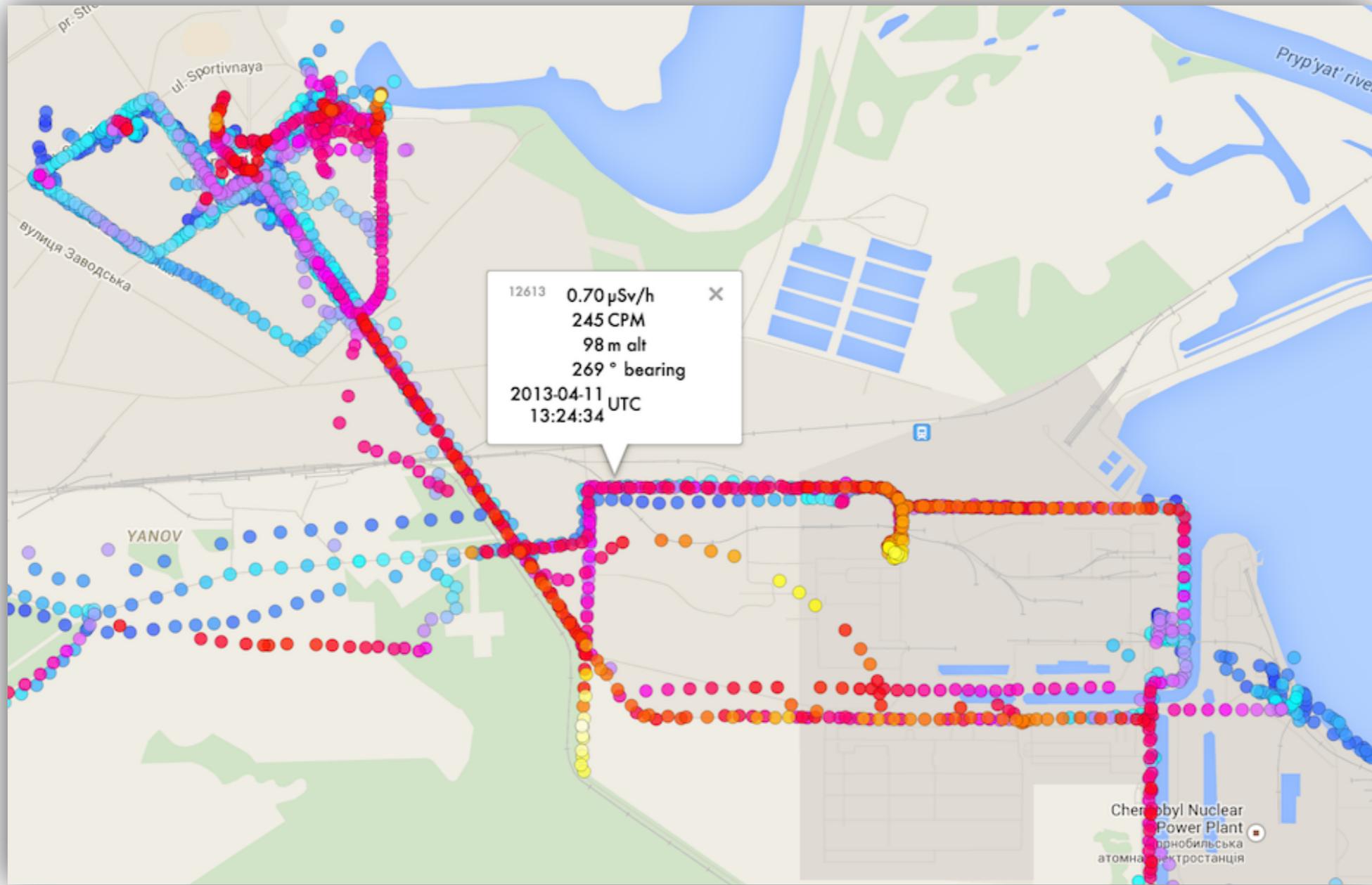
Longitude 140.3621

CPM 72

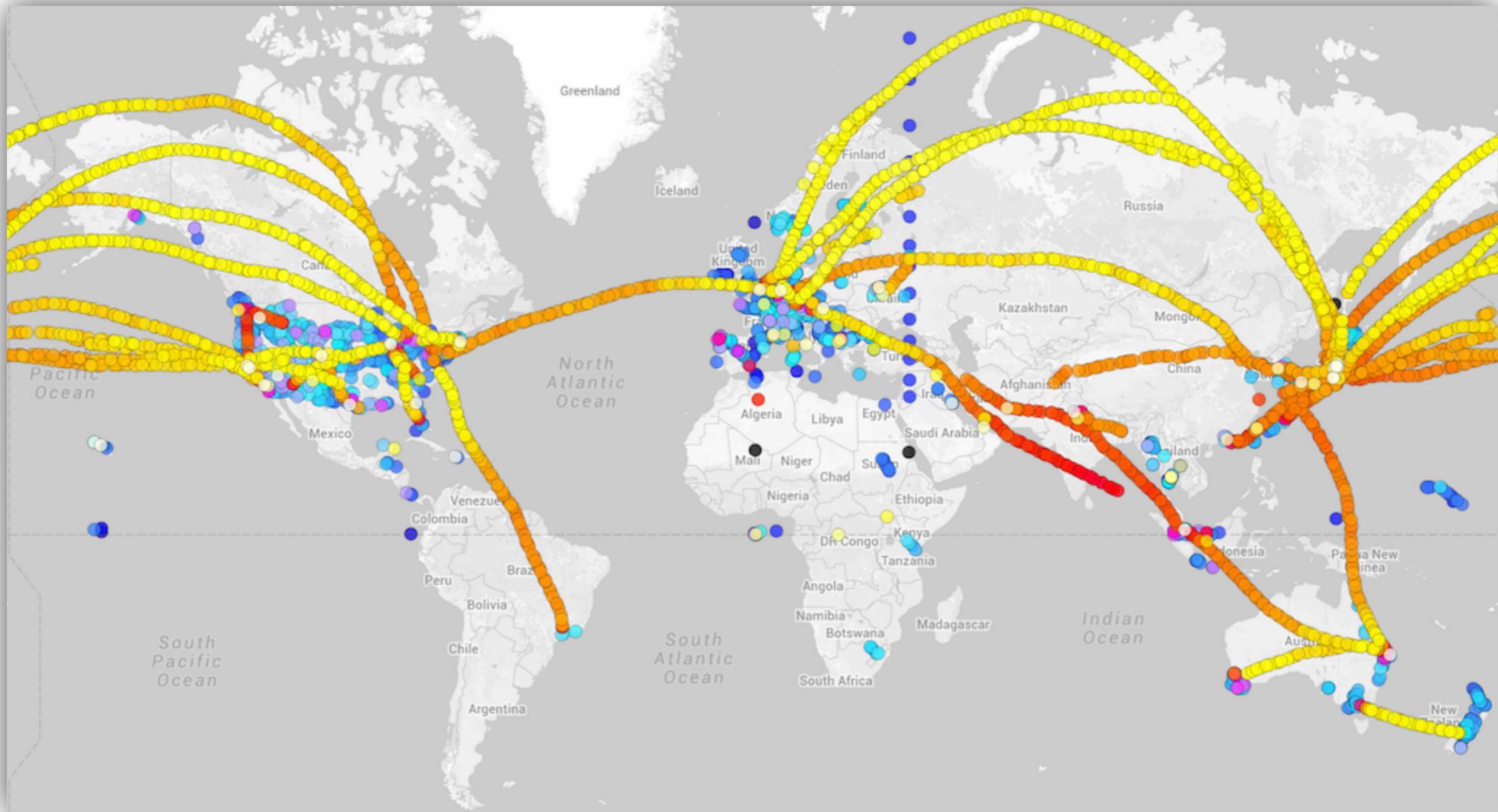
µsv 0.22



**We think it's very important
to keep humans in the loop!**

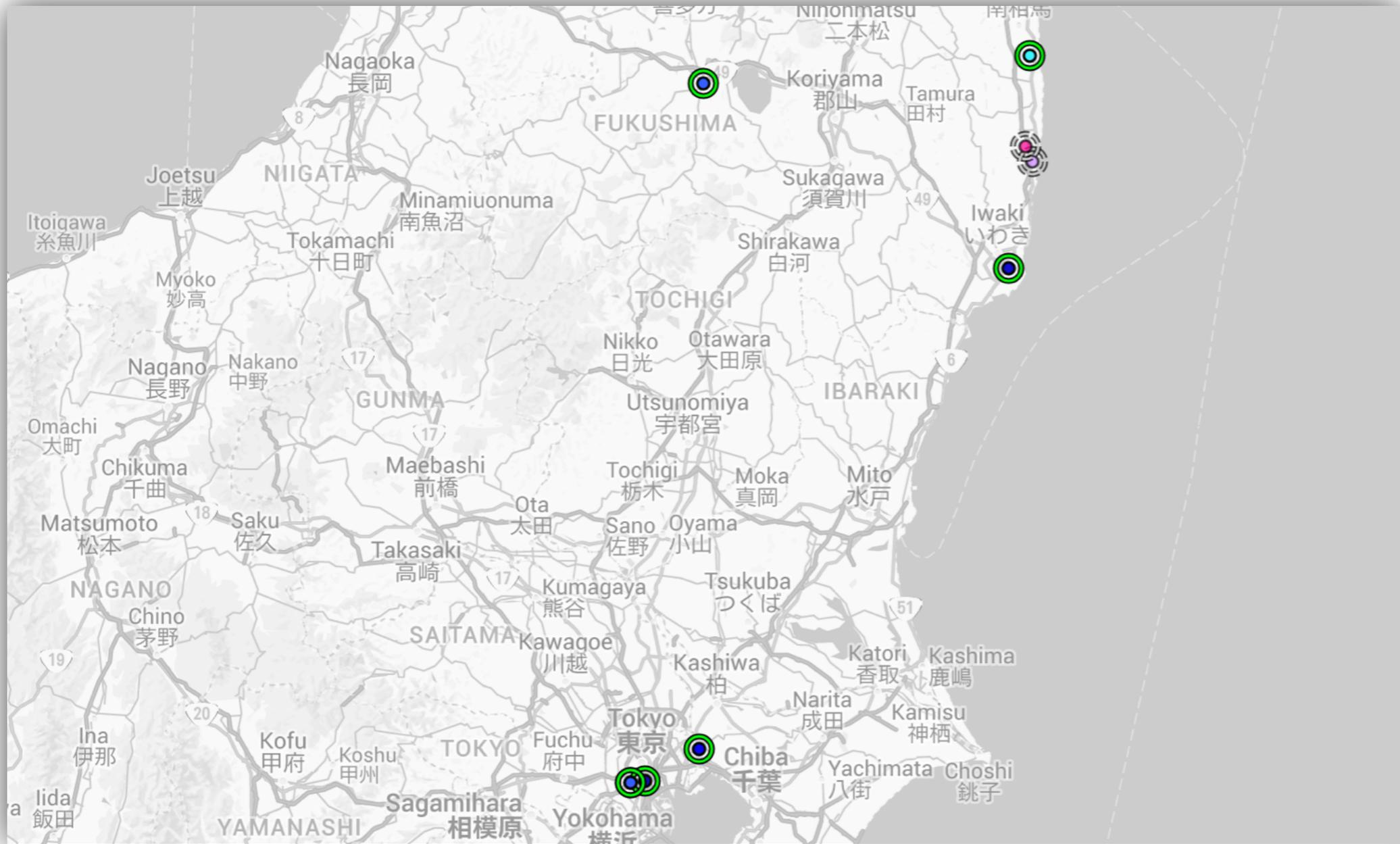


bGeigie Log Viewer



5000+ bGeigie Logs

(In-flight radiation data can be uploaded, but is not included on our main maps)



Realtime Sensors



Expanding network, new hardware deployment.

Japan, Fukushima, Iwaki (sensor 41)

Online

6 mins ago

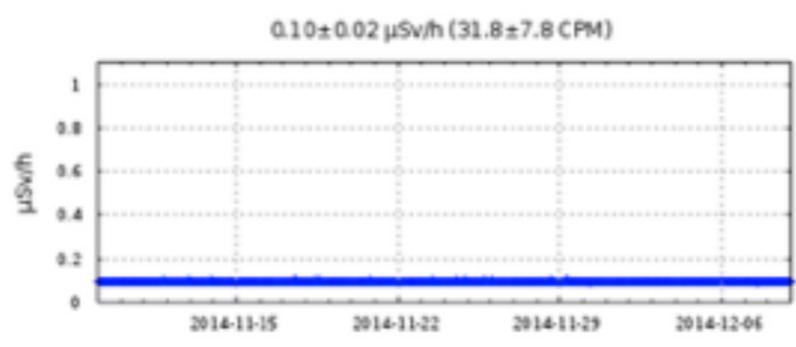
12 months ago

31 cpm

60 cpm

0.093 μSv/h

μSv/h



Download the dataset

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Leave a Reply

Name (required)

Email (will not be published) (required)

Website

Comment

37°00'37.8"N 140°55'31.1"E ★ Save

[View on Google Maps](#)

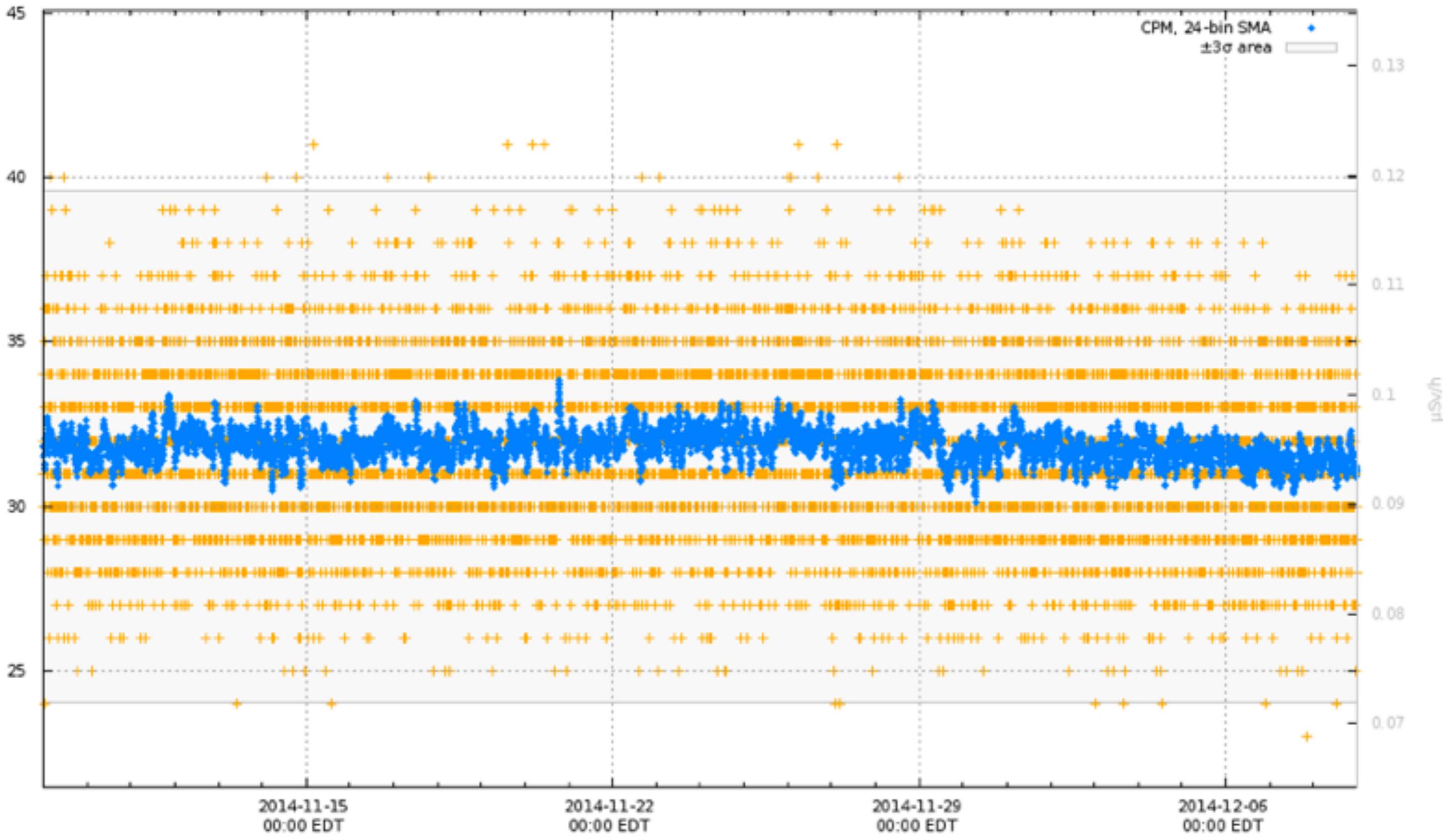
Google

©2014 Google - Map data ©2014 Google, ZENRIP

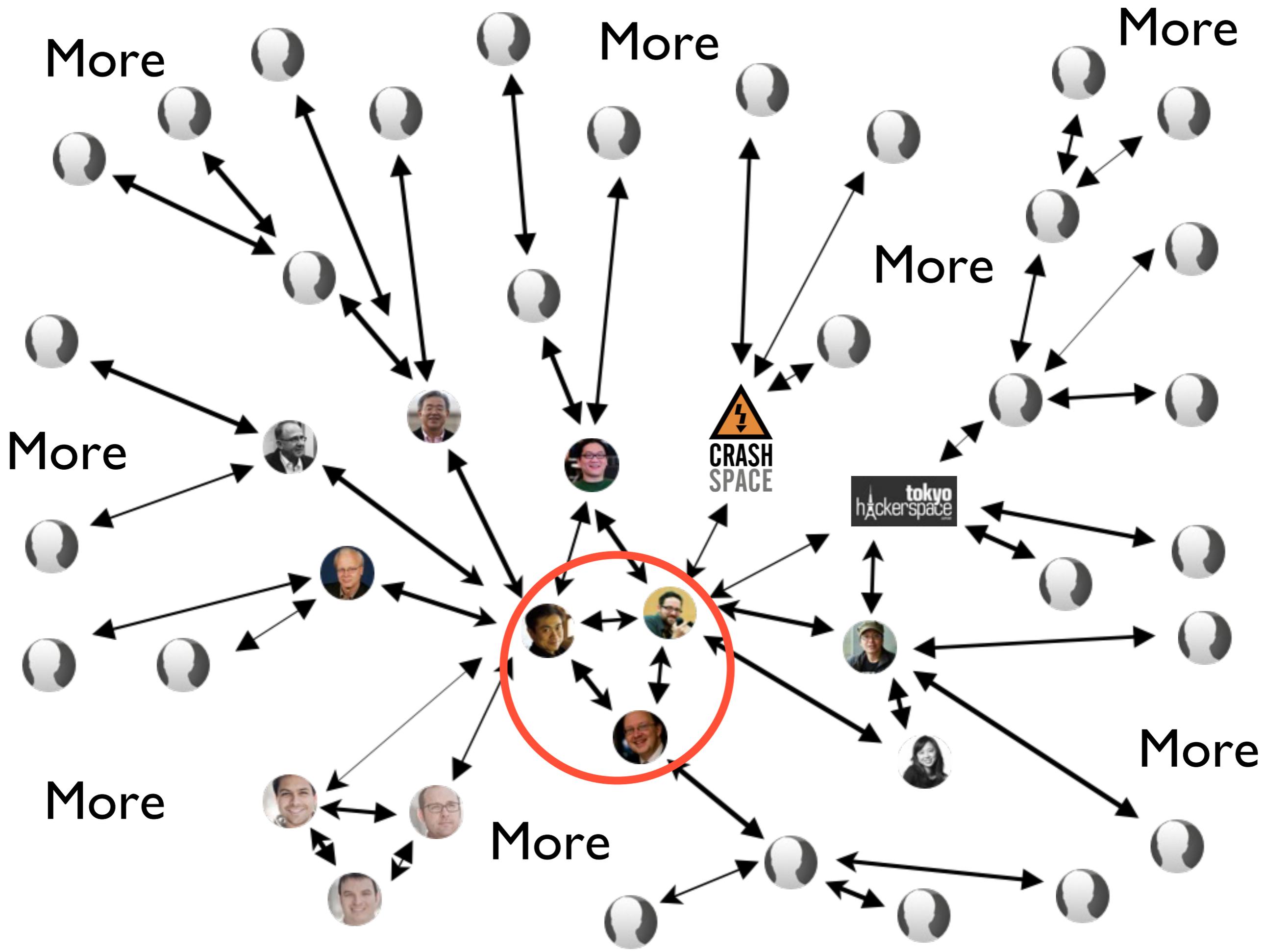
Comments

- Rob Oudendijk on [Japan, Tokyo, Embassy of the Netherlands](#)
- ray ozzie on [USA, MA, Manchester](#)
- ray ozzie on [USA, MA, Manchester](#)
- Safecast on [USA, Massachusetts, Cambridge](#)
- Safecast on [USA, Massachusetts, Cambridge](#)

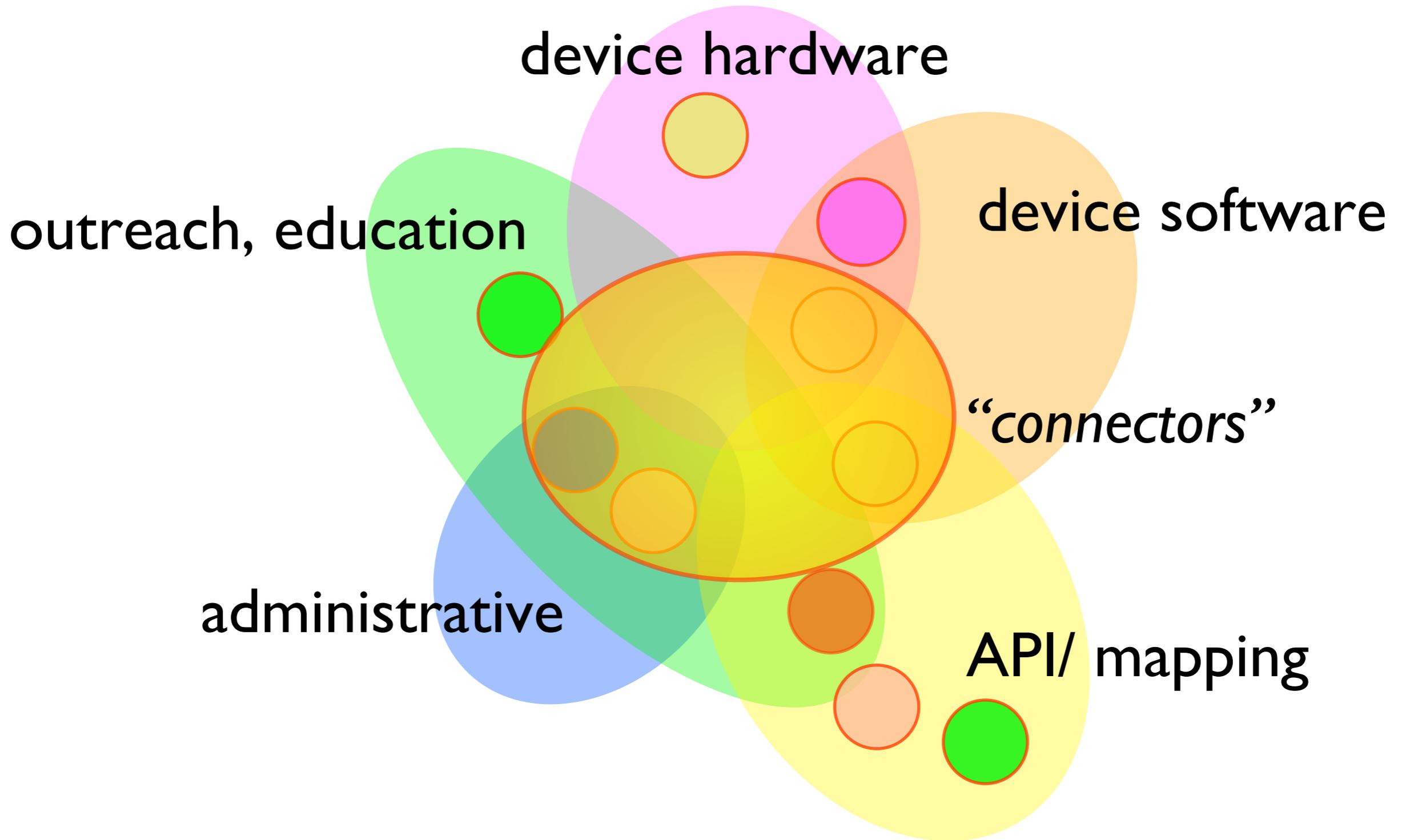
sensor=41, total 8387 records, 31.8 ± 7.8 CPM (0.10 ± 0.02 $\mu\text{Sv/h}$)



People



Our Teams



Lots of multitasking, multi-competence



Building Community

We want to encourage people to get involved.

This requires skills in education and media.

- Safecast blog, discussion, Facebook, Twitter, etc
- Geiger-counter building workshops
- Talks and presentations
- Media interviews



[Development: Real-Time Interpolation](#) | [Safecast OS X](#) | [Updated Safecast Webmap!](#) | [Safecasting DC](#) | [Safecasting Iraq: Open](#) >

ABOUT SAFECAST

Safecast is a global project to empower people with data, primarily by mapping radiation levels and building a sensor network, enabling

[Learn More](#)

OUR PROJECTS

Safecast is a global sensor network for collecting and sharing radiation measurements to empower people with data about their environments.

[Learn More](#)

DONATE

Safecast is made possible entirely thanks to tax deductible donations from people like you. We are a registered US 501(c) 3 non profit

[Learn More](#)

(日本語) BGEIGIE NANOの使用説明-YOUTUBE動画

Sorry, this entry is only available in 日本語.

© Posted on Saturday January 24th, 2015 07:16 PM

[Comment](#)



HELLO BIKINI !

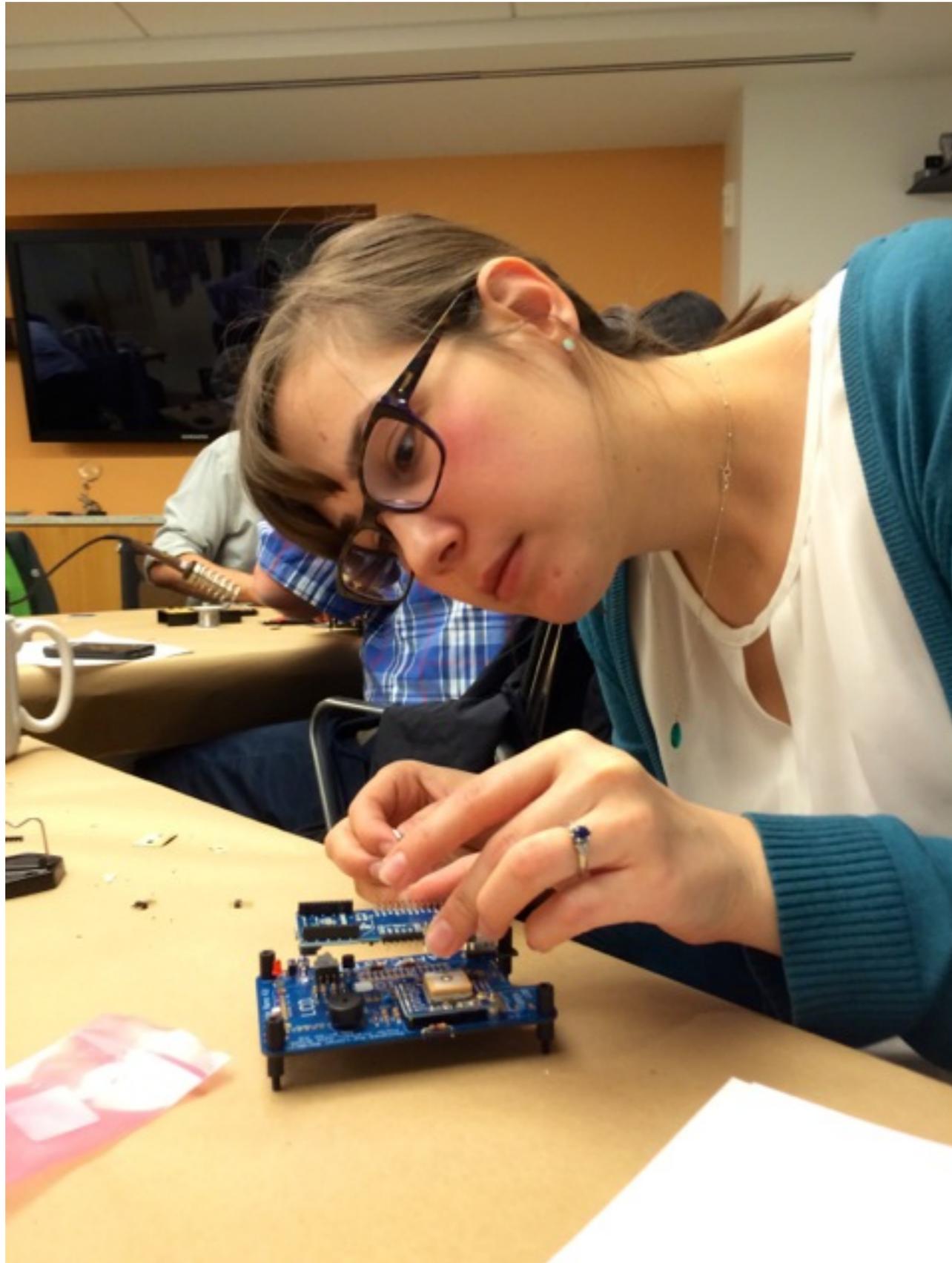
Above: Dr. Buessler on the beach at Bikini. We recently got some unique uploads from Bikini and Enewetak Atolls, courtesy of Dr. Ken Buessler, of the Woods Hole Oceanographic Institution O&M. Dr.

Search Here

Go

Build your own bGeigie Nano





Recent workshops in:

Tokyo

Fukushima

Kobe

Strasbourg

Taipei

Hong Kong

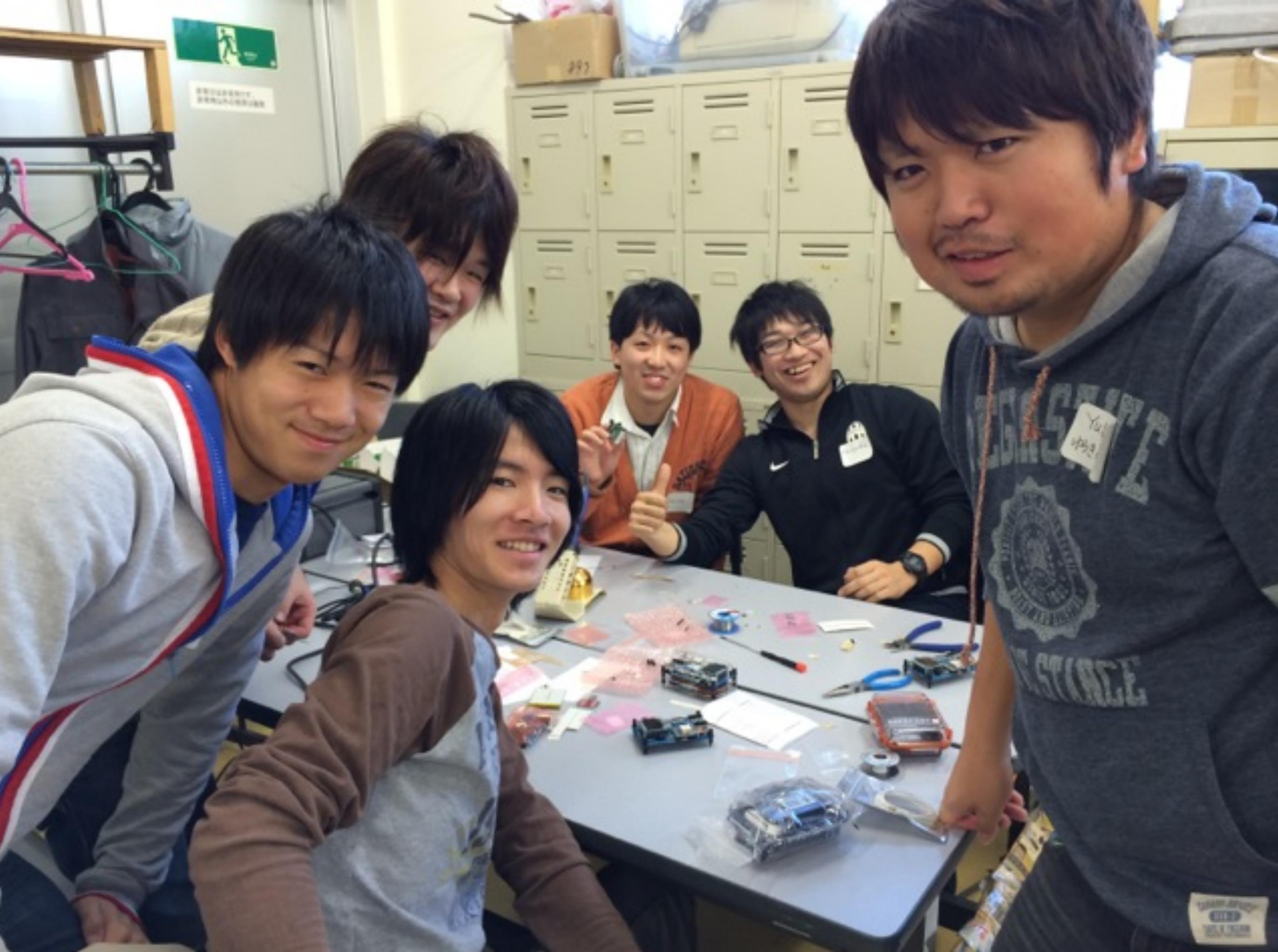
Upcoming workshops:

Washington, DC

Trieste

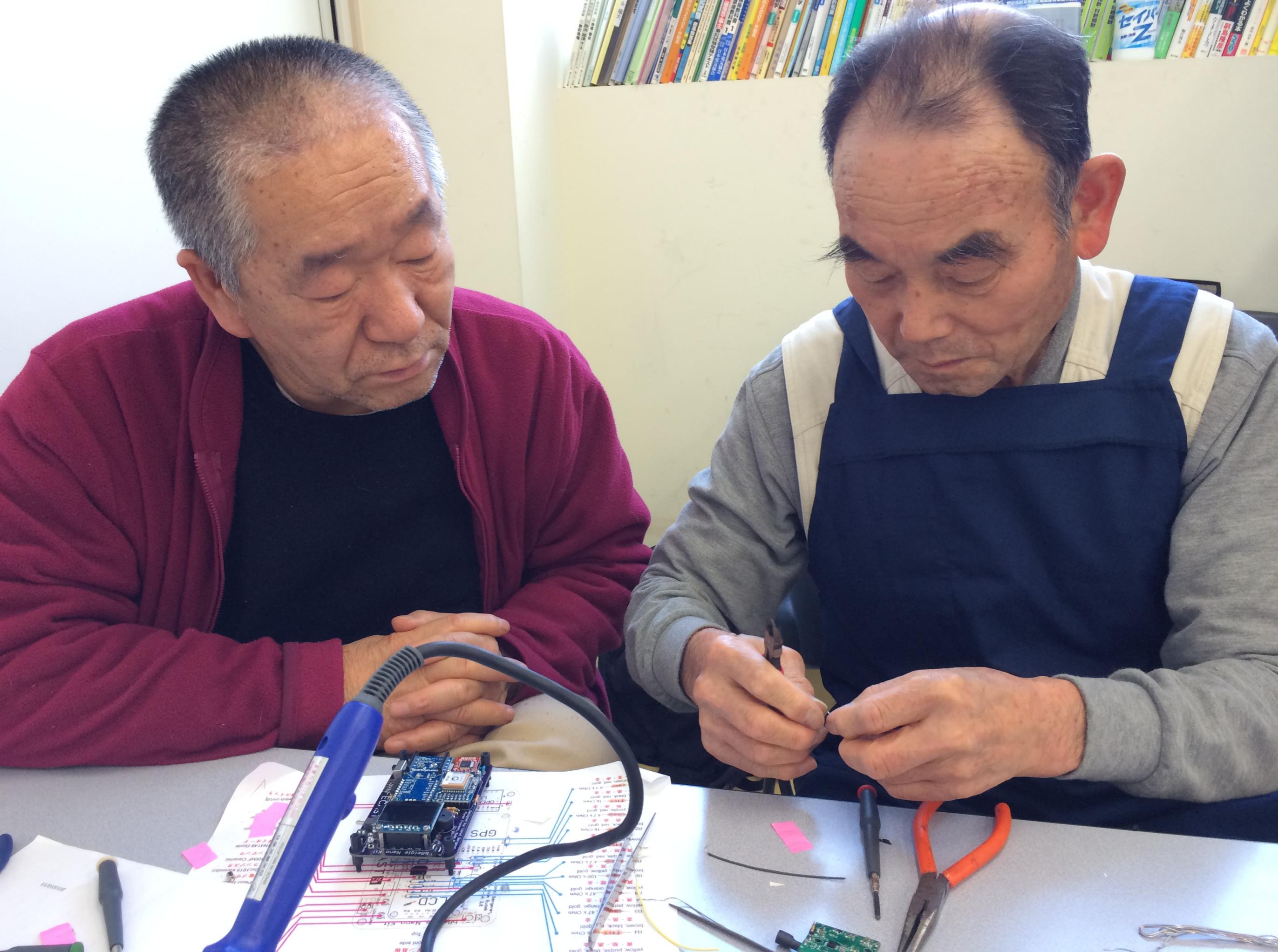


Workshop with college students in Koriyama





Testing 12 newly-built bGeigie Nanos in a nearby park.





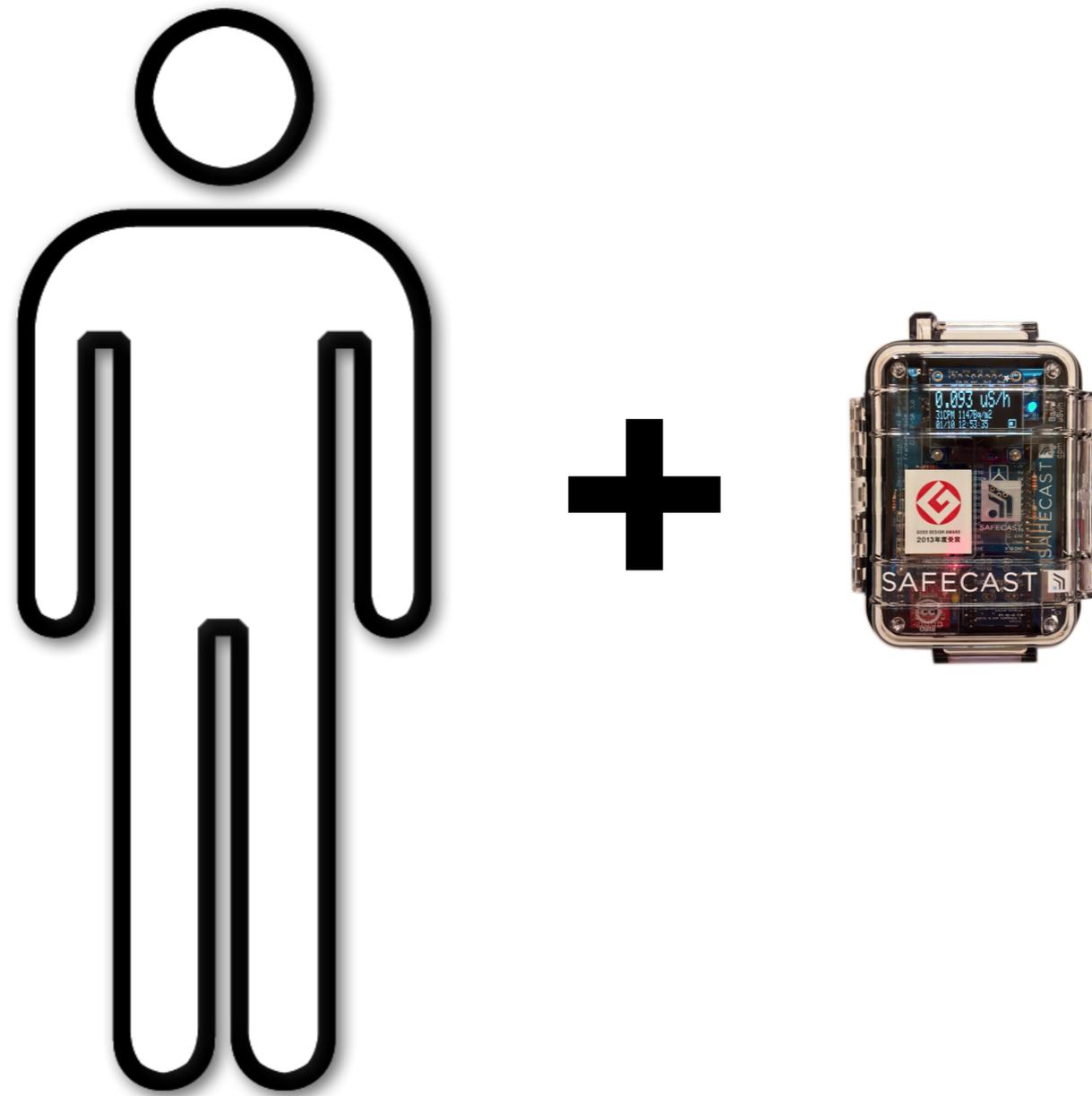
Safecast Volunteers and Koriyama City Officials



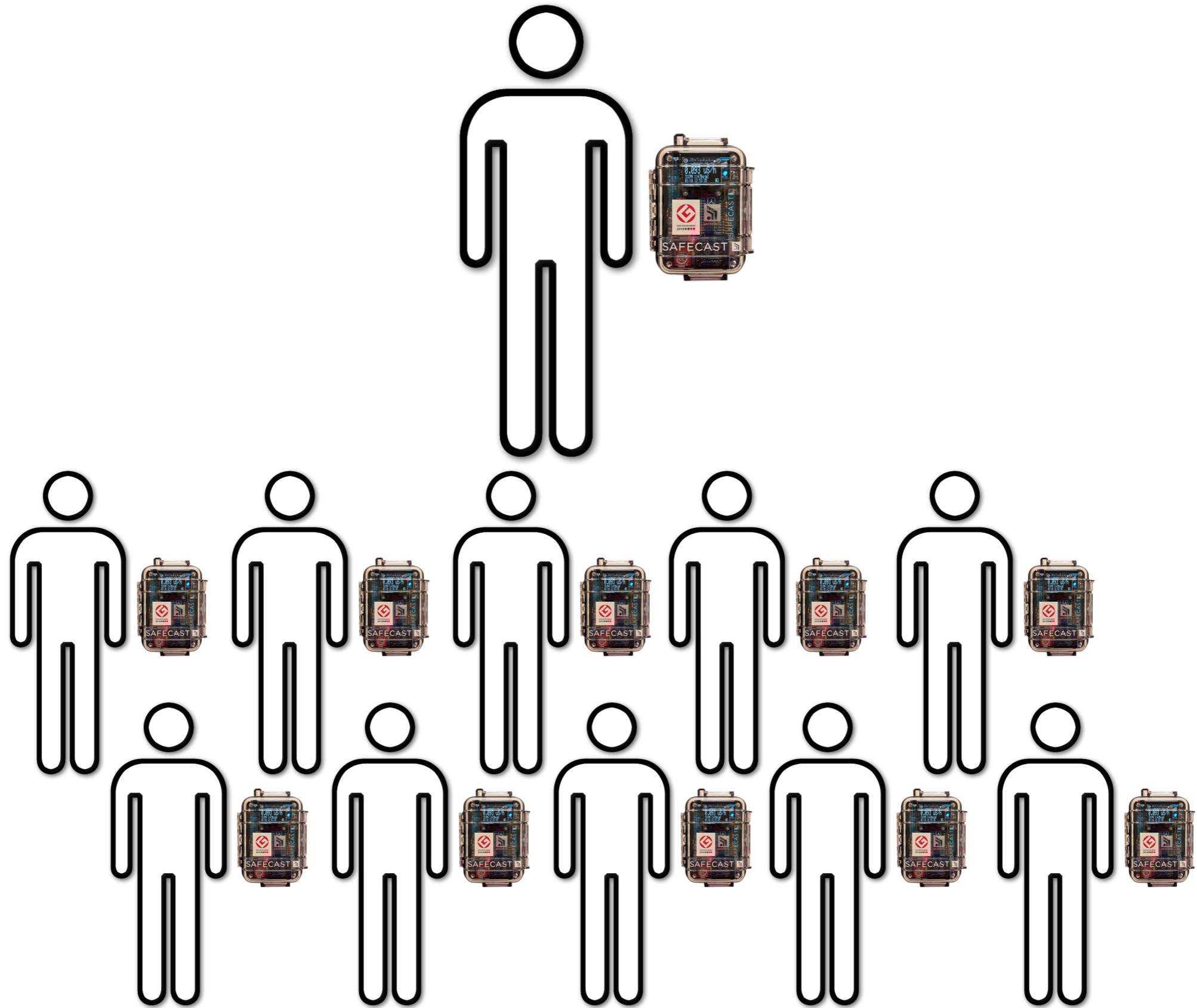
Ten bGeigies were delivered to Koriyama City



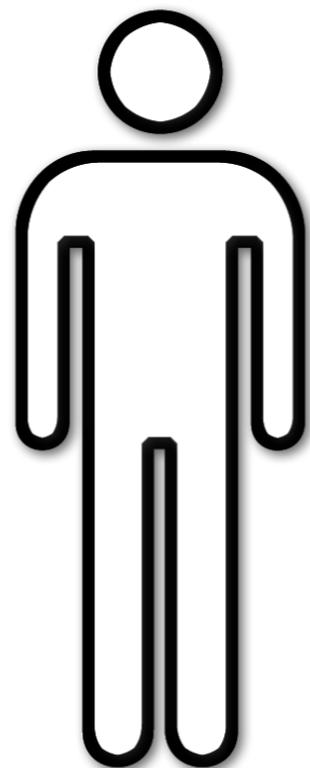
Mounted on postal delivery vehicles



Our experience after Fukushima suggests that in the event of another large radiation emergency additional manpower will be needed.



One person can quickly teach ten others.



We have prepared “airlift crates” of devices that can be quickly sent to emergency areas anywhere in the world.



We've found it's necessary to educate media as well.

THE SAFecast REPORT

VOLUME 1 - MARCH, 2015



www.safecast.org

SUMMARY:

Everything we do has been enabled by open hardware and software, new DIY fab tools, and social media.

It required putting into practice agile development and iterative design - “Deploy or Die”

Managing human networks is harder than managing technical systems.

Our credibility depends on our openness.

Govt. agencies are accountable for people’s lives and well-being. We aren’t, and that makes our work easier than theirs.



SAFECAST

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