MAKE RADIATION VISIBLE
Fact Sheet

Nothing is more frightening than an unseen danger. After the 2011 Fukushima Daiichi explosions, as 300,000 people were evacuated from the area, Prime Minister Naoto Kan said the Japanese were fighting an "invisible enemy." They had state-of-the-art computer models for tracking radiation plumes, but because someone in middle management did not trust the models and agencies hesitated to assume responsibility for directing costly evacuations – school children were sent directly into the path of the plume, rather than away from it.[1] Let us hope we can use this as our lesson, and not wait for a nuclear disaster in the U.S. before acting to prevent a similar outcome.

It took a Texas school explosion killing nearly 300 children and teachers in 1937 before odor markers were required for natural gas and propane.[2] Much like people before odors were put in gas, we have been complaisant about nuclear emissions – an invisible danger that can be made visible in multiple ways.

Emergency Release Dye-Markers

First, we propose that the Nuclear Regulatory Commission (NRC) MAKE RADIATION VISIBLE by requiring visible dye-markers be added to emergency radioactive plume releases. When radionuclide releases exceed permitted levels, a dye-release-valve can be activated to disperse visible tracers into the gas or liquid release. Uranine florescent dyes were already used to trace water pollutants and were successfully tested as aerosol tracers making atmospheric pollutants visible up to eight miles in 1959,[3] so advancements in dispersal technologies and dye compositions should make this safety feature far more effective now.[4,5] Many studies have been done on more complex (hindcast and network dependent) methods of plume detection, from computer modeling to post-incident Air Force and robot sensor tracking; [6,7] but the sensible, economically sound, and immediate solution (critically helpful to first-responders and the public) is to use a simple system of direct florescent dye dispersal at release points.

No doubt, there will be continued industry resistance to the prospect of direct plume viewing by the populace, and attempts will be made to delay this relatively simple improvement in preparedness. Industry will champion more expensive and/or less direct technologies; nevertheless, we call on the NRC to remember the Texas children before gas had an odor and the victims of Fukushima Daiichi who could not see the radioactive plume as they tried to escape it, and to expedite the use of these visible dyes for emergency release of radiation. We can learn important lessons about invisible hazards from the tragedies in Fukushima and Texas, and we suggest the NRC take these steps to MAKE RADIATION VISIBLE, in a straightforward way, and thereby increase the safety and confidence of our citizens.

Public Health Alerts

We also propose the NRC require notices for Public Health Alerts for both routine and emergency radioactive releases, when they are scheduled and/or detected. There are weather alerts, toxic spill alerts, even pollen alerts for U.S. citizens, yet no public health alerts for these known carcinogens and mutagens routinely released into our communities. This is one more way to MAKE RADIATION VISIBLE for public health and safety. The research has been done, now it is time to inform the public of potential exposures. The NRC can avoid costly state-by-state legal battles by adding these new regulations.

Over 60 studies worldwide have examined childhood cancer near nuclear plants, and “over 70% of them revealed pronounced cancer increases.”[8] Of those, about 40 studies specifically indicate increased leukemia risks among children living near nuclear power plants. The 2008 KiKK case-control study, commissioned by the German Government, found a 2.2 fold increase in leukemia risks among children living within 5 km of its 16 German nuclear power stations.[9] “This authoritative report led to geographical studies [“all very large studies commonly with over 100,000 data points”] sponsored by the governments of France, UK, Switzerland and Germany. These have now been published and all four had similar findings, ie 30% to 40% increases in child leukemias near NPPs [nuclear power plants].”[10]

It is important to remind ourselves, lest we lose sight of our government agency missions, that in regards to human exposure to radioactivity, 'permissible' is not the same as 'safe', and the accepted ALARA standard of 'As Low As Reasonably Achievable' is based on 'estimating', not 'measuring', the number of excess fatal cancers and severe genetic diseases caused by radiation exposures.[11] U.S. citizens, especially parents of the young, deserve to know when they are exposed to radionuclides.

Citizens in the Tennessee Valley are concerned about Browns Ferry problems, and wonder if similar problems are occurring around the country. With the three flawed and aging Browns Ferry GE Mark I reactors, the over 314,000,000 curies of 'spent' fuel (mostly stored in vulnerable raised cooling pools), the lack of ability to meet NRC fire safety standards (after nearly 40 years), multiple valve issues, an antiquated component replacement system (resulting in an annunciator control room fire in 2012), multiple serious safety culture issues (resulting in an alarming 'red finding' in 2001), and the repeated and severe multiple fuel failure incidents and fuel leakers – it is no wonder that citizens are concerned. Now, this new information that the NRC has allowed untested and far more radioactive High BurnUp Fuel, which is known to cause corrosion of fuel cladding and assemblies, and the fact that corrosion has been named as the root cause of the fuel cladding and assembly failures and fuel leakers there – in the early 1980s (causing the 1985 shutdown of all three reactor units (for 6, 10 and 22 years), in 1995 (with 4 fuel leakers when Unit 3 restarted), in 1998 (with 24 Unit 3 fuel leakers), and in 2002-2004 (with fuel failure again in Unit 3 and 63 bundle failures and at least 4 fuel failures in Unit 2)[12] – these fuel issues have certainly not increased our confidence in the safety of Tennessee Valley residents.

Online Real-Time Monitoring

One in three Americans now lives within fifty miles of a nuclear power plant, and they deserve to know when and where they are being exposed to potentially toxic radioactive poisons. Because multiple studies have determined that there is no safe dose of radiation, no threshold for danger to humans,[13, 14, 15, 16] we ask the NRC to protect the health and safety of the public by providing them real-time information on radiation levels in their communities, and when possible, pre-release alerts. It is time for the NRC to join the 21st century, and to reveal information about radiation releases and exposures to communities surrounding nuclear plants in real-time. The internet and monitoring technologies are solid, and accurate information will increase public confidence in the Nuclear Regulatory Commission and nuclear power.

Most operators have existing real-time radionuclide monitors in place (inside containment structures, at guard stations, and around perimeters), and some operators have monitors which cover wide-ranges surrounding the plants, but they are only required by the NRC to record averaged radionuclide readings quarterly, then report the averages annually. This averaging and delay of exposure data does not benefit the people exposed; and, as Dr. John Till testified before the NRC Commission, radioactive releases are public information that should be available on the web immediately.[17] It would cost very little, compared to the benefit in public confidence and safety, for operators to install additional real-time monitors that automatically upload data to the internet. Many public citizen groups are monitoring real-time online, since Fukushima revealed the inadequacy of our U.S. radiation monitoring system, but this monitoring of radionuclides should be done professionally with NRC oversight.

Thirdly, we propose that the NRC resolve to MAKE RADIATION VISIBLE by updating antiquated methods of reporting radionuclide monitoring. We suggest the following steps:

- Create an NRC web page to display real-time radiation monitoring data around nuclear facilities.
- Require that nuclear operators connect their existing real-time radionuclide monitoring system to this NRC webpage, to provide immediate transparency for the public.
- Require that nuclear operators upgrade their extended dosimeter monitoring stations to real-time radionuclide monitoring, to be linked to the NRC radiation monitoring webpage.

Now is the time to update outworn requirements for annual reports on quarterly monitoring data to utilize modern science, making radiation monitoring data available online in real-time. The EPA Radnet System[18] is providing near real-time air radiation data online, but the RadNet System is thinly scattered across the nation, monitors are not near nuclear facilities and the EPA does not really take responsibility for protecting United States citizens from radiation exposures – a task which IS the responsibility of the Nuclear Regulatory Commission. As noted, U.S. citizens have begun their own system of radiation

monitoring with real-time internet data uploads,[19] but this truly is the job of the NRC and EPA – to protect the public from exposure to commercially generated radiation.

In the mid-1970's both U.S. and Japanese officials were warned of major design flaws in the GE Mark I reactors by the design engineers themselves, three of whom resigned from General Electric in protest. Years before the 2011 Fukushima Daiichi disaster, Japanese officials were also made aware of three studies that warned of the danger of a tsunami flooding and cutting power to the GE Mark I plant (one study by the NRC, one by the Active Fault and Earthquake Research Center, and one by TEPCO). The Japanese response to the danger was much like our own NRC's repeated response – although studies are complete and conclusive, expert staff recommendations are not implemented by management, and probabilities are used to value corporate cost over human life and suffering.

An example of exemplary planning and inadequate oversight is the TVA monitoring program for the three GE Mark I reactors at the Browns Ferry Nuclear Power Plant in the Tennessee Valley. In addition to monitoring inside containment buildings, TVA established monitors at 16 compass points around the perimeter of the plant, positioned dosimeters at 16 points 4 to 5 miles from the plant, and additional dosimeter points up to 32 miles away. All told, 75 monitoring points were established. However, dosimeter readings are only taken quarterly and averages reported annually; and, as of the 2012 Browns Ferry Annual Radiological Report,[20] 33 of the 75 monitor locations reported no data. This represents a 44% failure rate – due to removal of monitors, malfunctions, or lack of data reporting. NRC also seems to overlook the fact that the reports include uncorrected gaps in data. As Union of Concerned Scientists Nuclear Safety Director David Lochbaum reminds us, “The NRC has breached its contract with the public by repeatedly tolerating unmonitored and uncontrolled leaks” of radioactivity into our water and air.[21]

Summary

Modern technology can now MAKE RADIATION VISIBLE with online real-time monitoring, emergency dye-markers, and public health alerts, and can thereby increase the health and safety of U.S. citizens and actually simplify the NRC and EPA tasks to protect and inform the public. We regularly have weather alerts, smog alerts and even pollen alerts. It is time to inform the public when these known carcinogens and DNA-altering toxins are being released into our air and water, just as we are alerted to other hazardous waste releases into our communities.

We propose:

- Dispersal of visible dyes with emergency radiation releases, providing immediate, direct warning of radioactive plume paths.
- Public health alerts for routine and emergency radiation releases into the public biosphere from power plants, mining, incineration, accidental releases, leaks, or spills.
- Real-time radiation monitoring, to coordinate and transparently report multiple-agency radioactive emissions data to the public, and nuclear operators posting real-time on-site monitoring data to the interagency monitoring website and upgrading area dosimeters to real-time radionuclide monitors.

Gretel Johnston
info@MakeRadiationVisible.org
MakeRadiationVisible.org

BEST/MATRR
best@matrr.org
Bellefonte Efficiency & Sustainability Team (BEST)
Mothers Against Tennessee River Radiation (MATRR)
MATRR.org – Because It Matters

[1] Norimitsu Onishi and Martin Fackler, “Japan Held Nuclear Data, Leaving Evacuees in Peril,” New York Times, Aug. 8, 2011, http://www.nytimes.com/2011/08/09/world/asia/09japan.html?_r=2&scp=1&sq=japan+radiation&st=cse

[2] Texas State Historical Commission. "New London School Explosion". http://www.stoppingpoints.com/texas/sights.cgi?marker=New+London+School+Explosion&cnty=rusk

[3] Elmer Robinson, J.A. MacLeod and C.E. Lapple, "A Meteorological Tracer Technique Using Uranine Dye"; Journal of Atmospheric Sciences, vol. 16, Issue 1, Feb. 1959, pp.63-67. http://adsabs.harvard.edu/abs/1959JAtS...16...63R

[4] J.O.G. Pecly and J.S.F. Roldäo, "Dye tracers as a tool for submarine outfall studies associated with Mathematical Modeling," *International Symposium on Outfall Systems, May15-18, 2011, Mar dell Plata, Argentina.* http://www.osmgp.gov.ar/symposium2011/Papers/11_Pecly.pdf

[5] Tracer Environmental Sciences & Technologies, Inc. (SCS Engineers), 25 years experience testing soil, gas, fluids and atmosphere. http://www.tracer-est.com/services02a974.html?id_svcs=8

[6] Tracy Kijewski-Correa et al, "Real-Time Plume Detection in Urban Zones Using Networked Sensing," Chemical and Biological Defense Physical Science and Technology Conference (CBD PS&T), New Orleans, LA, 17-21 Nov. 2008, http://www3.nd.edu/~pantsakl/Publications/386-CBDPS+T08.pdf

[7] DOE Research News, "Sandia airborne pods seek to trace nuclear bomb's origins: Modular units crossing 'Valley of Death' for Air Force use", Jan. 2013, http://www.eurekalert.org/features/doe/2013-01/dnl-sap011513.php

[8] Ian Fairlie, MD, “Infant Leukemias Near Nuclear Power Stations,” CND London, Jan. 2010, www.cnduk.org/campaigns/anti-war/item/download/42

[9] Peter Kaatsch, Claudia Spix, Irene Jung, Maria Blettner, “Childhood Leukemia in the Vicinity of Nuclear Power Plants in Germany,” Journal of the German Medical Association, Dtsch Arztebl Int 2008; 105(42), http://www.aerzteblatt.de/pdf.asp?id=62000

[10] Ian Fairlie, “Recent Evidence of the Risks of Low-Level Radiation,” Jan. 2013, http://www.ianfairlie.org/news/recent-evidence-on-the-risks-of-very-low-level-radiation/

[11] Rosalie Bertell, *No Immediate Danger: Prognosis for a Radioactive Earth*, Part 1, “Nuclear Radiation and Its Biological Effects,” 1985, pg. 34, http://www.ratical.org/radiation/NRBE/NRadBioEffects.html

[12] Electric Power Research Institute (EPRI), *Browns Ferry Corrosion Failure Data Assessment:* Abstract of Nuclear Technical Report on Browns Ferry Unit 3 poolside inspection of Cycle 8 (1998) fuel rods showed CILC corrosion caused the failures of 24 GE 8x8 fuel rods resulting in 24 fuel leakers, Sept. 27, 2012 Program 41.02.01, Fuel Reliability (QA), http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001025191

[13] National Academy of Sciences, "Health Risks from Exposure to Low Levels of Ionizing Radiation," *Biological Effects of Ionizing Radiation BEIR VII Phase 2* report, page 311. http://www.nap.edu/openbook.php?record_id=11340&page=311

[14] Herbert Abrams, M.D., “Hazards of Ionizing Low Level Radiation: Controversy and Evidence,” presentation at the “Medical and Ecological Consequences of the Fukushima Nuclear Accident Symposium”, March 11-12, 2013, http://www.totalwebcasting.com/view/?id=hcf#

[15] Anders Pape Møller and Timothy A. Mousseau, “The Effects of Low-Dose Radiation,” *Significance Magazine*, The Royal Statistical Society, Feb. 2013, http://www.significancemagazine.org/details/magazine/4370861/The-effects-of-lowdose-radiation-Soviet-science-the-nuclear-industry--and-indepe.html

[16] European Committee on Radiation Risk (ECRR), “Health Effects of Exposure to Low Doses of Ionizing Radiation,” Regulators’ Edition, Brussells 2010, http://www.euradcom.org/2011/ecrr2010.pdf

[17] John Hill, PhD, testimony to the NRC during Groundwater Protection Workshop, October 4, 2010, http://pbadupws.nrc.gov/docs/ML1028/ML102861795.pdf

[18] U.S. Environmental Protection Agency (EPA), EnviroFacts: RadNet National Network, http://www.epa.gov/enviro/facts/radnet/index.html

[19] MineraLab, LLC, Radiation Network real-time online maps, http://www.radiationnetwork.com

[20] TVA, “Annual Radiological Environmental Operating Report, Browns Ferry Nuclear Plant, 2012”, May 2012. http://pbadupws.nrc.gov/docs/ML1314/ML13140A042.pdf

[21] David Lochbaum, “Regulatory Roulette: The NRC’s Inconsistant Oversight of Radioactive Releases from Nuclear Power Plants”, Union of Concerned Scientists, 2010, http://www.ucsusa.org/assets/documents/nuclear_power/nuclear-power-radioactive-releases.pdf