This Book is

Made

out of Rice Straw Grown
on Decontaminated Fields

in Fukushima

Made in Fukushima

“The numbers prove that the rice is safe. But not everyone can read scientific data. We need to come up with a different way, something unique to help people understand.”

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

Table of Contents

6–7

00 Introduction

Dr. Colin Campbell,
VP Environment, METER Group

[1]

[1] Dr. Campbell and
Dr. Mizoguchi in Iitate.

Seven years ago, I paused at the top of a hill alongside my close friend Dr. Masaru “Mizo” Mizoguchi to look out at an overgrown sign that read “Iitate Village”. Less than a year before, around 40 kilometers away, a tsunami, spawned by an earthquake, struck the Fukushima Daiichi power plant, resulting in a nuclear meltdown and one of the biggest ecological disasters in history.

As we descended to the outskirts of the village, we passed a newly built school shrouded in silence. No cars traversed the winding roads, no tractors worked the fertile soil, no cattle sat placidly in the sun. I was overcome by a profound sadness for the lost community.

Radiation contamination was ubiquitous, and while homes and gardens were decontaminated by thousands of volunteers from around the world immediately after the disaster, everything else remained in stasis, waiting for the government to decide what to do next. Meanwhile, Mizo, head of the agricultural department at The University of Tokyo, had an idea. Sitting around a table littered with tea cups and biscuits, he and our fellow scientists from Japan’s most

0.0007

mSv
Background radiation exposure while reading this book

0.0646

mSv
Cosmic radiation exposure on flight from Seattle to Tokyo

400

mSv
Maximum radiation exposure measured per hour at Fukushima Daiichi power plant on March 14, 2011

prestigious universities discussed with an Iitate Village farmer named Ocobo-san how to revive his land and livelihood. The solution was born of soil physics – and stunningly simple: cesium is bound to clay particles in the soil. Clay floats on water. If you stir up the topsoil during flood irrigation, the clay-cesium compound would rise to the top and could be drained off into a pit. The farmland would then be ready for growing again.

METER had already provided instruments for Fukushima farmers to monitor atmospheric and soil conditions. Now we were excited to contribute our efforts and resources in a different capacity: to bring the farmland out of hibernation. I felt renewed hope.

We returned the next spring with METER equipment to test different decontamination approaches. Our boots sinking deep into the flooded soil, we placed barriers between different treatment areas while other volunteers drained water from the field. Taking a break from the hot, backbreaking work, we used a METER infiltrometer to test how water would infiltrate the soil in an adjacent field.

The Japanese government had decontaminated it by removing the topsoil and replacing it with crushed granite. This method was fast, but it made farming impossible: topsoil contains most of the organic material needed to grow crops. Additionally, much of the removed radioactive waste was now stacked in black plastic bags all over Fukushima Prefecture.

The day culminated in a home-cooked meal, prepared by some of the group, spread across a tarp in front of Ocobo-san’s house. As night fell, we listened to Ocobo-san’s 100-year-old grandfather sing ancient village songs that spoke of rebirth and spring●

01 The Evergreen State

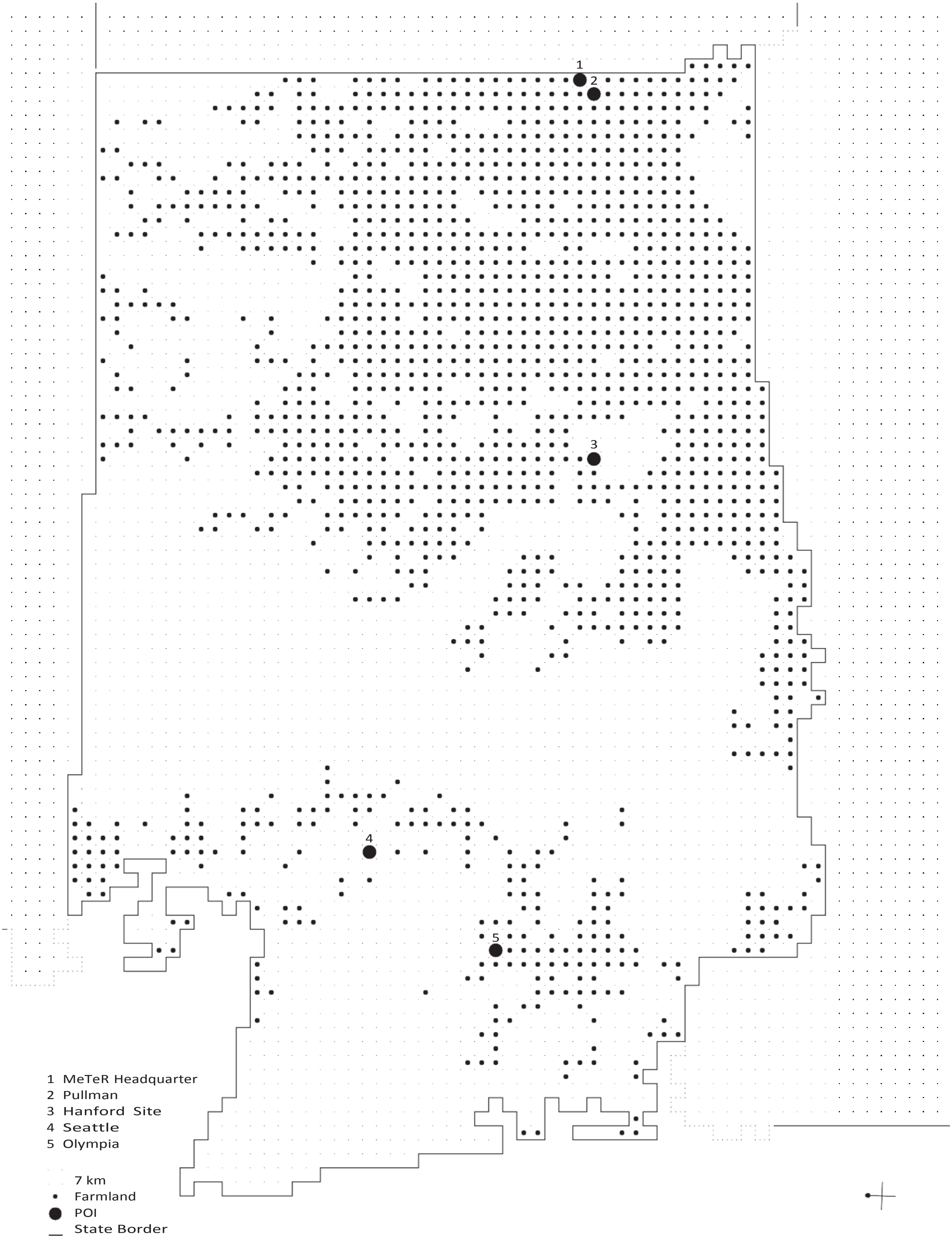
Washington, U.S.

14–15

[1]

[1] The rolling hills of the Palouse region are characteristic of southeastern Washington.

[2] The hills consist of fertile loess soil, which makes the area perfect for farming.


1
2
3
4
5
1 MeTeR Headquarter
2 Pullman
3 Hanford Site
4 Seattle
5 Olympia
7 km
Farmland
POI
State Border

1 in 10

People
Residents that work in STeM

1 in 3

km^2
Land mass that is farmland

Olympia

Capital

Seattle

Largest city

172,120

km^2
Total land mass

59,683

km^2
Farmland

7,535,591

Population

44

People per km^2

02 Home of METER

Pullman, Washington

In southeastern Washington lies the town of Pullman, surrounded by rolling hills of rich loamy soil. Wheat grown in this soil yields up to 100 bushels per hectare – twice the national average – and abundant rain means no need for irrigation. In fact, 90% of America's lentils are grown in this area.

At the heart of Pullman is Washington State University, a land-grant university founded in 1892 that continues to focus on the intersection of agriculture with STEM (science, technology, engineering, and mathematics).

Physicist Gaylon Campbell has been involved in agricultural and environmental research since the early 1960s. If the right measurement device did not yet exist, Campbell invented it himself. One of the devices he created, the Thermocouple Psychrometer, allowed him to study water relations in the fertile soil of the Palouse. As time went by, Dr. Campbell's invention quickly gained notice in the scientific community. Fellow scientists asked him to make thermocouple psychrometers for them to use. Growing demand for his instruments led to the creation of Decagon Devices in the early 1980s. In 1985, the company moved from the Campbell basement into its own building and hired its first employees. As the business grew, the scientific focus was enriched by engineering, which resulted in new instruments for environmental scientists and the agricultural industry as well as for food production. By 2000, Decagon employed 100 people.

In 2016, the company teamed up with the Munich-based fellow scientific sensor producer UMS to form the METER Group. From its Pullman headquarters, Gaylon Campbell‘s sons Scott and Colin continue to run the family business as CEO and VP of Environment. Today, METER products are used in universities and research laboratories and by farmers and food manufacturers all around the world. They can be found across Africa through TAHMO, the first trans-African weather station network, on Mars as part of the Phoenix lander, and in Fukushima Prefecture reviving agriculture●

1983

Year MeTeR was founded

1996

Year the first MeTeR sensor was installed at Fukushima Prefecture

2008

Year the first MeTeR sensor was used on Mars


[1]

[1] A MeTeR employee takes a look at crops on a client visit.

[2] MeTeR scientists conduct soil experiments in Brazil.

[3] The Campbell family breaks ground in Pullman.

[4] MeTeR's first individual company headquarters in Pullman.

[5] The founder of MeTeR, Dr. Gaylon Campbell.


[2]

[3]

[4]

[5]

800,000

Number of MeTeR environmental sensors produced since 1983

236

Number of MeTeR environmental sensors installed in Fukushima Prefecture today

35

Number of environmental factors MeTeR sensors can measure

[6]

[6] MeTeR's ATMOS 41 weather station can measure 12 environmental parameters.

[7] The PHYTOS 31 measures leaf wetness to prevent diseases.

[8] MeTeR scientist with soil samples in the lab.

[9] The KSAT is a device that measures the flow of water through soil.

[7]

[8]

[9]

03 The Most Toxic Place in America

Hanford Site, Washington

In 1943, in the middle of World War II, the U.S. government transformed a remote area in Washington's Columbia River Basin into a giant production facility for nuclear fuel. It would ultimately become the most contaminated site in the Western Hemisphere. The U.S. government confiscated over 200,000 hectares and turned it into the Hanford Site. Huge processing plants were built to extract plutonium that was later used in the 1945 "Fat Man" atomic bomb, which was detonated over the Japanese city of Nagasaki.

Nuclear waste from these efforts was processed in ponds and buried in underground storage tanks. Decades passed before the environmental consequences came to light and soil scientists understood the principles needed to remediate the problem. In the mid-1980s, the U.S. government finally began to address the decontamination of the Hanford Site and plan for the long-term storage of the nuclear waste. Dr. Gaylon Campbell was one of the soil scientists asked to consult on this project, bringing his expertise in water movement through soil to the task of protecting the Columbia River area from nuclear contamination●

390

Million USD
Budget to build the
Hanford Site

323

Billion USD
Budget to clean up the
Hanford Site

9

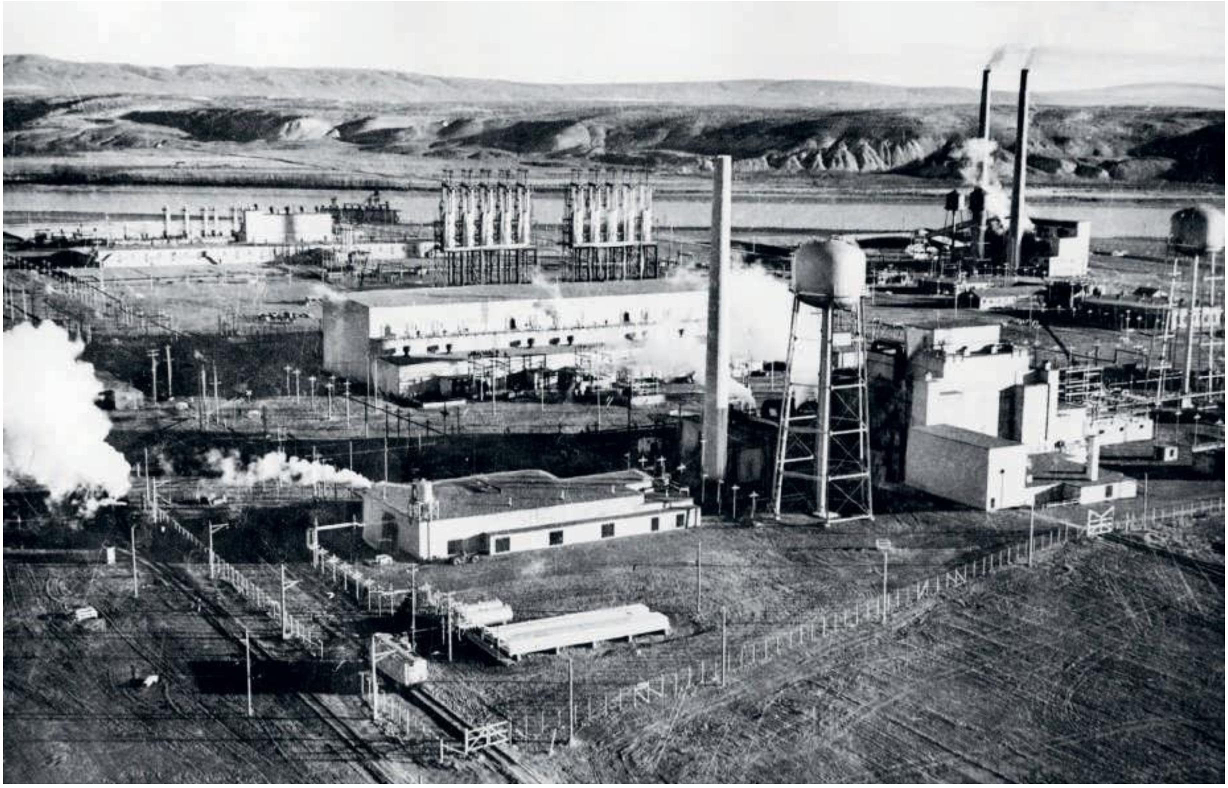
Number of nuclear reactors
at the Hanford Site

25.1

GW
Power potential of all reactors at
the Hanford Site combined

239

km
Distance from Pullman
to the Hanford Site



[1]

[2]

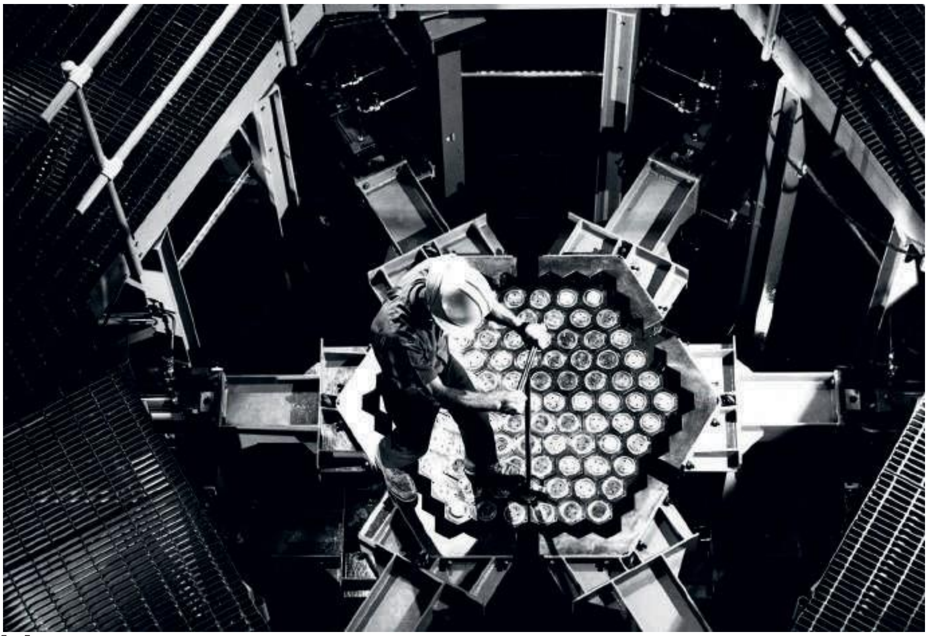
[1] The Hanford engineering Plant (now Hanford Site) in 1945.

[2] Workers measure radiation levels at waste site in 1988.

[3] The Fat Man atomic bomb before being dropped on Nagasaki in 1945.

[4] An engineer at the Hanford Site's Fast Flux Test Facility in 1971.

[3]



[4]

04 Radioactivity

Basics, Physics, and Effects

Definition

Radioactivity is the spontaneous emission of energy as electromagnetic waves or moving subatomic particles. It occurs when an atomic nucleus is energetically unstable and releases some of its energy to achieve balance. Radioactivity occurs naturally in some elements but can also be generated artificially by adding energy to stable atoms.

Applications

Medicine
- CT / PET / X-ray scans
- Cancer treatment
- Diagnostics

Science
- Biological research
- Environmental research
- Geological research

Industry
- Power generation
- Detection of material thickness
- Food treatment

Surveillance
- Metal detectors
- Full-body screening
- Baggage screening

Radioactive Elements in Periodic Table

1								
3	4							
11	12							
19	20	21	22	23	24	25	26	27
37	38	39	40	41	42	43 Tc	44	45
55	56	57 /71	72	73	74	75	76	77
87 Fr	88 Ra	89 /103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt
	Lanthanide Series	57	58	59	60	61 Pm	62	63
	Actinide Series	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am

								2
			5	6	7	8	9	10
			13	14	15	16	17	18
28	29	30	31	32	33	34	35	36
46	47	48	49	50	51	52	53	54
78	79	80	81	82	83	84 Po	85 At	86 Rn
110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
64	65	66	67	68	69	70	71	
96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

Radioactive Elements and Atomic Weights

[43] Technetium 98

[61] Promethium 145

[84] Polonium 209

[85] Astatine 210

[86] Radon 222

[87] Francium 223

[88] Radium 226

[89] Actinium 227

[90] Thorium 232.038

[91] Protactinium 231.036

[92] Uranium 238.029

[93] Neptunium 237

[94] Plutonium 244

[95] Americium 243

[96] Curium 247

[97] Berkelium 247

[98] Californium 251

[99] Einsteinium 252

[100] Fermium 257

[101] Mendelevium 258

[102] Nobelium 259

[103] Lawrencium 266

[104] Rutherfordium 267

[105] Dubnium 268

[106] Seaborgium 271

[107] Bohrium 270

[108] Hassium 269

[109] Meitnerium 278

[110] Darmstadtium 281

[111] Roentgenium 282

[112] Copernicium 285

[113] Nihonium 286

[114] Flerovium 289

[115] Moscovium 289

[116] Livermorium 293

[117] Tennessine 294

[118] Oganesson 294

Radioactive Isotopes and Half-Lives

YOCTOSeCONDS (10^{-24})

HYDROGeN-7	23
HYDROGeN-5	80
HYDROGeN-4	139
NITROGeN-10	200
HYDROGeN-6	290
LITHIUM-5	304
BORON-7	350
OxYGeN-12	580
NITROGeN-11	590
NITROGeN-11M	690
LITHIUM-4	756
HeLIUM-5	760

ZePTOSeCONDS (10^{-21})

SODIUM-18	1.34
HeLIUM-10	1.52
LITHIUM-10	2
CARBON-8	2
HeLIUM-7	3.04
BeRYLLIUM-6	5
HeLIUM-9	7
BORON-9	80

ATTOSeCONDS (10^{-18})

BeRYLLIUM-8	81.9

PICOSeCONDS (10^{-12})

BORON-16	190
BeRYLLIUM-13	500

NANOSeCONDS (10^{-9})

LITHIUM-12	10
BORON-18	26
CARBON-21	30
BeRYLLIUM-15	200
BeRYLLIUM-16	200
POLONIUM-212	299

MICROSeCONDS (10^{-6})

DARMSTADTIUM-267	3
NOBeLIUM-250	5.7
RUTHeRFORDIUM-254	23
DARMSTADTIUM-270	160
POLONIUM-214	164
DARMSTADTIUM-273	170
DARMSTADTIUM-269	230
COPeRNICIUM-277	240
NIHONIUM-278	340
FeRMIUM-258	370
HASSIUM-264	540
FeRMIUM-241	730
HASSIUM-263	760
eRMIUM-242	800
OGANeSSON-294	890

MILLISeCONDS (10^{-3})

HASSIUM-265	2
BORON-19	2.92
MeITNeRIUM-266	3.4
RADON-196	4.7
BORON-17	5.08
CARBON-22	6.2
OxYGeN-13	8.58
LITHIUM-11	8.59
BORON-15	9.87
NITROGeN-12	11
BORON-14	12.5
NITROGeN-22	13.9
NITROGeN-23	14.5
CARBON-20	16
BORON-13	17.33
BORON-12	20.2
BeRYLLIUM-12	21.49
CARBON-19	46.2
OxYGeN-24	65
OxYGeN-23	82
NITROGeN-21	87
CARBON-18	92
BOHRIUM-262	102
HeLIUM-8	119
CARBON-9	126.5
NITROGeN-20	130
LITHIUM-9	178.3
NITROGeN-19	271
CARBON-17	193
NITROGeN-18	622
CARBON-16	747
BORON-8	770
HeLIUM-6	806.7
LITHIUM-8	839.9
LUTeTIUM-153	900

SeCONDS (10^{0})

OxYGeN-22	2.25
CARBON-15	2.449
FLeROvIUM-289	2.6
OxYGeN-21	3.42
NITROGeN-17	4.173
BeRYLLIUM-14	4.84
NITROGeN-16	7.13
OxYGeN-20	13.51
BeRYLLIUM-11	13.81
CARBON-10	19.29
OxYGeN-19	26.464
DUBNIUM-261	27
SeABORGIUM-266	30
DUBNIUM-262	34
OxYGeN-14	70.598
RUTHeRFORDIUM-261	81
NOBeLIUM-253	97
OxYGeN-15	122.24
COPPeR-62	580.4
NITROGeN-13	597.9
MeRCURY-210	600

KILOSeCONDS (10^{3})

CARBON-11	1.2200
NOBeLIUM-259	3.5
FLUORINe-18	6.586
MeNDeLevIUM-257	19.9
eRBIUM-165	37.3
SODIUM-24	53.9
FeRMIUM-252	91.4
eRBIUM-160	102.9
GOLD-198	232.8
NePTUNIUM-239	203.6
FeRMIUM-253	260
GOLD-199	273.8
RADON-222	330.35
CALCIUM-47	391.9
MANGANeSe-52	483.1
GOLD-196	534.2
IODINe-131	693
THULIUM-167	799

MeGASeCONDS (10^{6})

PHOSPHORUS-32	1.235
vANADIUM-48	1.38011
CALIFORNIUM-253	1.539

CHROMIUM-51	2.39350
MeNDeLevIUM-258	4.45
BeRYLLIUM-7	4.590
CALIFORNIUM-254	5.23
COBALT-56	6.676
SCANDIUM-46	7.239
SULFUR-35	7.544
THULIUM-168	8.04
FeRMIUM-257	8.68
THULIUM-170	11.11
POLONIUM-210	11.9
CALCIUM-45	14.06
GOLD-195	16.08
ZINC-65	21.06
COBALT-57	23.483
vANADIUM-49	29
CALIFORNIUM-248	28.81
RUTHeNIUM-106	32.3
NePTUNIUM-235	34.2
CADMIUM-109	40
THULIUM-171	61
CAeSIUM-134	65.17
SODIUM-22	82.1
IRON-55	86.4
RHODIUM-101	100
COBALT-60	166.35
KRYPTON-85	339.4
HYDROGeN-3	389
CALIFORNIUM-250	413
NIOBIUM	509
STRONTIUM-90	909
CURIUM-243	920
CAeSIUM-137	952

GIGASeCONDS (10^9)

TITANIUM-44	2.0
URANIUM-232	2.17
PLUTONIUM-238	2.77
SAMARIUM-151	3.05
NICKeL-63	3.16
SILICON-32	5.4
ARGON-39	8.5
CALIFORNIUM-249	11.1
SILveR-108	13.2
AMeRICIUM-241	13.64
MeRCURY-194	14.0
NIOBIUM-91	21
CALIFORNIUM-251	28.3
HOLMIUM-166 M1	38
BeRKeLIUM-247	44
RADIUM-226	50
MOLYBDeNUM-93	130
HOLMIUM-153	144
CURIUM-246	149
CARBON-14	181
PLUTONIUM-240	207.1
THORIUM-229	232
AMeRICIUM-243	233
CURIUM-245	270
CURIUM-250	280
NIOBIUM-94	640
PLUTONIUM-239	761

TeRASeCONDS (10^{12})

PROTACTINIUM-231	1.034
LeAD-202	1.66
LANTHANUM-137	1.9
THORIUM-230	2.379
NICKeL-59	2.4
CALCIUM-41	3.3
NePTUNIUM-236	4.9
URANIUM-233	5.02
RHeNIUM-186 M	6.3
TeCHNeTIUM-99	6.66
KRYPTON-81	7.2
TIN-126	7.3
URANIUM-234	7.75
PLUTONIUM-242	8.59
CHLORINe-36	9.5
CURIUM-248	11
BISMUTH-208	11.6
ALUMINIUM-26	22.6
SeLeNIUM-79	36
IRON-60	82
BeRYLLIUM-10	43
ZIRCONIUM-93	48
GADOLINIUM-150	56
NePTUNIUM-237	67.7
CAeSIUM-135	73
TeCHNeTIUM-97	82
DYSPROSIUM-154	95
BISMUTH-210 M	96
MANGANeSe-53	120
TeCHNeTIUM-98	130
PALLADIUM-107	210
HAFNIUM-182	280
LeAD-205	480
CURIUM-247	490
IODINe-129	500
URANIUM-236	739

PeTASeCONDS (10^{15})

NIOBIUM-92	1.10
SAMARIUM-146	2.1
PLUTONIUM-244	2.5
URANIUM-235	22.21
POTASSIUM-40	40.3
URANIUM-238	141.0
THORIUM-232	443.6

exASeCONDS (10^{18})

LUTeTIUM-176	1.21
RHeNIUM-187	1.3002 ± 0.0063
RUBIDIUM-87	1.554
LANTHANUM-138	3.2
SAMARIUM-147	3.3
PLATINUM-190	20.51 ± 0.95

ZeTTASeCONDS (10^{21})

GADOLINIUM-152	3.4
INDIUM-115	13.9
HAFNIUM-174	63
OSMIUM-186	63
NeODYMIUM-144	72
SAMARIUM-148	220
CADMIUM-113	240

YOTTASeCONDS (10^{24})

vANADIUM-50	4.4 ± 1.3
LeAD-204	4.4
TUNGSTeN-180	56.8 ± 6.3
eUROPIUM-151	160
NeODYMIUM-150	210
MOLYBDeNUM-100	270
BISMUTH-209	600 ± 63
ZIRCONIUM-96	630
CADMIUM-116	980 ± 130

SeCONDS (10^{27})

CALCIUM-48	1.4
SeLeNIUM-82	3.1
TeLLURIUM-130	25
BARIUM-130	50
GeRMANIUM-76	57
xeNON-136	75
KRYPTON-78	290

SeCONDS (10^{30})

TeLLURIUM-128	69.4 ± 9.5

Early History

1895	Wilhelm Röntgen discovers X-rays.	While exploring the path of electric current, German physicist Wilhelm Röntgen realizes that he can use electromagnetic waves to produce an image of the bones in his wife's hand.
1898	Marie and Pierre Curie discover radium and polonium.	After studying uranium and its changes over time, Marie Curie dubs the phenomenon "radioactivity". Further studies lead her and her husband, Pierre, to discover two new elements: radium and polonium.
1933	Irene and Frederic Joliot-Curie discover artificial radioactivity.	By bombarding boron, aluminum, and magnesium with alpha particles, Irene and Frederic Joliot-Curie create the first man-made isotopes.
1945	U.S. creates first atomic weapons.	The U.S. uses fission, a newly discovered process which generates immense energy, to create the first atomic bombs. They drop these bombs on the cities of Hiroshima and Nagasaki to end World War II.
1954	First nuclear power plant generates commercial electricity.	In Obninsk, the Soviets connect the nuclear power plant APS-1 to the power grid. With an electrical output of 5 MW, it becomes the first commercial nuclear power plant to generate electricity.

Nuclear Fission

Fission is the process in which the nucleus of an atom splits into two smaller nuclei, either through natural decay or when instigated within a lab, and it releases a great amount of energy.

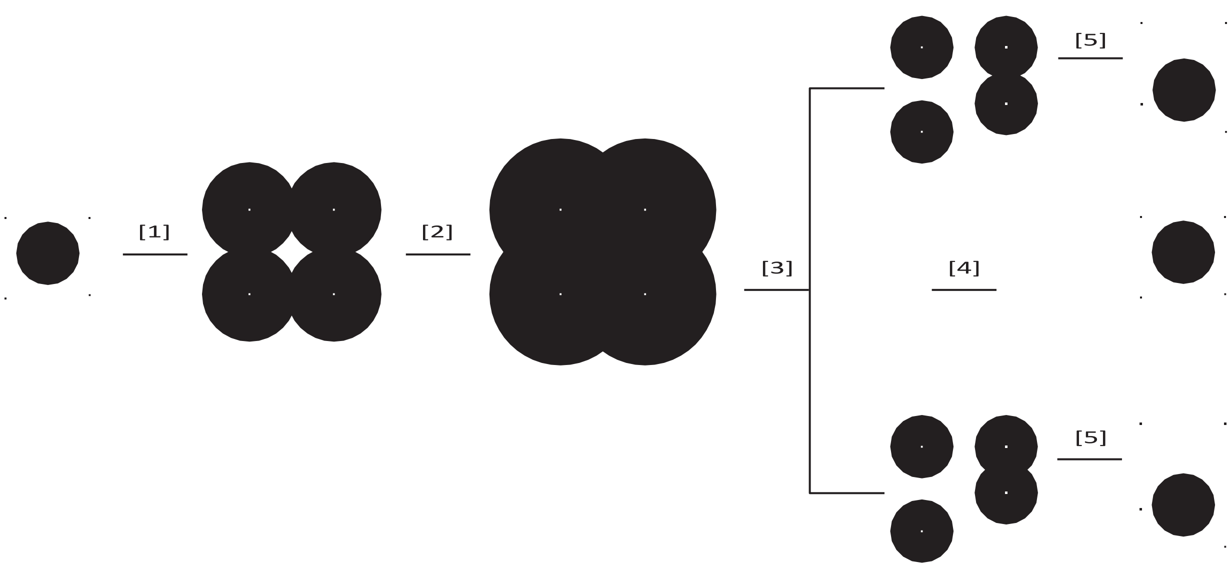
[1] A particle strikes the nucleus and is absorbed.

[2] The absorbed particle causes the nucleus to undergo deformation. In about 10–14 seconds, one of the deformations is so dramatic that the nucleus cannot recover.

[3] The nucleus fissions, releasing an average of two to three neutrons.

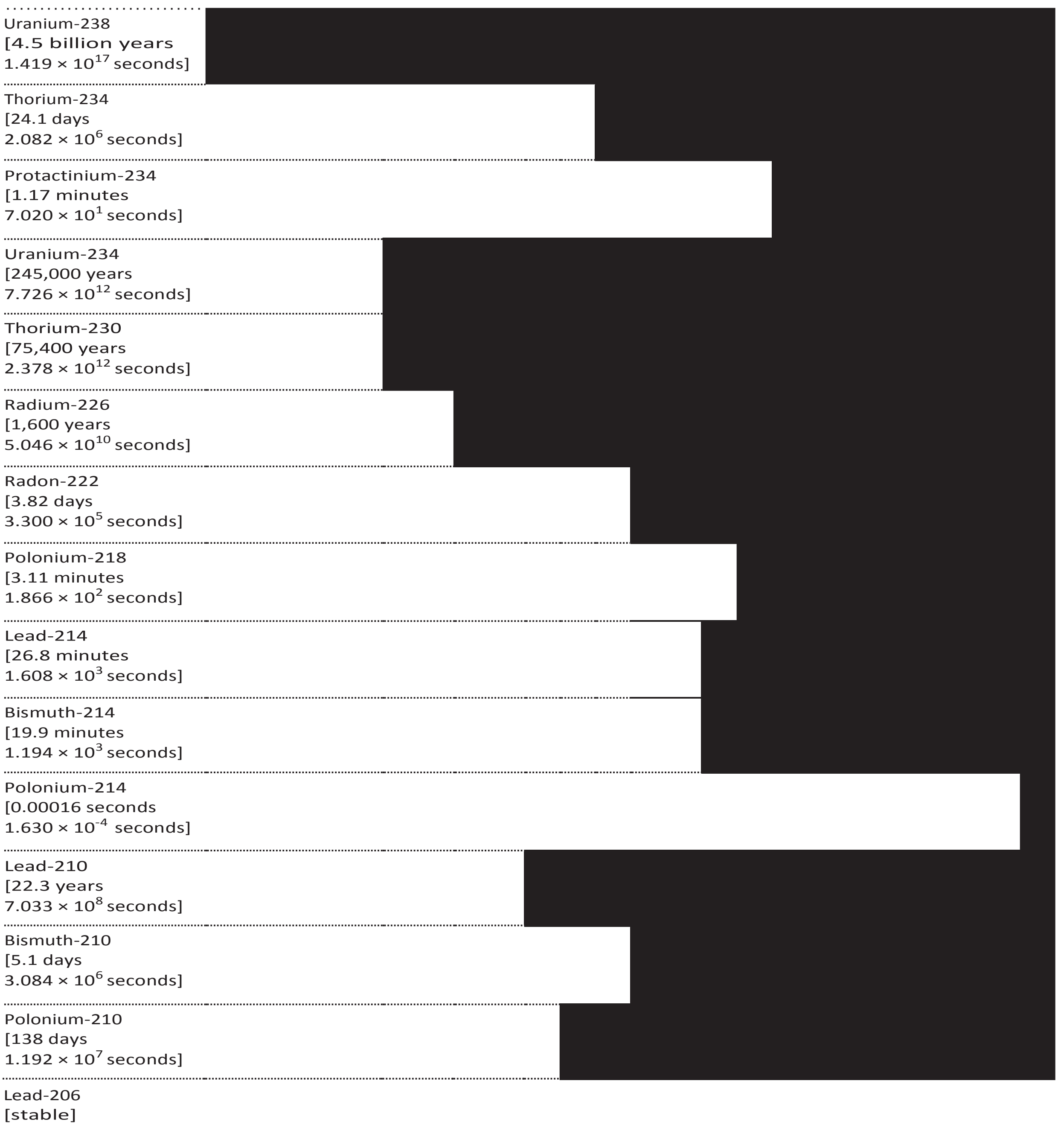
[4] In about 10–12 seconds, the fission fragments lose their kinetic energy and come to rest, emitting a number of gamma rays. Now the fragments are called fission products.

[5] The fission products lose their excess energy by radioactive decay, emitting particles over a varying time period (seconds to years).



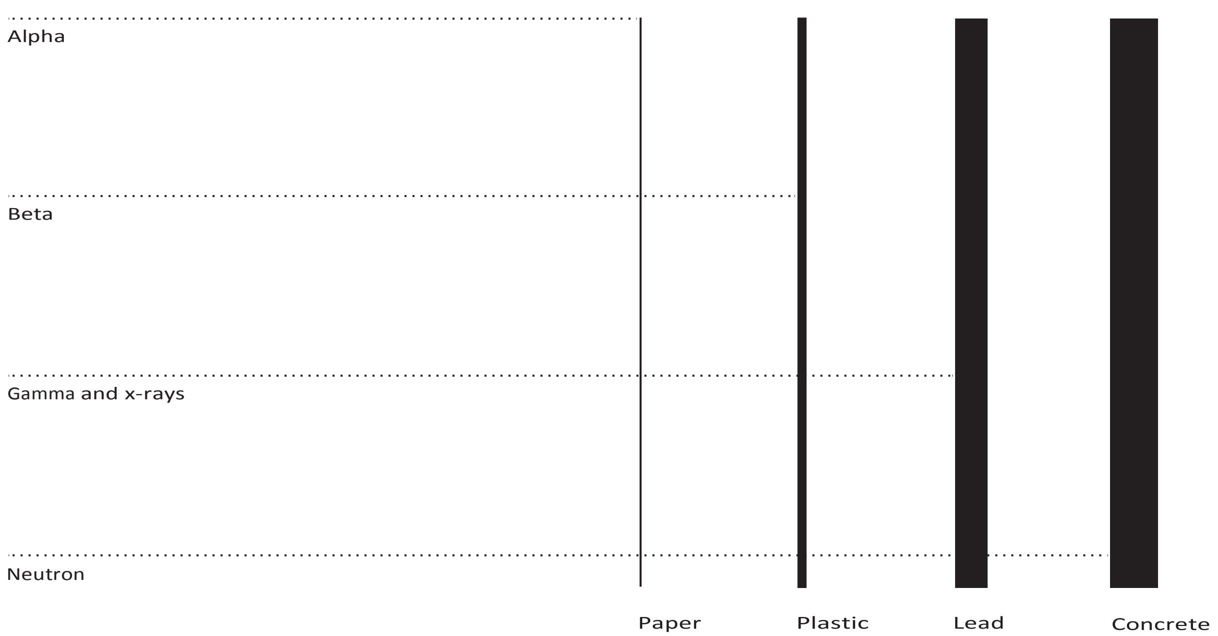
Decay and Half-Life

The natural process of radioactive elements turning into a different element or isotope is called decay and is measured in half-lives. A half-life is the time it takes for one half of any specified amount of an isotope to decay. It is used over "whole life" because an isotope's life span is random, inestimable, and essentially infinite. This chart shows the natural decay of uranium-238 toward stability.



Ionizing Radiation

As radioactive materials decay, they can release alpha particles, beta particles, gamma rays, X- rays, and neutrons. All emissions lose intensity as they travel further away from the initial radioactive material and can be absorbed by substances in their path, and they all penetrate materials in different ways.



Effect on DNA

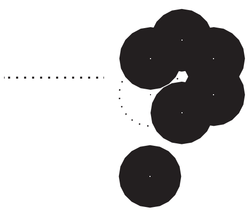
Ionizing radiation – the kind that minerals, atomic bombs, and nuclear reactors emit – does one main thing to the human body: it weakens and breaks up DNA, either damaging cells enough to kill them or causing them to mutate in ways that may eventually lead to cancer.

[1] Ionizing radiation leads to formation of free radicals – atoms and molecules missing an electron – in cells.

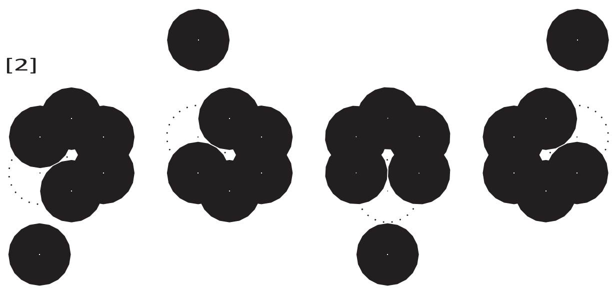
[2] Free radicals try to take away the missing electron from other bonds, causing a chain reaction of free radical formation.

[3] The integrity of cells and DNA molecules is disrupted.

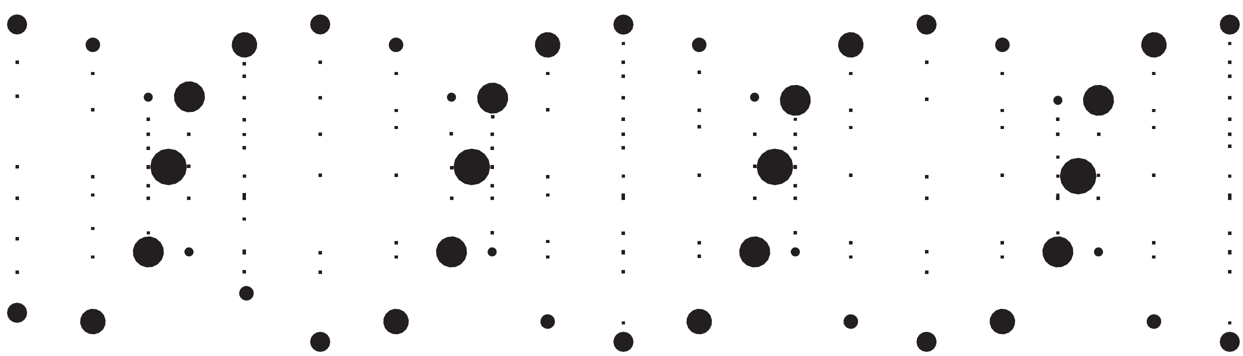
[1]



[2]



[3]



Units

Radioactivity is often measured in sieverts (Sv) or becquerels (Bq). Sieverts measure ionizing radiation dose and are used to communicate possible danger. Becquerels measure the rate of disintegration and are mainly used for scientific purposes.

1,000,000,000,000 Bq =
1,000,000,000 kBq =
1,000,000 MBq =
1,000 GBq =
1 TBq

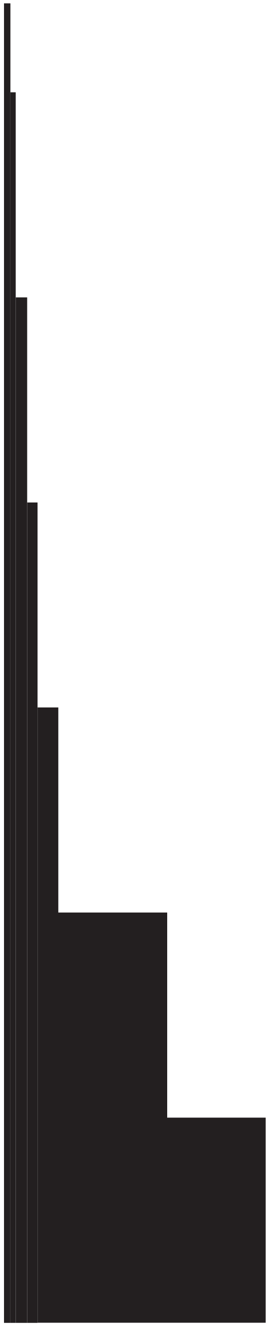
1 Sv =
1,000 mSv =
1,000,000 µSv =
1,000,000,000 nSv

Dosage

0.100 nSv	eating a banana
0.250 nSv	Maximum permitted at airport security scan
5.0 μSv	Dental x-ray
7.5 μSv	One day in Tokyo (June 26, 2011)
10 μSv	Background radiation received by an average person on an average day
40 μSv	Flight from New York to LA

exPOSURe	INSTANT	HOURS	DAY	YeAR
50 μSv		One hour at Chernobyl in 2010		
70 μSv				Living in a stone, brick, or concrete building for a year
100 μSv	Chest x-ray	One hour near the Fukushima Daiichi power plant (June 3, 2011)		
250 μSv				Release limit for a nuclear power plant for a year
400 μSv				Annual dose for an average person from food
1.5 mSv		One hour at Fukushima Daiichi power plant (March 12, 2011)		

2.4 mSv	Background radiation received by an average person per year
10 mSv	Average CT scan
36 mSv	Smoking 1.5 packs of cigarettes a day for a year
100 mSv	Lowest annual dose where increased lifetime risk of cancer is evident
400 mSv	Maximum radiation level measured per hour at Fukushima Daiichi power plant (March 14, 2011)
1 Sv	Temporary radiation sickness, not fatal



exPOSURe	INSTANT	HOURS	DAY	YeAR
2 Sv	Highly targeted dose used in conventional radiotherapy			
4 Sv		Severe damage, fatal within 4–6 weeks if untreated		
6 Sv		Fatal within 2–4 weeks if untreated		
10 Sv		Fatal within 2 weeks		
30 Sv		Fatal within 48 hours		
50 Sv	10 minutes next to the Chernobyl reactor core after meltdown			

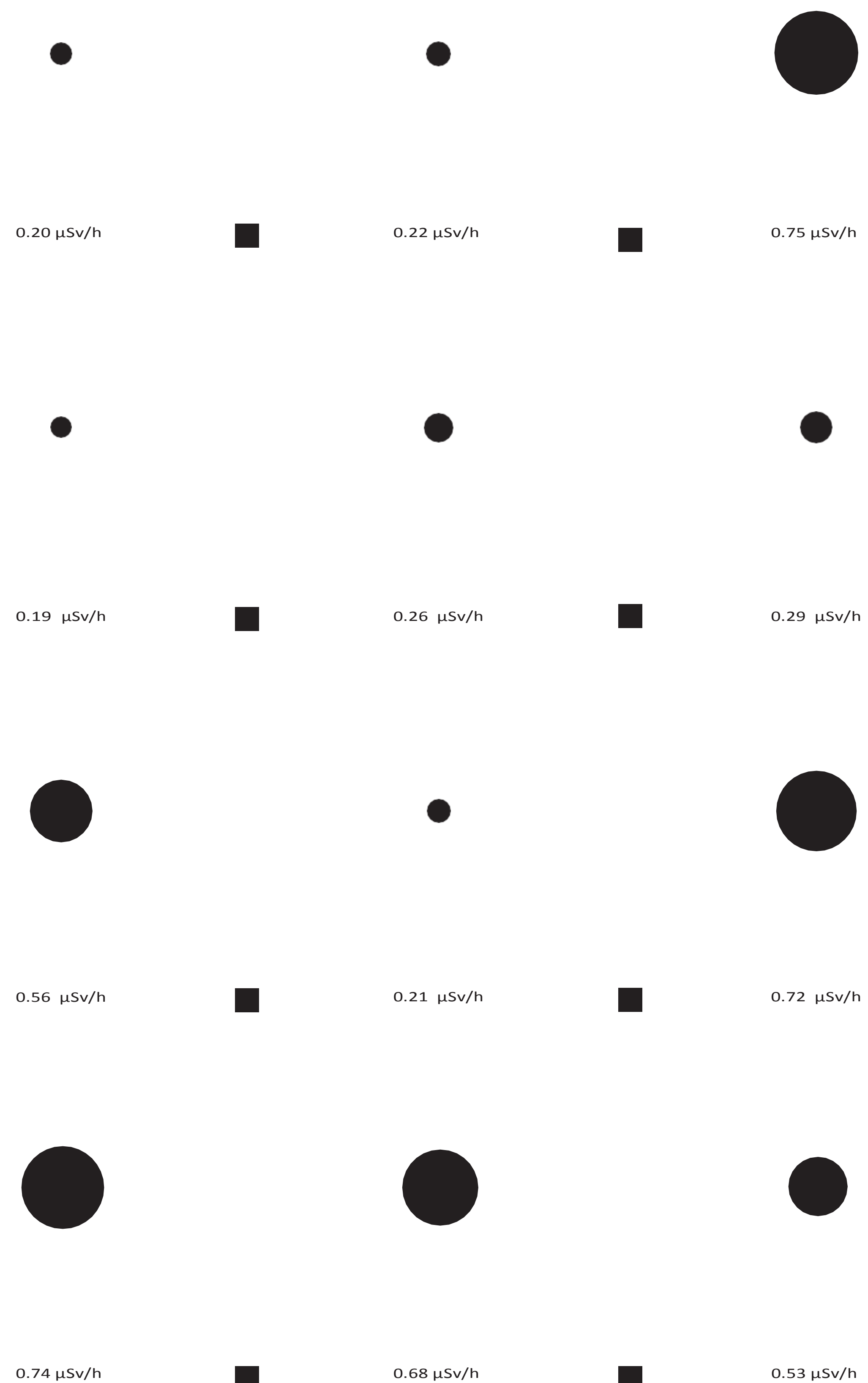
05 The Fruit Kingdom

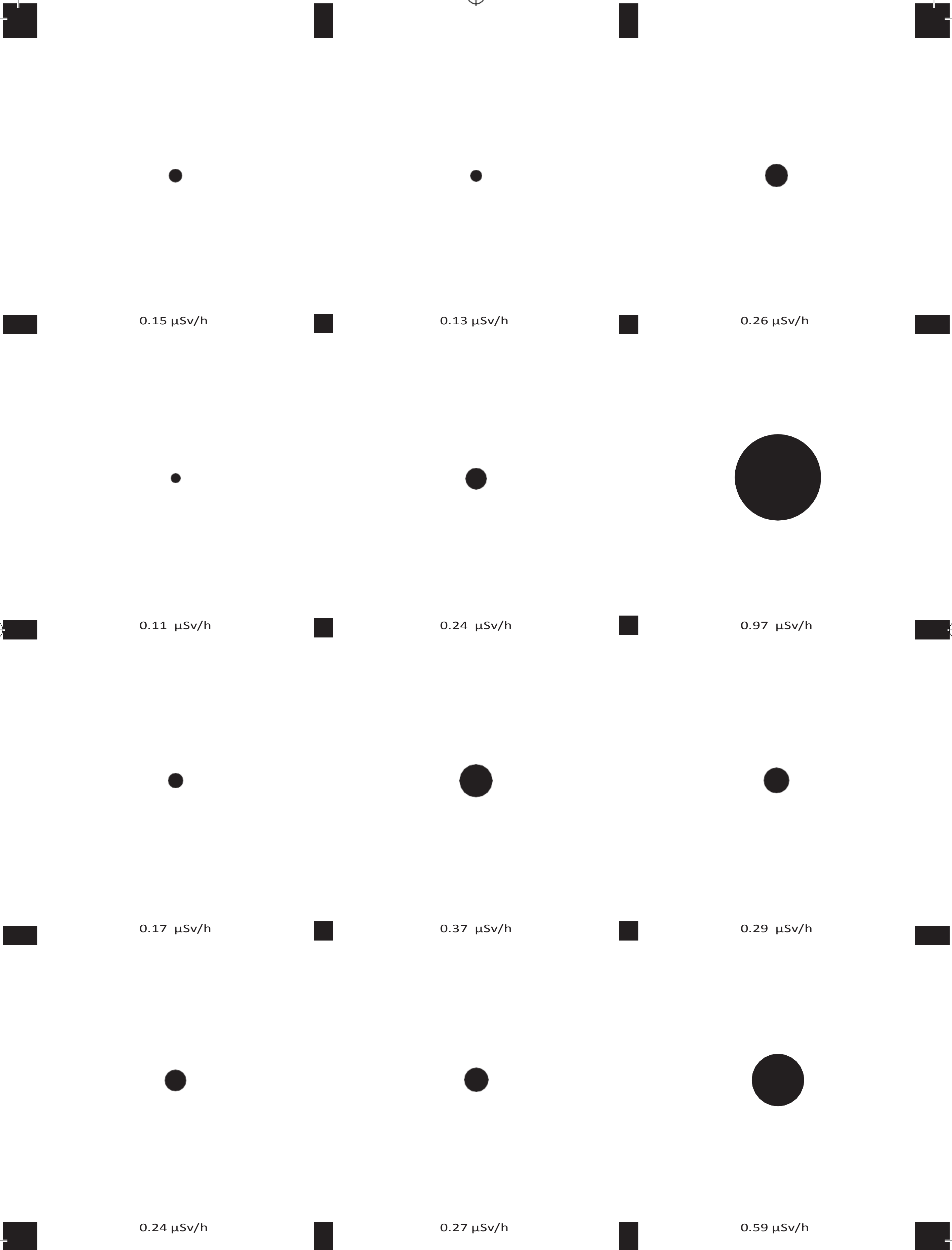
Fukushima Prefecture, Japan

52–53


[1]

[1] Fukushima Prefecture is one of Japan's most important agricultural regions.

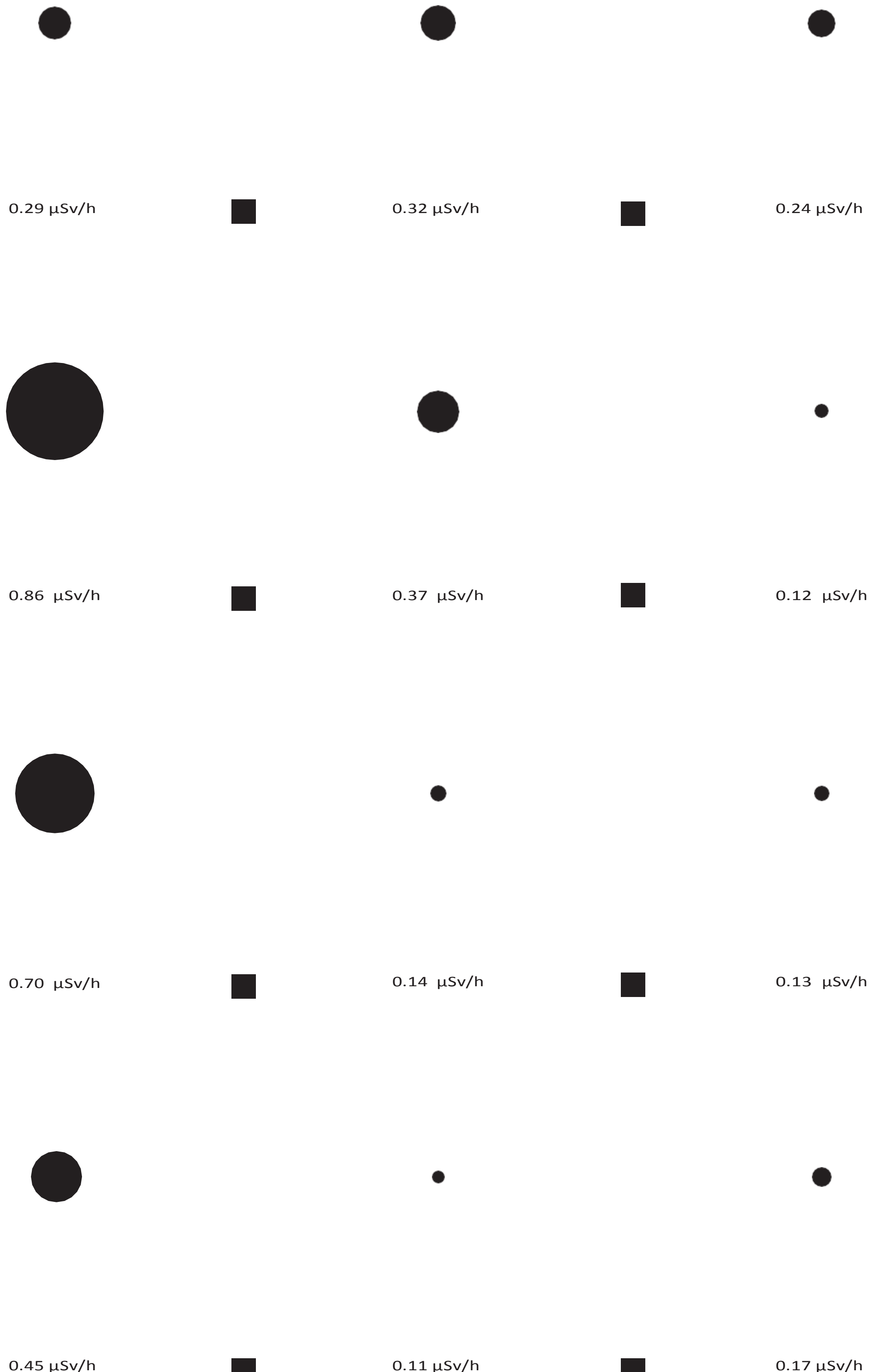

0.20 µSv/h
0.22 µSv/h
0.75 µSv/h
0.19 µSv/h
0.26 µSv/h
0.29 µSv/h
0.56 µSv/h
0.21 µSv/h
0.72 µSv/h
0.74 µSv/h
0.68 µSv/h
0.53 µSv/h


0.15 µSv/h
0.13 µSv/h
0.26 µSv/h
0.11 µSv/h
0.24 µSv/h
0.97 µSv/h
0.17 µSv/h
0.37 µSv/h
0.29 µSv/h
0.24 µSv/h
0.27 µSv/h
0.59 µSv/h

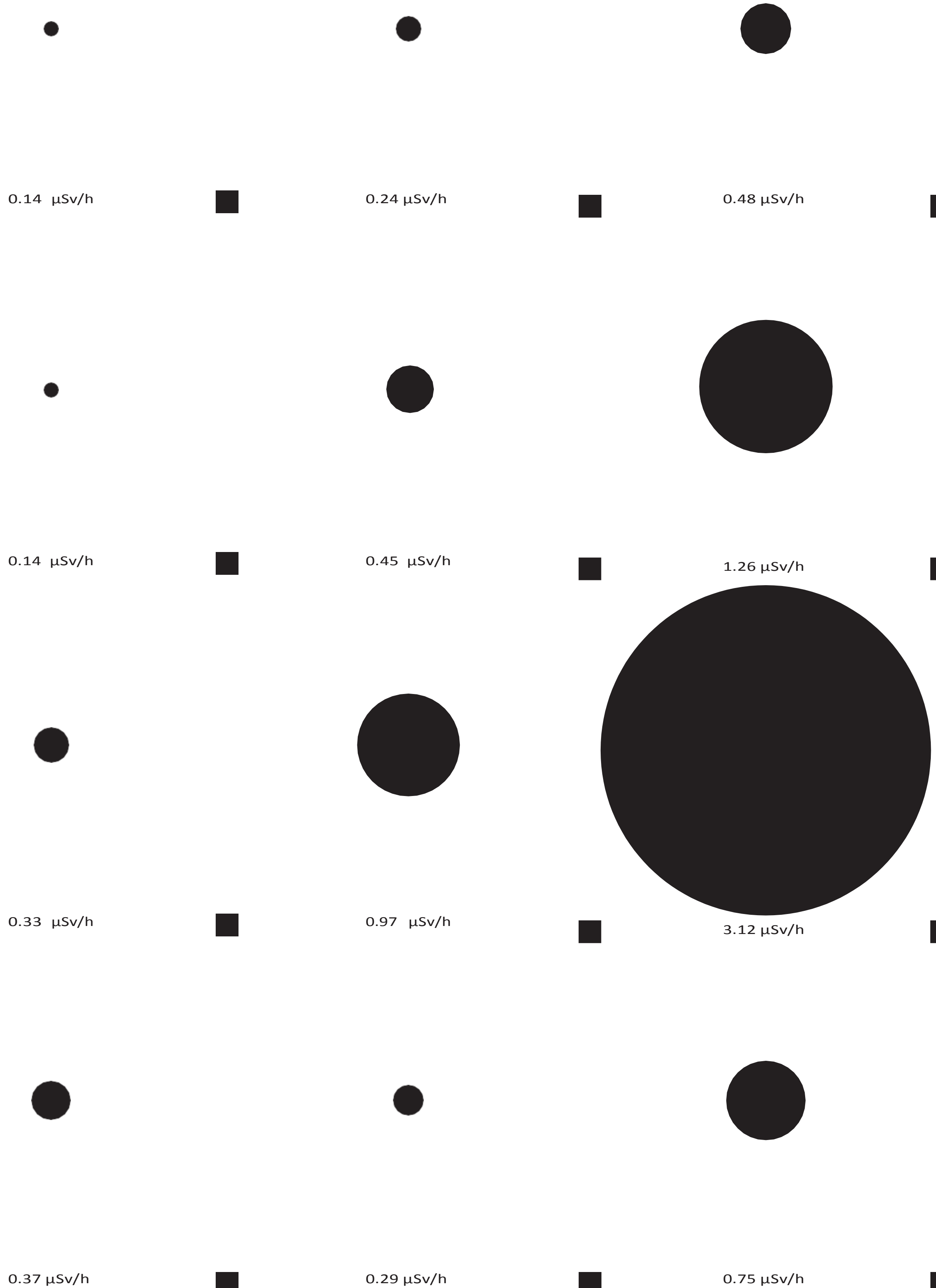
37.662500, 140.898472 0.26 µSv/h

[2]

37.914124, 140.593903 0.24 μSv/h



0.29 µSv/h
0.32 µSv/h
0.24 µSv/h
0.86 µSv/h
0.37 µSv/h
0.12 µSv/h
0.70 µSv/h
0.14 µSv/h
0.13 µSv/h
0.45 µSv/h
0.11 µSv/h
0.17 µSv/h

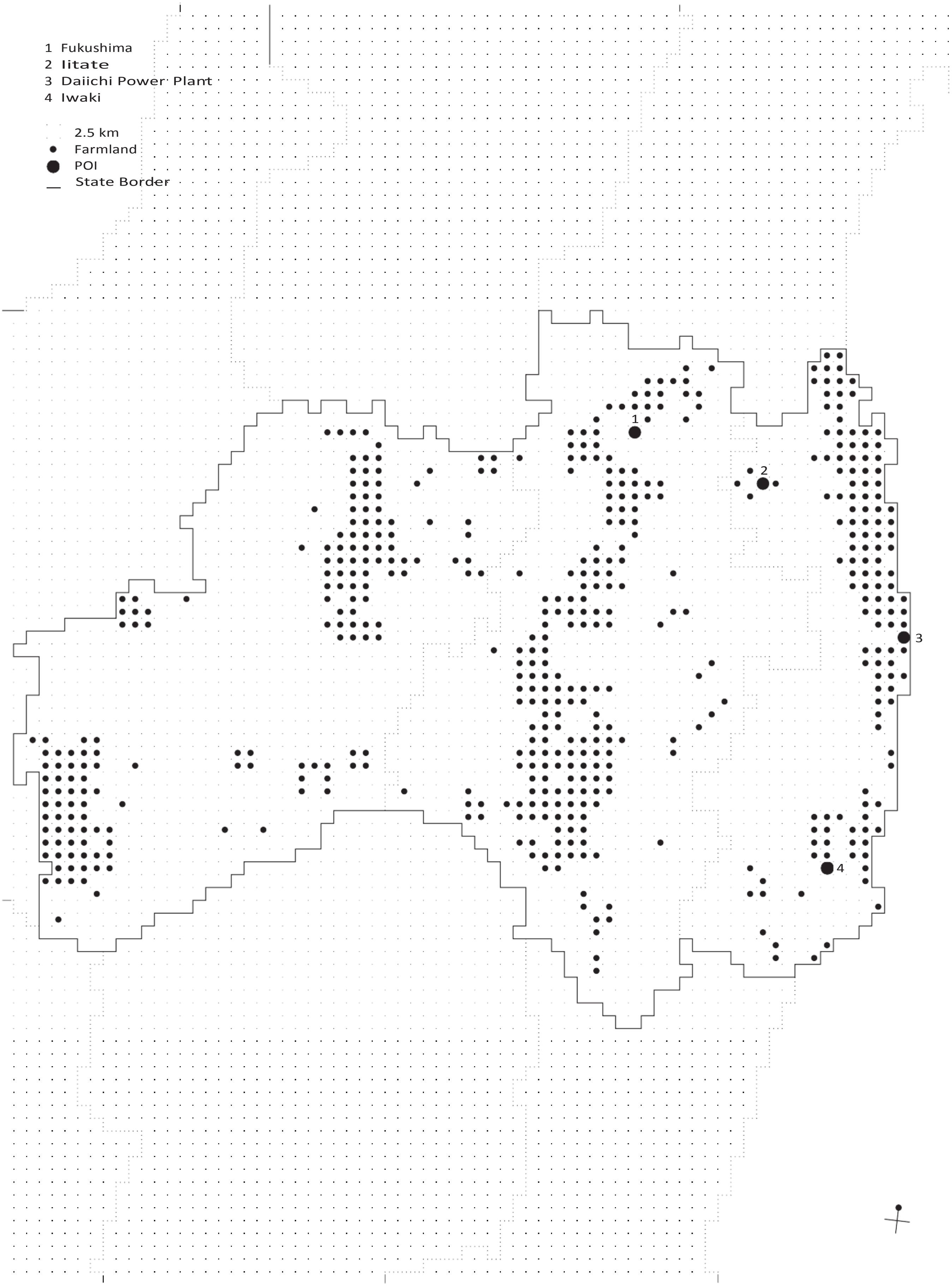

0.14 µSv/h
0.24 µSv/h
0.48 µSv/h
0.14 µSv/h
0.45 µSv/h
1.26 µSv/h
0.33 µSv/h
0.97 µSv/h
3.12 µSv/h
0.37 µSv/h
0.29 µSv/h
0.75 µSv/h

[3]

37.690250, 140.834056   0.45 µSv/h

[2] Rice can be grown both on dry and watered fields.

[3] Large parts of the region consist of mountains and forests.



1 Fukushima
2 Iitate
3 Daiichi Power Plant
4 Iwaki
2.5 km
Farmland
POI
State Border
1
2
3
4

1 in 8

People
Residents that work in manufacturing

1 in 11

km^2
Land mass that is farmland

Fukushima

Capital

Iwaki

Largest city

13,784

km^2
Total land mass

1,215

km^2
Farmland

1,862,705

Population

135

People per km^2

06 Rice

Farming, Economy, and Culture

"Japan is a land of rice; it's at the heart of our culture. Rice is used for clothing, food, and housing. It's part of everyday life."

Numeo Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

Farming

In Japan, most farmers use wet rice cultivation.

In spring, farmers plow their fields and flood them with water. Then they plant early seedlings. The water does little harm to the plants. In fact, it protects them against pests or weed formation. It's important to check the water level daily and manage the level throughout the process. This method requires an enormous amount of water – between 3,000 and 5,000 liters per kilogram of rice. Before harvesting in autumn, the farmer drains the water then dries and cleans the rice ●

3.3

Billion USD
value of Fukushima
Prefecture agricultural
sector in 2010

75

Percent
Amount of farmland in
Fukushima Prefecture where
rice was planted in 2010

403,
697

Tonnes
Amount of rice produced in
Fukushima Prefecture in
2010

Economy

Rice plays an important role in the Japanese economy. Japan is fully self-sufficient when it comes to rice, and domestic rice is protected by high import tariffs. The current per capita consumption is 54.4 kilograms per year, but it has many other uses, too. You can find rice in paper, cosmetics, and medicine. Despite high demand, most rice is still grown in small fields. The Japan Agricultural Cooperatives group is responsible for purchasing and sales. It keeps prices at a high level and ensures that traditional agriculture remains largely unaffected by external influences

55

Number of sake breweries located in Fukushima Prefecture

[01] Sasamasamune Brewery Co., Ltd.
[02] Homare Shuzo Brewery Co., Ltd.
[03] Minenoyuki Coorporation
[04] Yumegokoro Shuzo Brewery Co., Ltd.
[05] Yoshinogawa Shuzouten Limited Partnership
[06] Ohara Shuzo Brewing Co., Ltd.
[07] Kitanohana Shuzojo Limited Partnership
[08] Yamatogawa Shuzo Brewery Co., Ltd.
[09] Aizu Nishiki Limited Partnership
[10] Sakaegawa Shuzo Limited Partnership
[11] Hiroki Shuzo Honten Limited Partnership
[12] Toyokuni Shuzo Limited Partnership
[13] Akebono Shuzo Limited Partnership
[14] Bandai Shuzo Co., Ltd.
[15] eisen Shuzo Co., Ltd.
[16] Inagawa Shuzoten Limited Partnership
[17] Suehiro Shuzo Brewery Co., Ltd.
[18] Hanaharu Shuzo Co., Ltd.
[19] Tsurunoe Shuzo Co., Ltd.
[20] Tatsuizumi Shuzo Limited Partnership
[21] Yamaguchi General Partnership
[22] Nagurayama Shuzo Brewery Co., Ltd.
[23] Takahashi Shosaku Shuzoten
[24] Miyaizumi Meijo Co.
[25] Shirai Shuzoten Limited Partnership
[26] Kaito Otokoyama Shuzo
[27] Aizu Shuzo Co., Ltd.
[28] Kokken Brewery Co., Ltd.
[29] Hanaizumi Shuzo Brewery General Partnership
[30] Kinsuisho Shuzo Brewery Co., Ltd.
[31] Himonoya Shuzoten Co., Ltd.
[32] Daishichi Shuzo Brewery Co., Ltd.
[33] Ninki Inc.
[34] Okunomatsu Shuzo Brewery Co., Ltd.
[35] Daitengu Shuzo Brewery Co., Ltd.
[36] Watanabe Shuzo Honten Co., Ltd.
[37] Wakaseki Shuzo Co., Ltd.
[38] Sasanokawa Shuzo Co., Ltd.
[39] Niida Honke Co., Ltd.
[40] Sato Shuzoten Corporation
[41] Sato Shuzo Co., Ltd.
[42] Genba Honten Co., Ltd.
[43] Suzunoi Co., Ltd.
[44] Matsuzaki Shuzoten
[45] Wakashimizu Shuzo Co., Ltd.
[46] Toyokuni Shuzo Limited Partnership
[47] Oki Daikichi Honten General Partnership
[48] Oya Chukichi General Partnership
[49] Senkoma Brewing Co., Ltd.
[50] Ariga Brewing Co., Ltd.
[51] Shirakawa Meijo Co., Ltd.
[52] Yazawa Shuzo Inc.
[53] Shike Shuzoten General Partnership
[54] Taihei Sakura Shuzo Co., Ltd.
[55] Suzuki Shuzoten Co., Ltd.

3,074

Number of shrines in Fukushima Prefecture

1,133

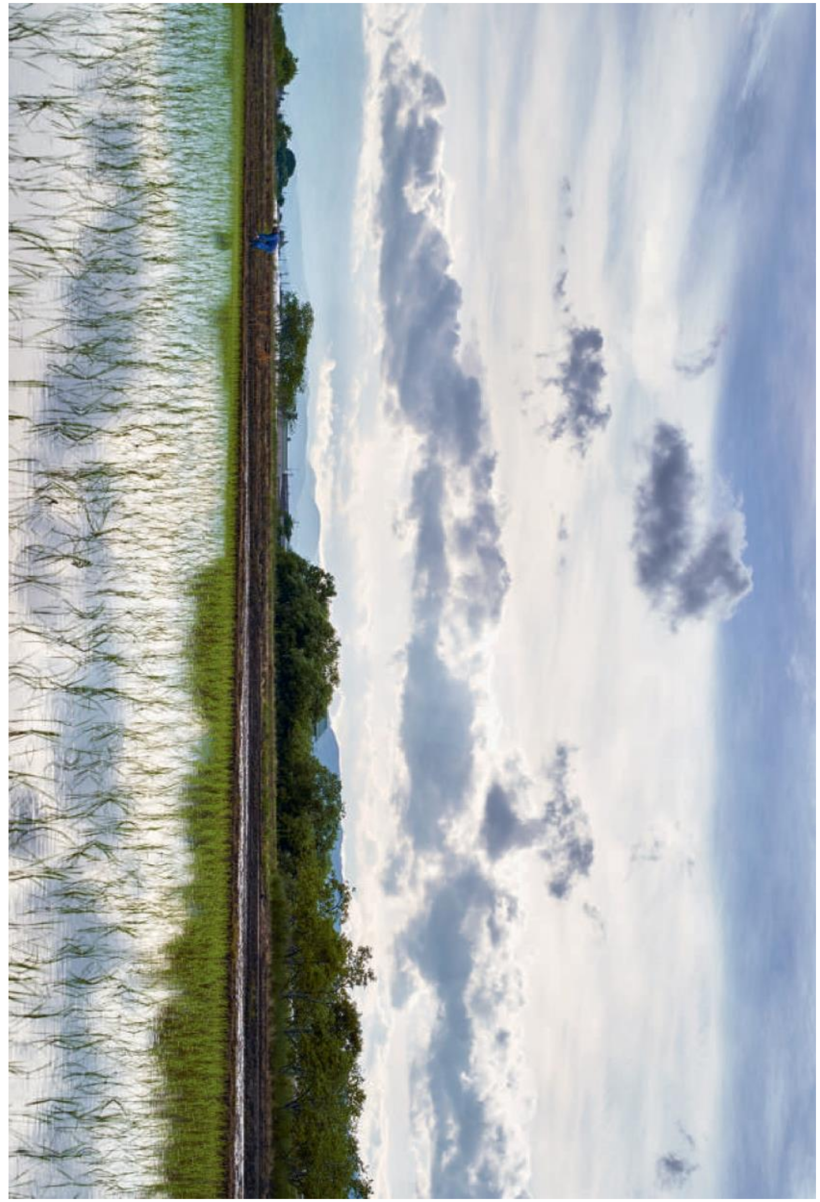
Number of shrines in Fukushima Prefecture devoted to the rice god Inari

Rice and food are one in Japan. 御飯 (Gohan), the word for “cooked rice”, means both “meal” and “food” in Japanese. Rice has been the nation’s staple food and pride and soul for over 2,000 years. Shinto’s own prosperity god is also known as the rice deity. It goes by the name 稲荷 (Inari). In order to win the favor of the deity’s fox guardian, believers regularly bring rice or sake offerings to their prayer shrines. During rice cultivation, dancers perform special ritual dances for Inari, such as the taue-sai to ensure a plentiful harvest ●

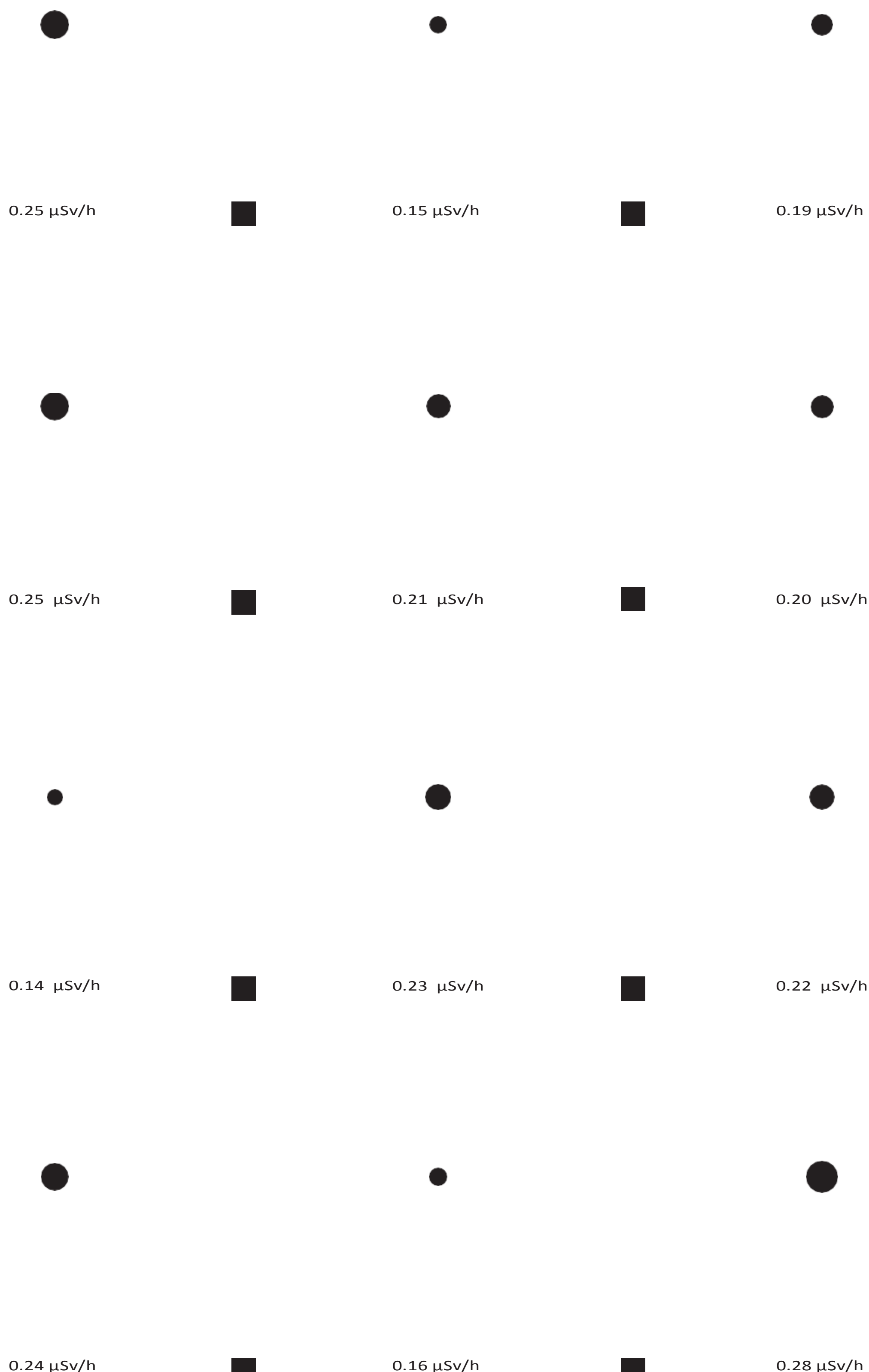
風流の
初やおくの
田植うた

Haiku by Matsuo Basho

The beginning of all art—
in the deep north
a rice-planting song.



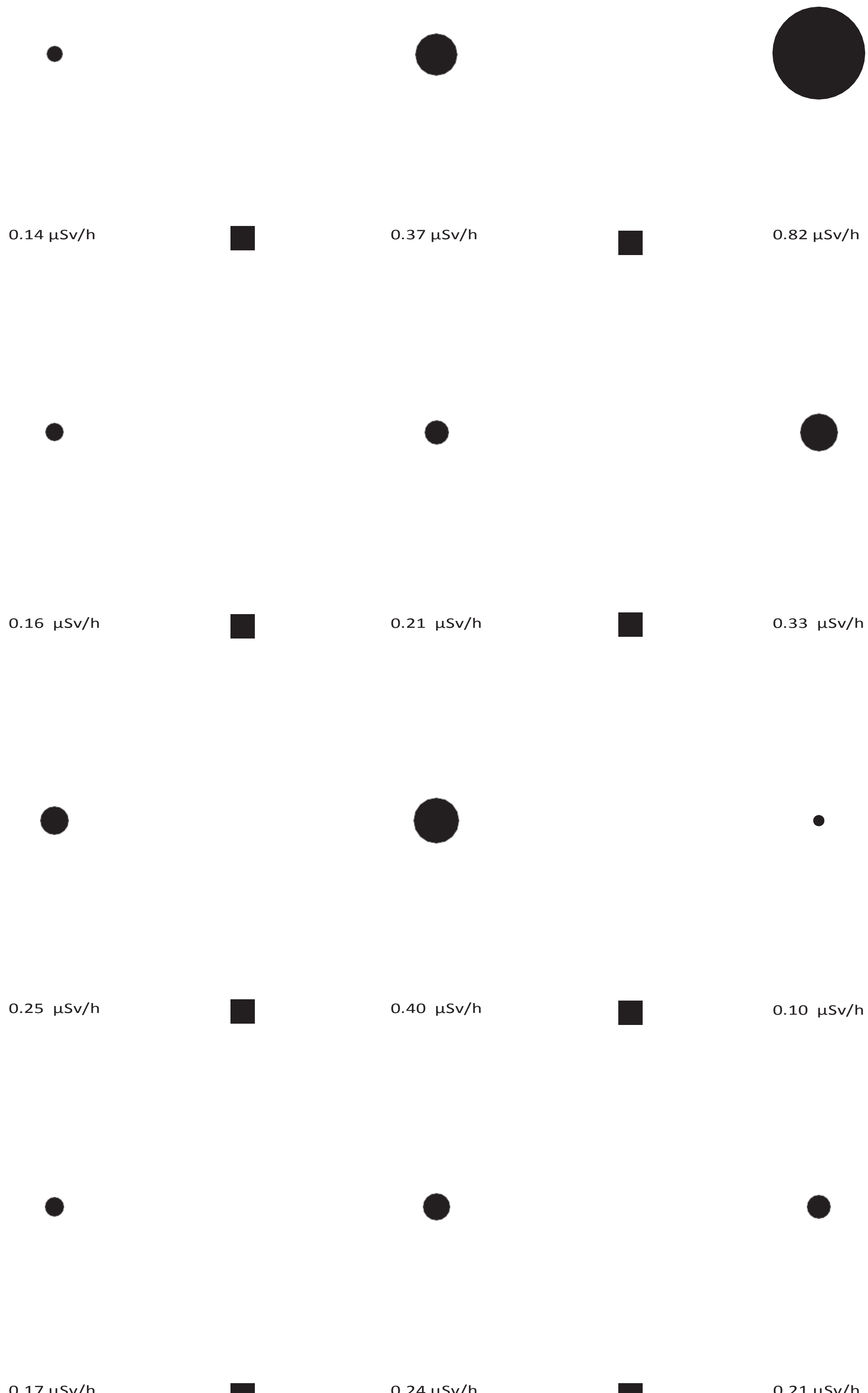
37.843788, 140.612976 0.21 µSv/h

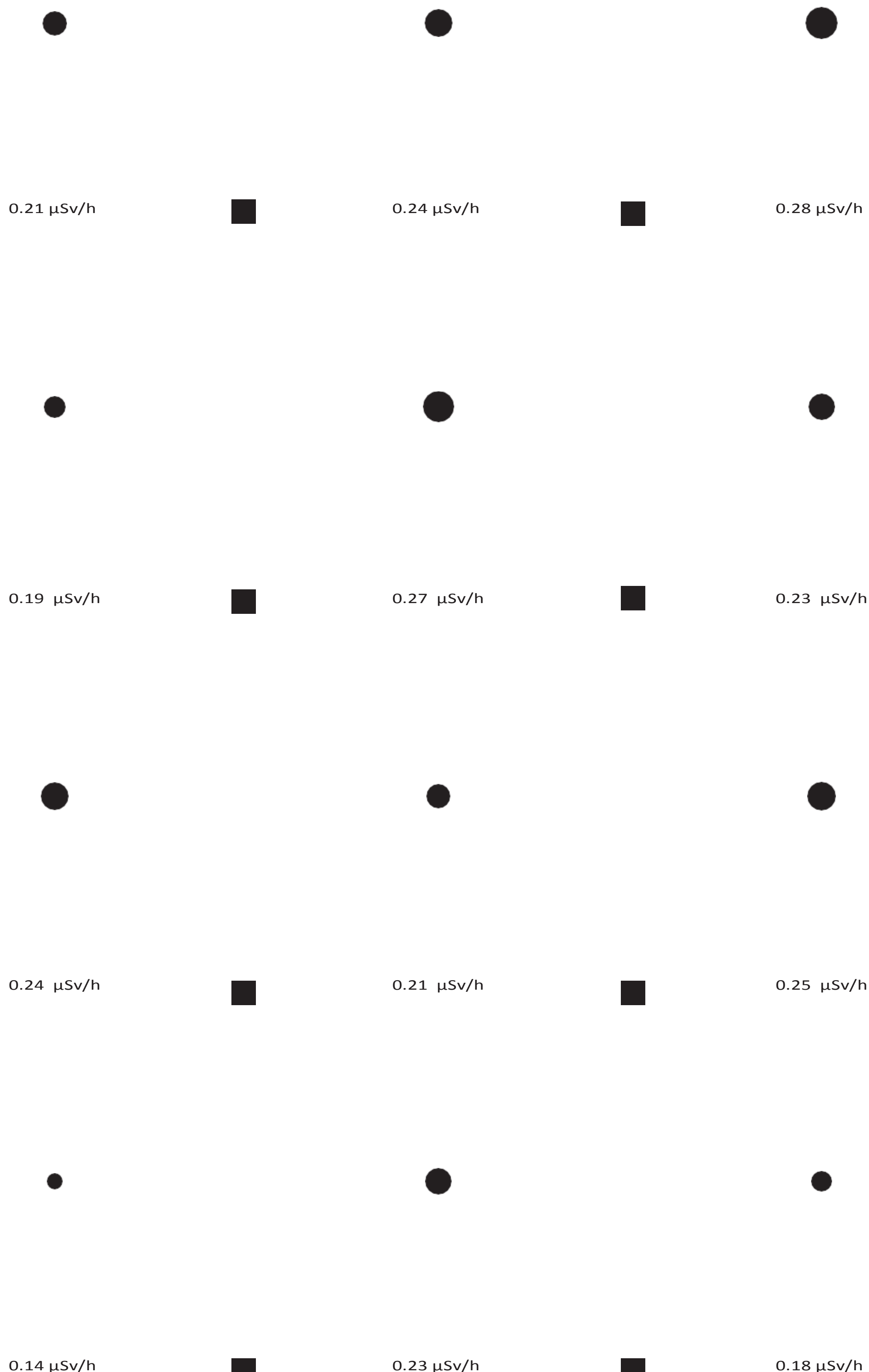

0.25 μSv/h
0.15 μSv/h
0.19 μSv/h
0.25 μSv/h
0.21 μSv/h
0.20 μSv/h
0.14 μSv/h
0.23 μSv/h
0.22 μSv/h
0.24 μSv/h
0.16 μSv/h
0.28 μSv/h

0.30 μSv/h	0.17 μSv/h	0.27 μSv/h
0.20 μSv/h	0.10 μSv/h	0.23 μSv/h
0.16 μSv/h	0.32 μSv/h	0.28 μSv/h
0.21 μSv/h	0.25 μSv/h	0.27 μSv/h

[1]

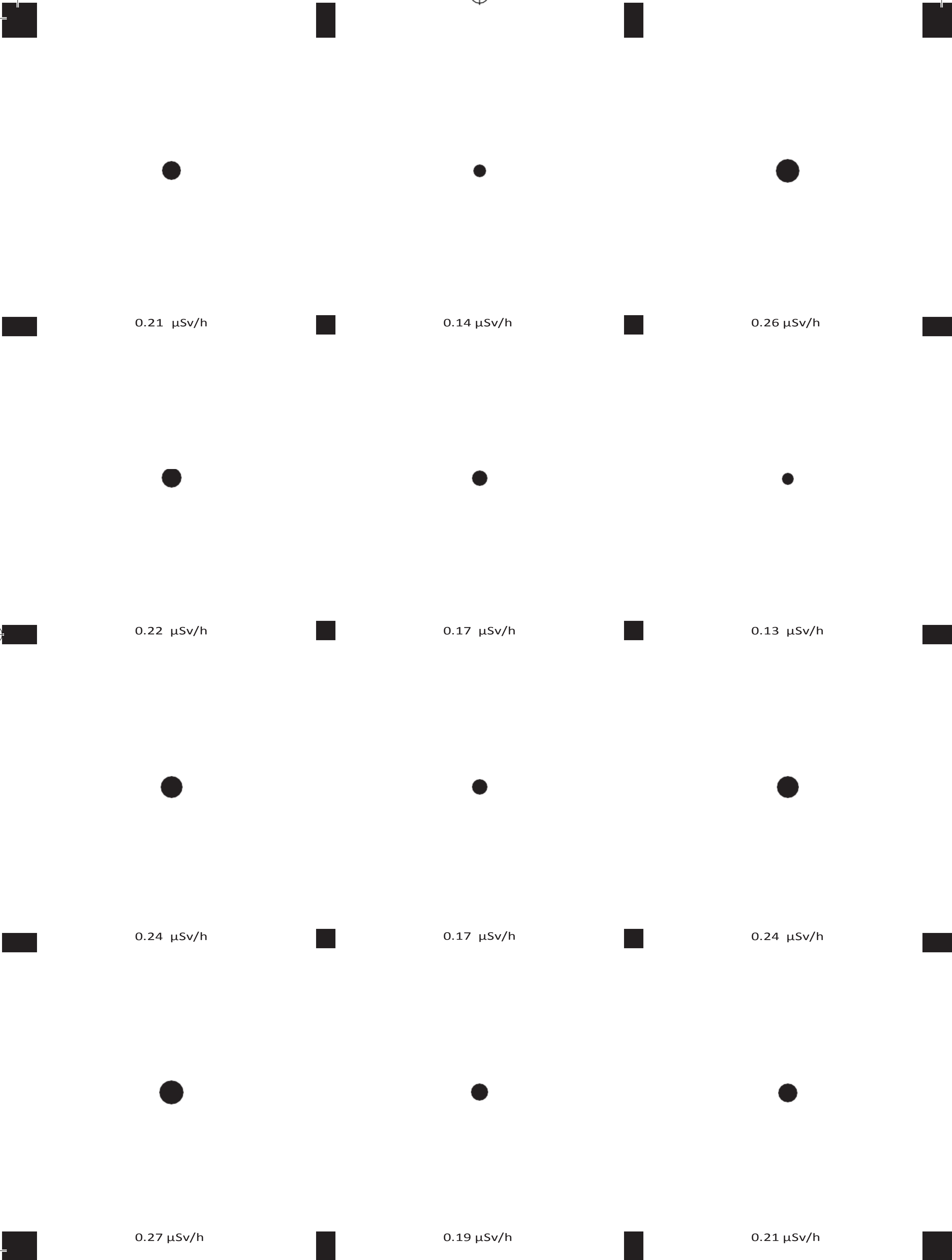
37.684684, 140.565163 0.10 µSv/h


0.14 µSv/h
0.37 µSv/h
0.82 µSv/h
0.16 µSv/h
0.21 µSv/h
0.33 µSv/h
0.25 µSv/h
0.40 µSv/h
0.10 µSv/h
0.17 µSv/h
0.24 µSv/h
0.21 µSv/h

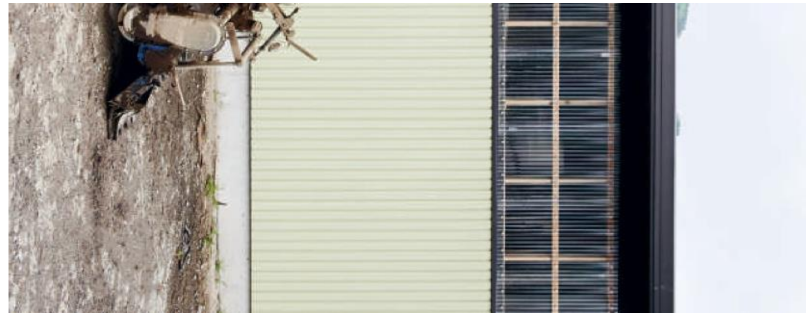

0.21 µSv/h
0.24 µSv/h
0.28 µSv/h
0.19 µSv/h
0.27 µSv/h
0.23 µSv/h
0.24 µSv/h
0.21 µSv/h
0.25 µSv/h
0.14 µSv/h
0.23 µSv/h
0.18 µSv/h

37.912611, 140.589417 0.25 µSv/h

37.892881, 140.570545   0.24 μSv/h


0.21 µSv/h
0.14 µSv/h
0.26 µSv/h
0.22 µSv/h
0.17 µSv/h
0.13 µSv/h
0.24 µSv/h
0.17 µSv/h
0.24 µSv/h
0.27 µSv/h
0.19 µSv/h
0.21 µSv/h

0.17 μSv/h	0.21 μSv/h	0.19 μSv/h
0.20 μSv/h	0.17 μSv/h	0.28 μSv/h
0.24 μSv/h	0.29 μSv/h	0.24 μSv/h
0.27 μSv/h	0.24 μSv/h	0.31 μSv/h

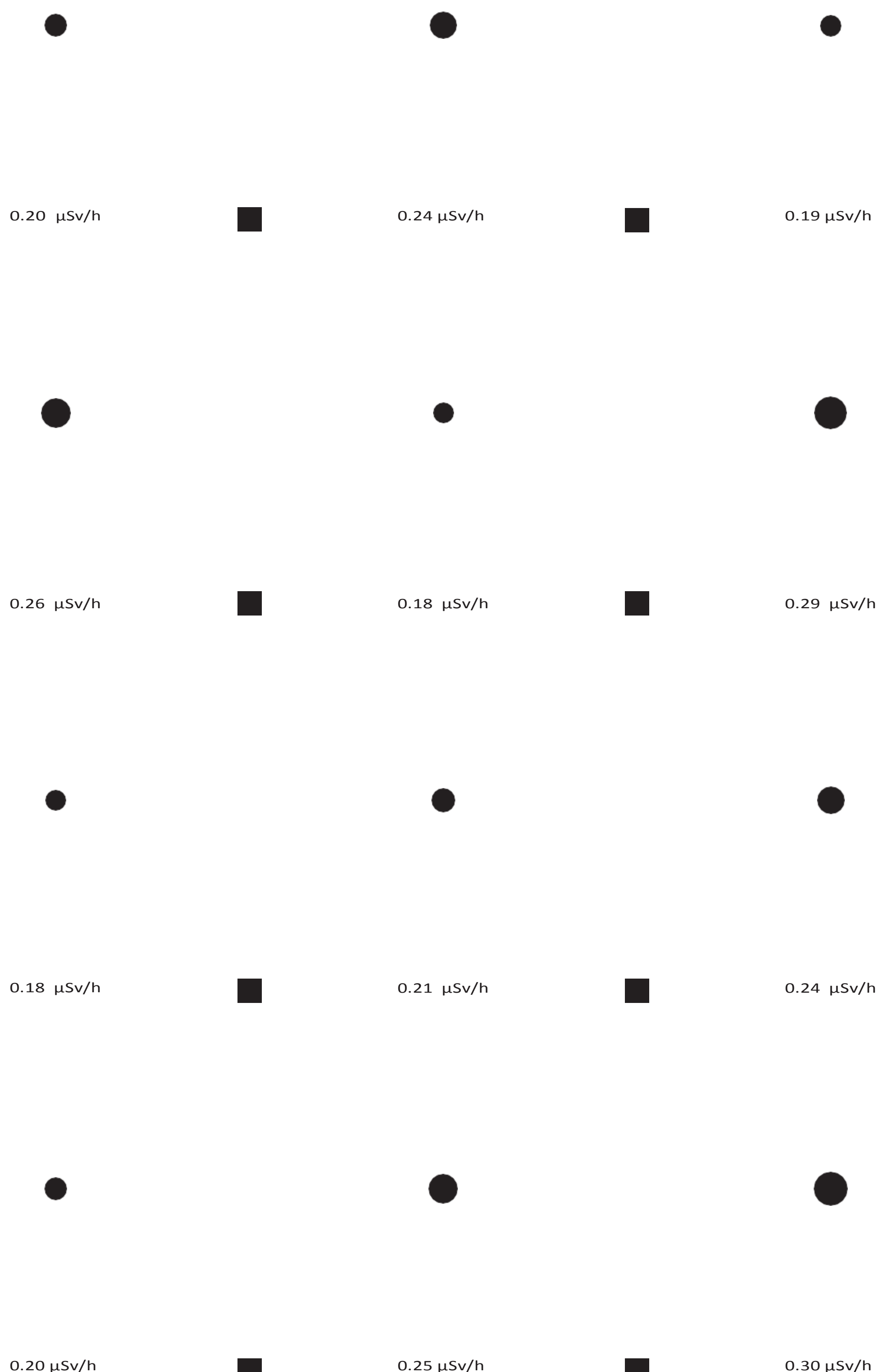


37.906202, 140.581602 0.24 μSv/h

[2]

140.583028

[3]


0.20 µSv/h
0.24 µSv/h
0.19 µSv/h
0.26 µSv/h
0.18 µSv/h
0.29 µSv/h
0.18 µSv/h
0.21 µSv/h
0.24 µSv/h
0.20 µSv/h
0.25 µSv/h
0.30 µSv/h

0.24 μSv/h

0.19 μSv/h

0.34 μSv/h

0.31 μSv/h

0.20 μSv/h

0.22 μSv/h

0.18 μSv/h

0.21 μSv/h

0.18 μSv/h

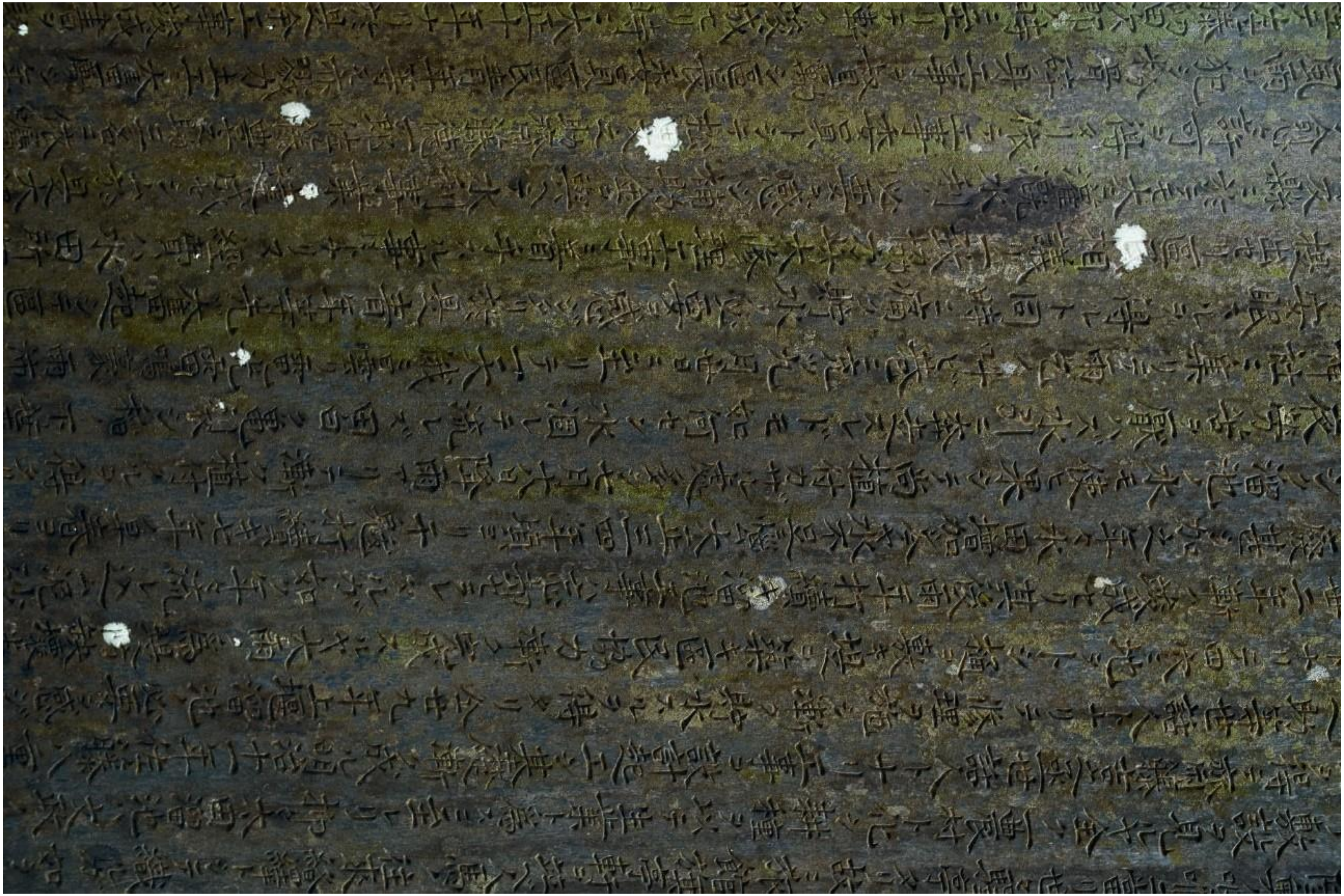
0.12 μSv/h

0.19 μSv/h

0.25 μSv/h

37.907889, 140.582917　0.18 µSv/h

[4]



37.908139, 140.583278　0.18 µSv/h

[1] Rice paddies are divided by narrow banks for easier irrigation.

[2] Farmland near Iitate is being decontaminated.

[3] entrance to a Shinto shrine near Kunimi.

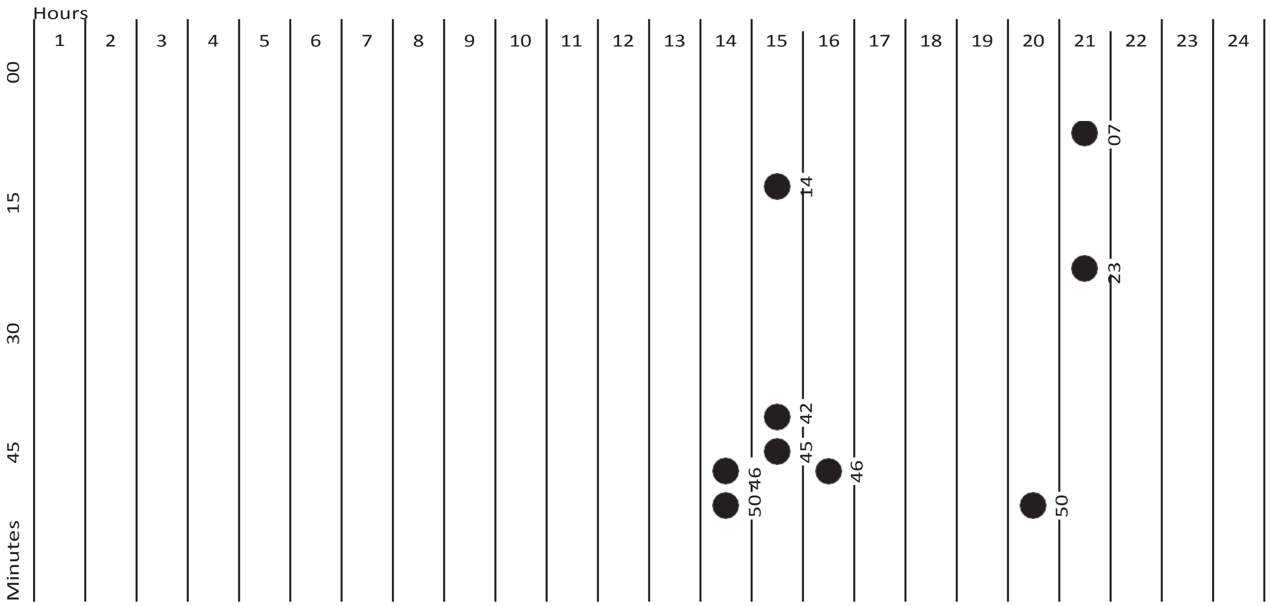
[4] Stone plate with inscription about creating a lake to store water for rice fields.

07 Catastrophe

March 11, 2011 14:46

“From the east, I heard a sound come echoing through the valley. The ground began to shake and form cracks across my path. I was worried about my mother, so I jumped over the cracks and ran to the house.”

Kenichi Okubo,
Rice Farmer, Iitate,
Fukushima Prefecture



March 11, 2011

Day 1

14:46

A 9.0 magnitude earthquake occurs 373 km northeast of Tokyo at a depth of 24 km, triggering automatic shutdown of the 3 operating reactor units at the Fukushima Daiichi power plant.

14:50

A 14-meter-high tsunami triggered by the earthquake hits the Fukushima Prefecture coast.

15:14

The Japanese government establishes disaster headquarters.

15:42

All AC power sources at the power plant are lost.

15:45

Fuel tanks for emergency diesel generators are swept away by the tsunami.

16:46

emergency core cooling systems of Unit 1 and 2 reactors fail.

20:50

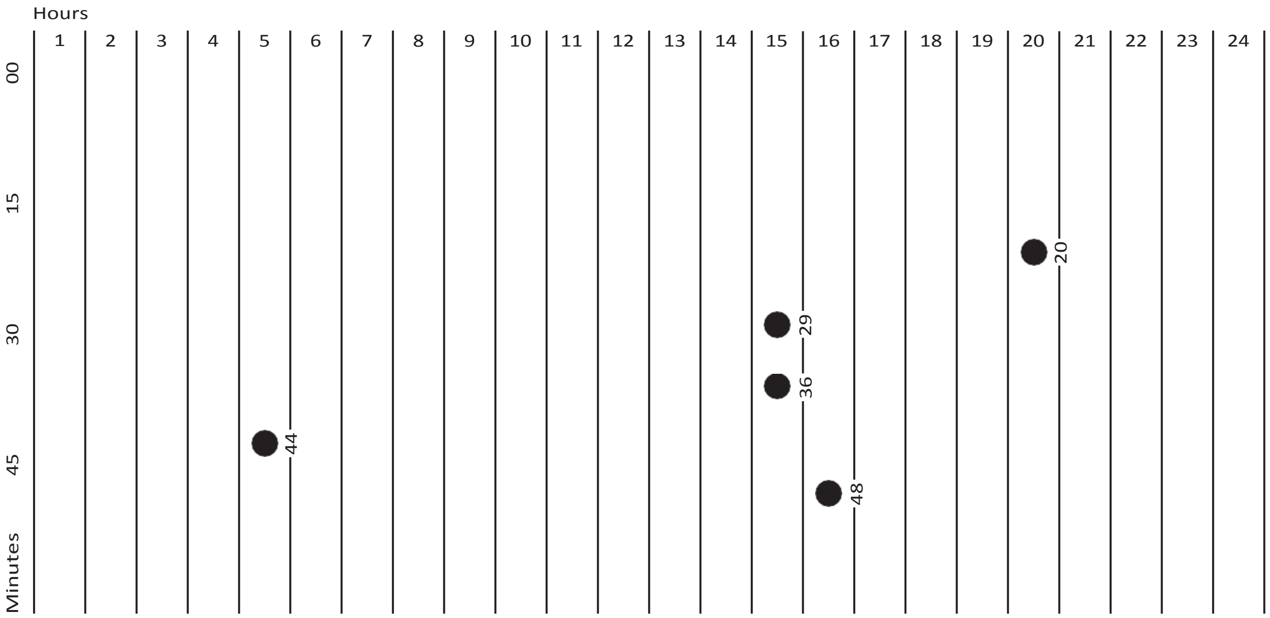
evacuation order issued to anyone in a 2 km radius of the power plant.

21:07

Pressure relief valve of containment vessel in Unit 1 reactor is opened, releasing vapor into the air.

21:23

evacuation order issued to anyone in a 3 km radius of the power plant.



March 12, 2011 Day 2

5:44

evacuation order issued to anyone in a 10 km radius of the Fukushima Daiichi power plant.

15:29

Radiation reading at the power plant exceeds 500 µSv/h.

15:36

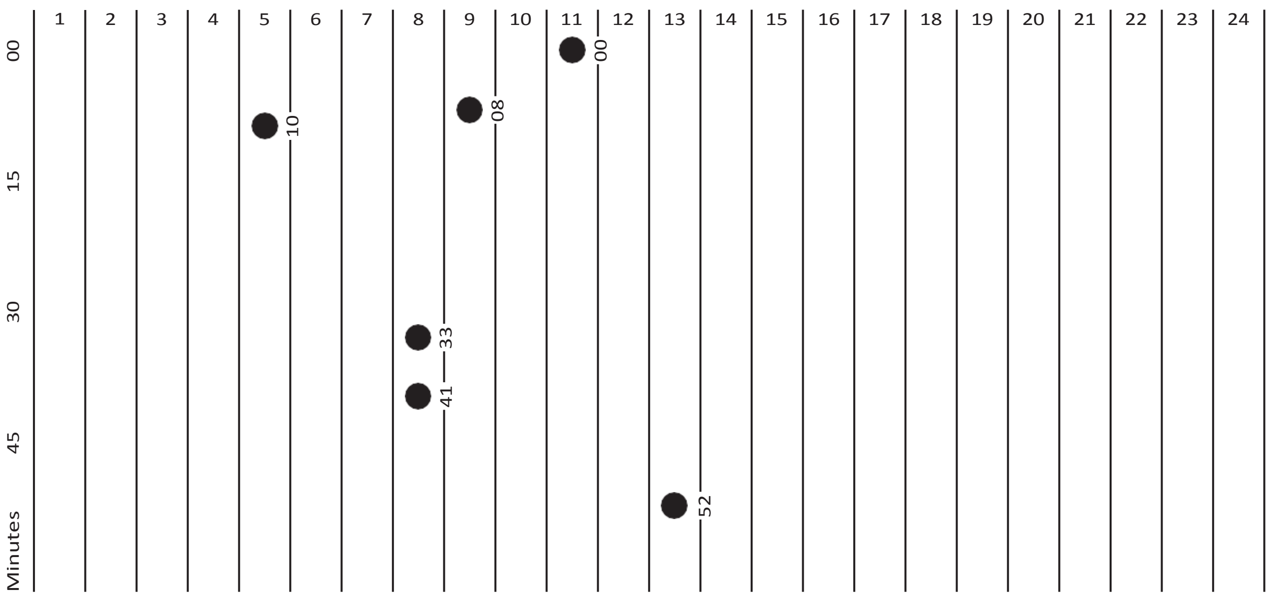
Hydrogen explosion blows off roof of Unit 1 reactor building.

16:48

evacuation order issued to anyone in a 20 km radius of the power plant.

20:20

Seawater and boron injection to cool down the Unit 1 reactor core starts.

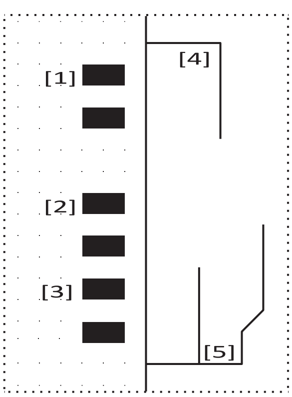


March 13, 2011

Day 3

Map of the Fukushima Daiichi power plant.

[1] Reactor 5 and 6 with Turbine Buildings
[2] Reactor 1 and 2 with Turbine Buildings
[3] Reactor 3 and 4 with Turbine Buildings
[4] North Breakwater
[5] Southeast Breakwater



● 5:10

emergency core cooling system of Unit 3 reactor fails.

● 8:33

Radiation reading at the Fukushima Daiichi power plant exceeds 1204.2 µSv/h.

● 8:41

Pressure relief valve of containment vessel in Unit 3 reactor is opened, releasing vapor into the air.

● 9:08

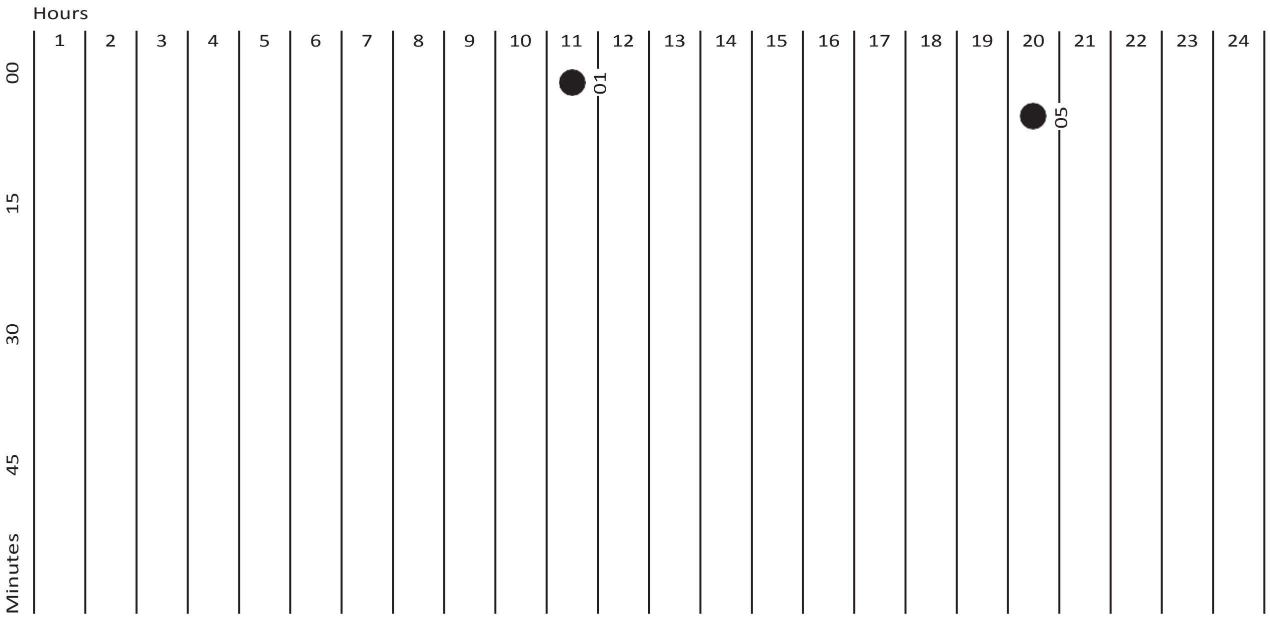
emergency water injection to cool down Unit 3 reactor core starts.

● 11:00

Pressure relief valve of containment vessel in Unit 2 reactor is opened, releasing vapor into the air.

● 13:52

Radiation reading at the power plant exceeds 1557.5 µSv/h.



March 14, 2011

Day 4

11:01

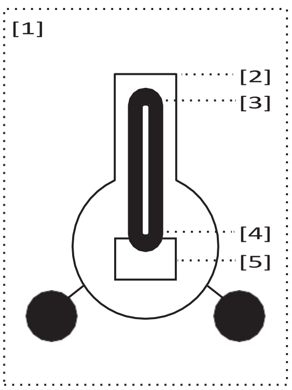
Hydrogen explosion blows off roof of Unit 3 reactor building.

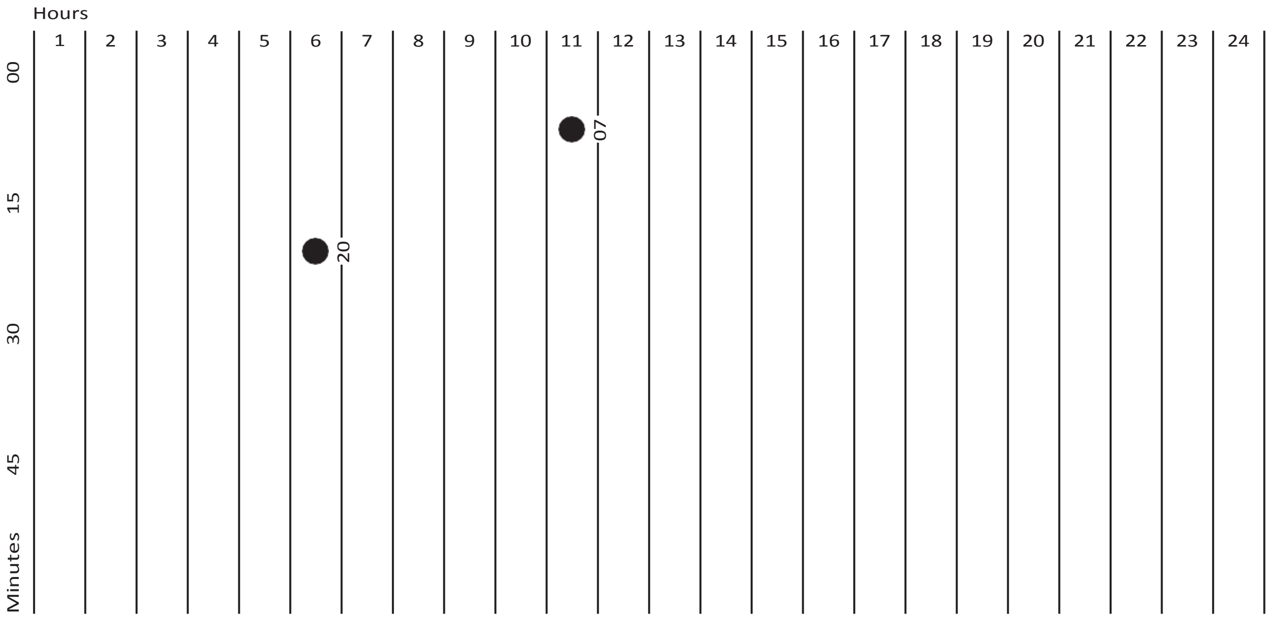
20:05

emergency seawater injection to cool down Unit 2 reactor core starts.

Internal structure of the nuclear reactor.

[1] Reactor Building
[2] Primary Containment vessel
[3] Reactor Pressure vessel
[4] Control Rod Drive
[5] Pedestal





March 15, 2011

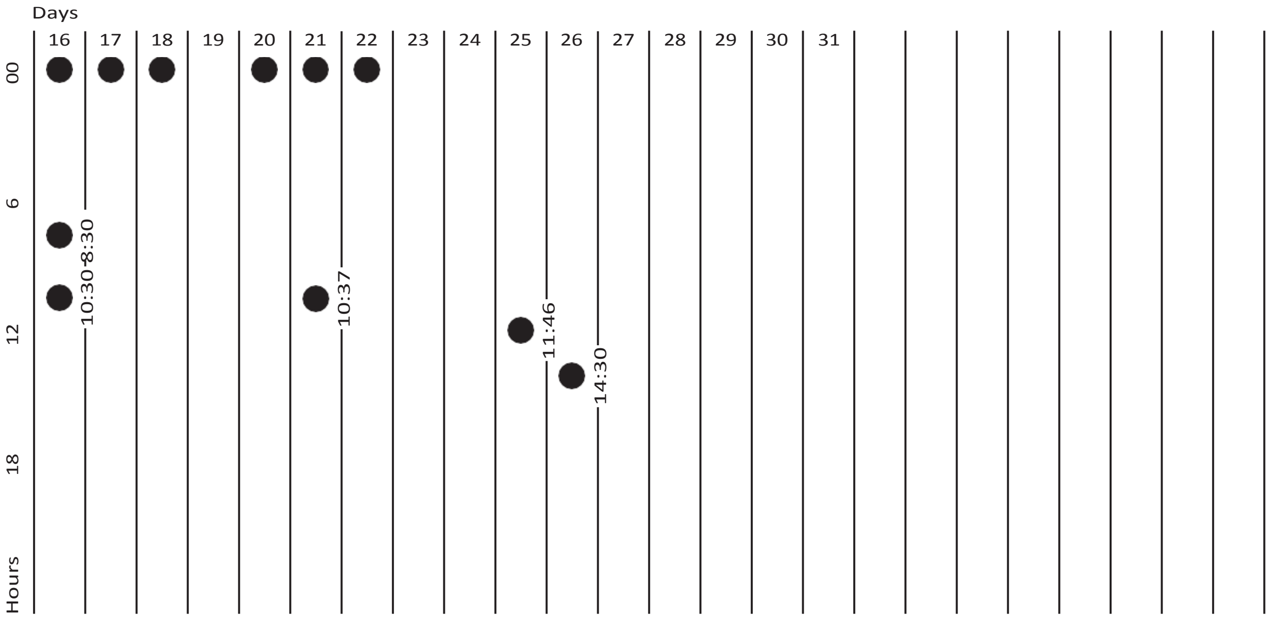
Day 5

● 6:20

explosion-like noise is heard coming from suppression chamber of Unit 2 reactor.

● 11:07

People within a 30 km radius of the Fukushima Daiichi power plant instructed to stay indoors.



March 16–31, 2011

Days 6–21

● March 16, 8:30

White smoke starts to come out of the Unit 3 reactor building.

● March 16, 10:30

Radiation reading at the Fukushima Daiichi power plant exceeds 1 mSv/h.

● March 16

Radiation level in milk in Fukushima Prefecture exceeds safety limits.

● March 17

Radiation level in water in Ibaraki Prefecture exceeds safety limits.

● March 18

Radiation level in spinach in Fukushima Prefecture exceeds safety limits.

● March 20

Drinking tap water is declared unsafe in some regions in Fukushima Prefecture.

● March 21

Plutonium is found in the Fukushima Prefecture plant soil.

● March 21, 10:37

Measures to cool critical structures start.

● March 22

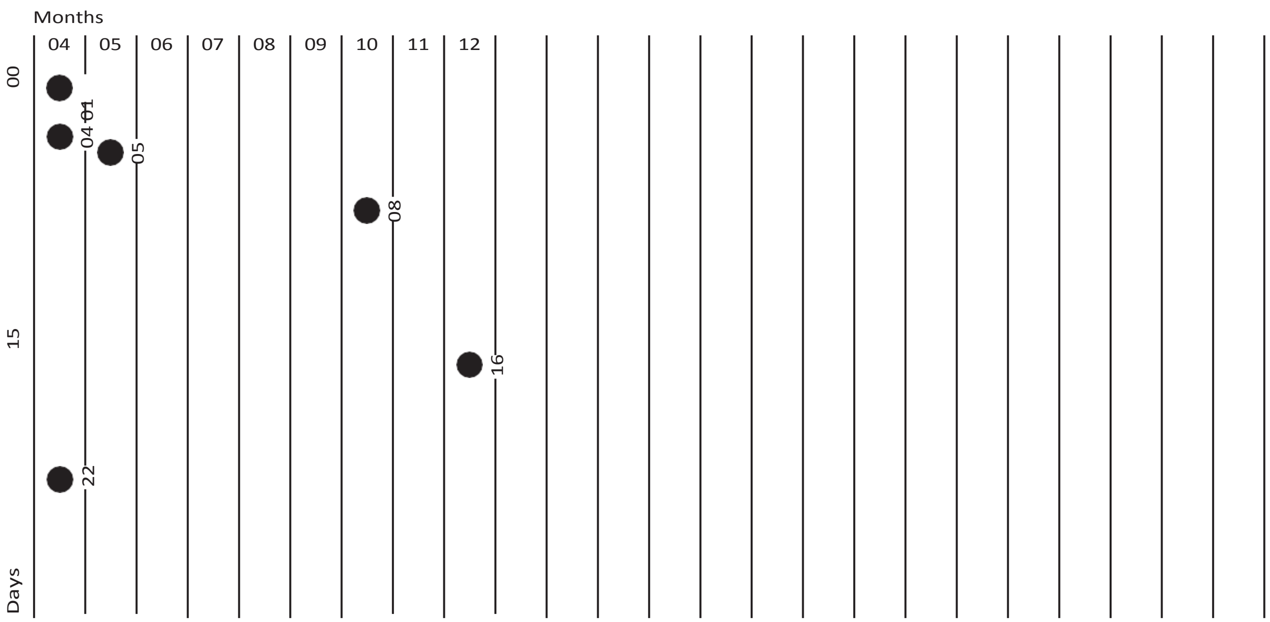
external power is connected to all 6 reactor units.

● March 25, 11:46

evacuation recommendation issued to anyone in a 30 km radius of the power plant.

● March 26, 14:30

Iodine-131 level 1850.5 times the legal limit is found in water from power plant.



April–December 2011

Months 2–10

April 01

Containment measures start.

April 04

11,521 tonnes of less radioactive water are released into the ocean to make room for more highly contaminated water.

April 22

Last evacuation order issued to village of Iitate.

May 05

Workers in protective gear start to enter Unit 1.

October 08

High levels of radioactive particles are found outside the 30 km evacuation zone.

December 16

Leaking reactors are declared by Japanese to be under control.

5

Days
Time the initial disaster lasted

6,560

Years
Time until the radioactive outfall has reached its half-life

"We hadn't thought about nuclear accidents because the government told us it was safe and secure."

Keiichi Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

6

Number of nuclear reactors at Fukushima Daiichi power plant

4.7

GW

Power potential of all reactors at Fukushima Daiichi power plant combined

239

km

Distance from Tokyo to Fukushima Daiichi power plant

570,
000,
000

GBq
Radioactivity of the cesium-134 and iodine-131 released into the air during the disaster

0.0254

GBq
Radioactivity of 1 kg of uranium

“After the meltdown, the wind carried the radioactive material northeast. It rained a few days after that, and the nuclear material floating in the air fell down here.”

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

Radiation Map
Fukushima 2011

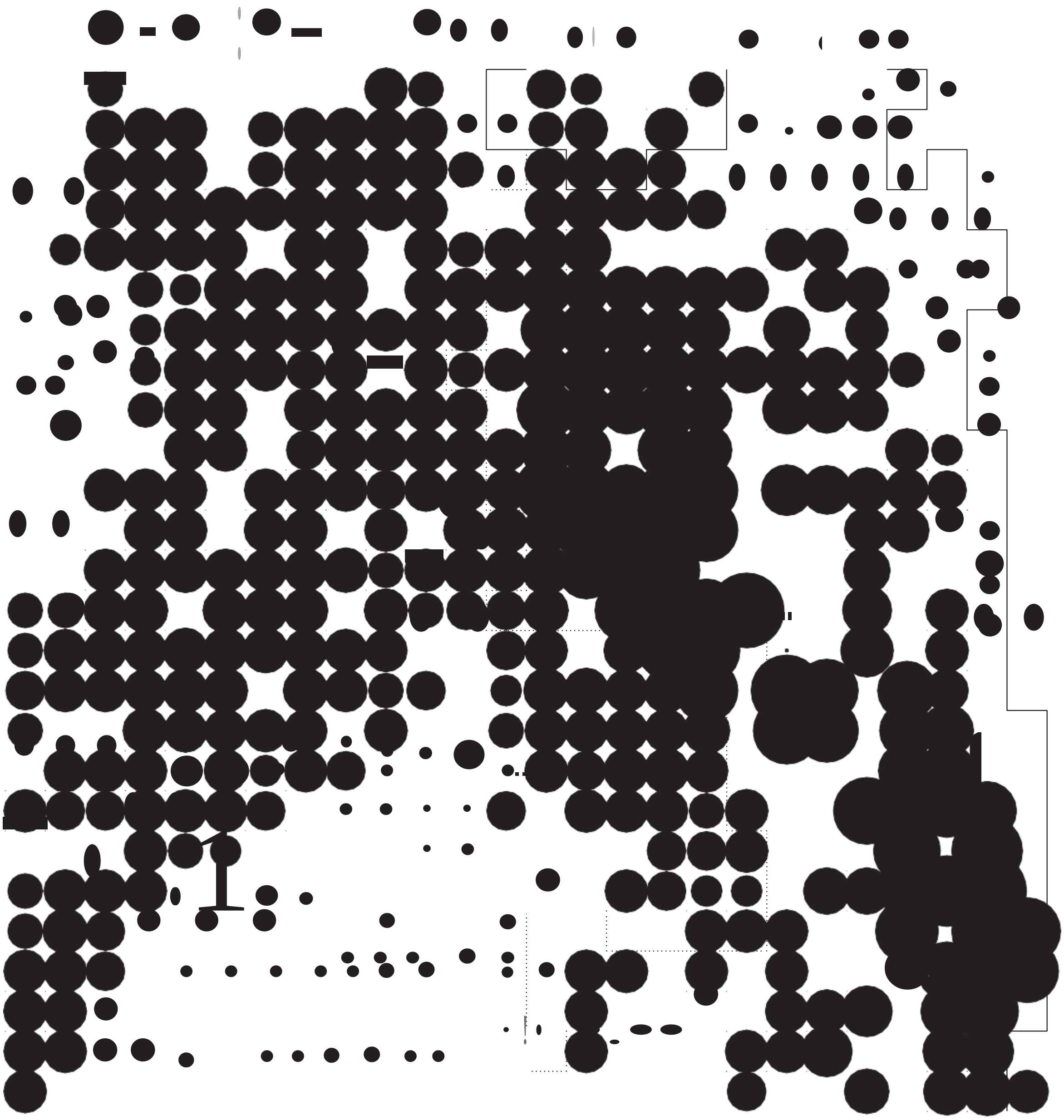
10–60 μSv/h

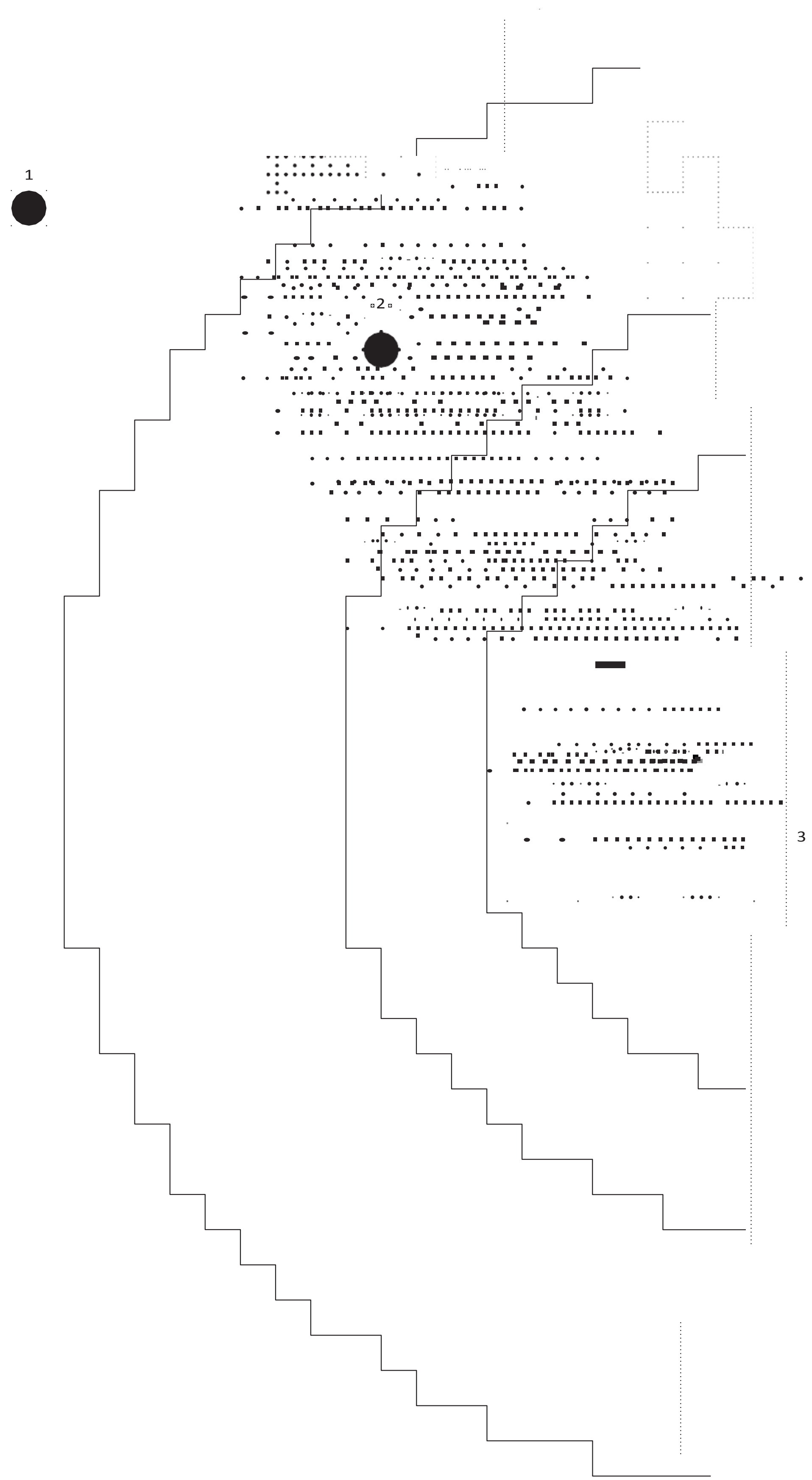
1–10 μSv/h

0–1 μSv/h

2.5 km

92–93




1
2
3

“My family members were separated, and I didn’t even know where I was. Everything in our lives was lost in the blink of an eye. There’s no word to describe this.”

1 Fukushima
2 Iitate
3 Daiichi Power Plant

19–91 μSv/h

9.5–19 μSv/h

3.8–9.5 μSv/h

1.9–3.8 μSv/h

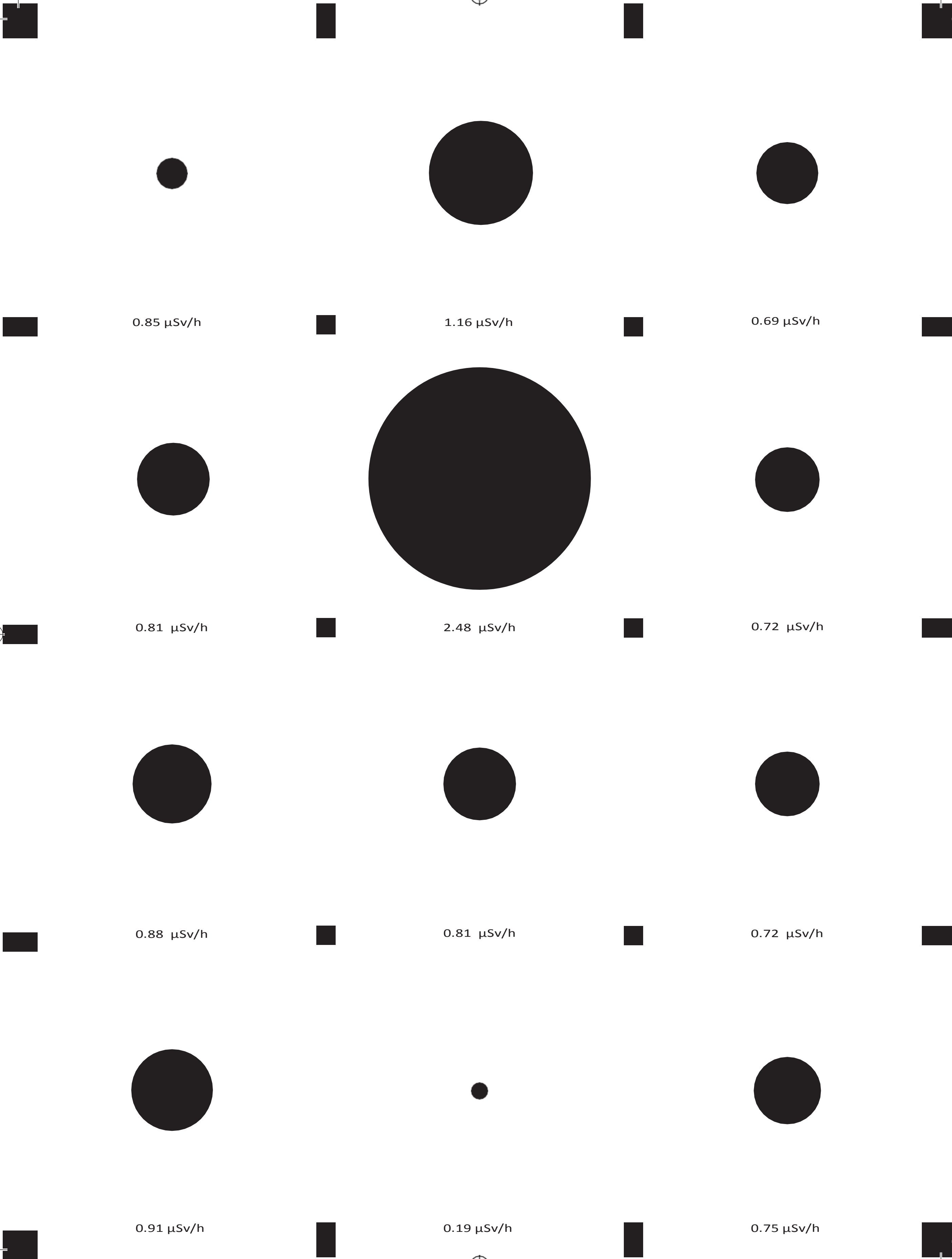
20 km, 30 km, 50 km
Distance from Power Plant

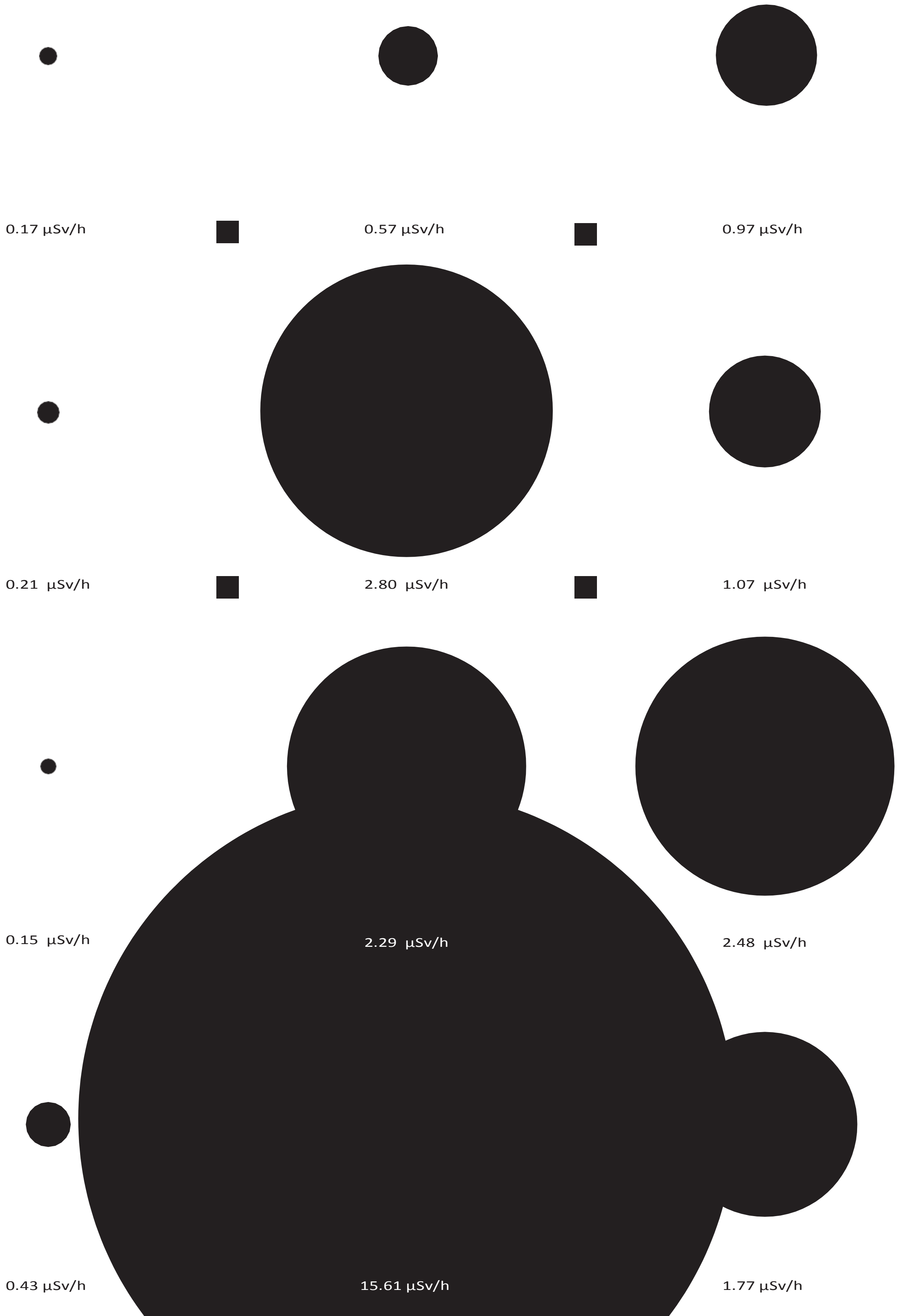
2.5 km

Numeo Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

[1] One of the many checkpoints set up around the restricted area to prevent accidents and looting.

[1]

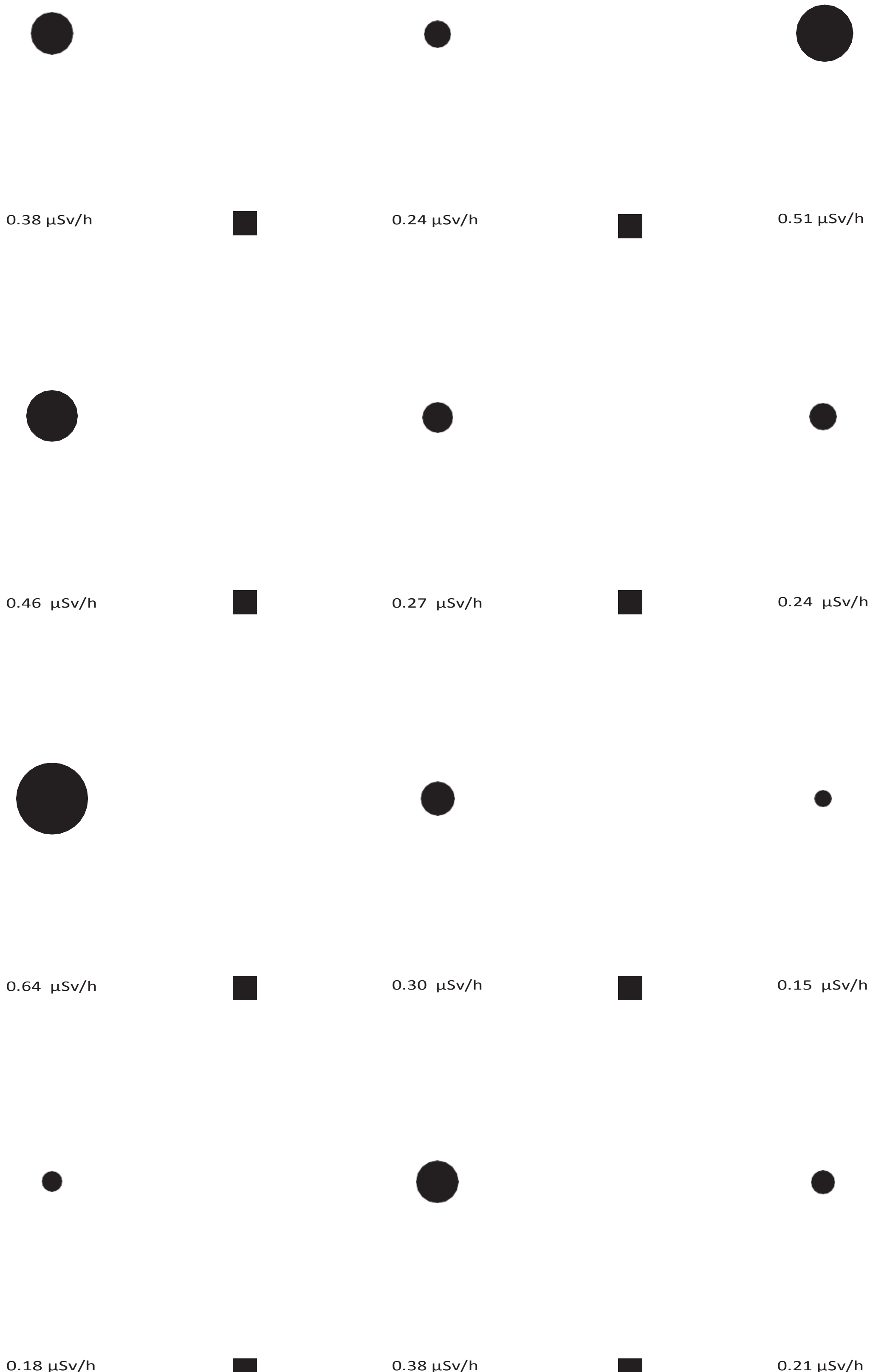

0.85 μSv/h
1.16 μSv/h
0.69 μSv/h
0.81 μSv/h
2.48 μSv/h
0.72 μSv/h
0.88 μSv/h
0.81 μSv/h
0.72 μSv/h
0.91 μSv/h
0.19 μSv/h
0.75 μSv/h

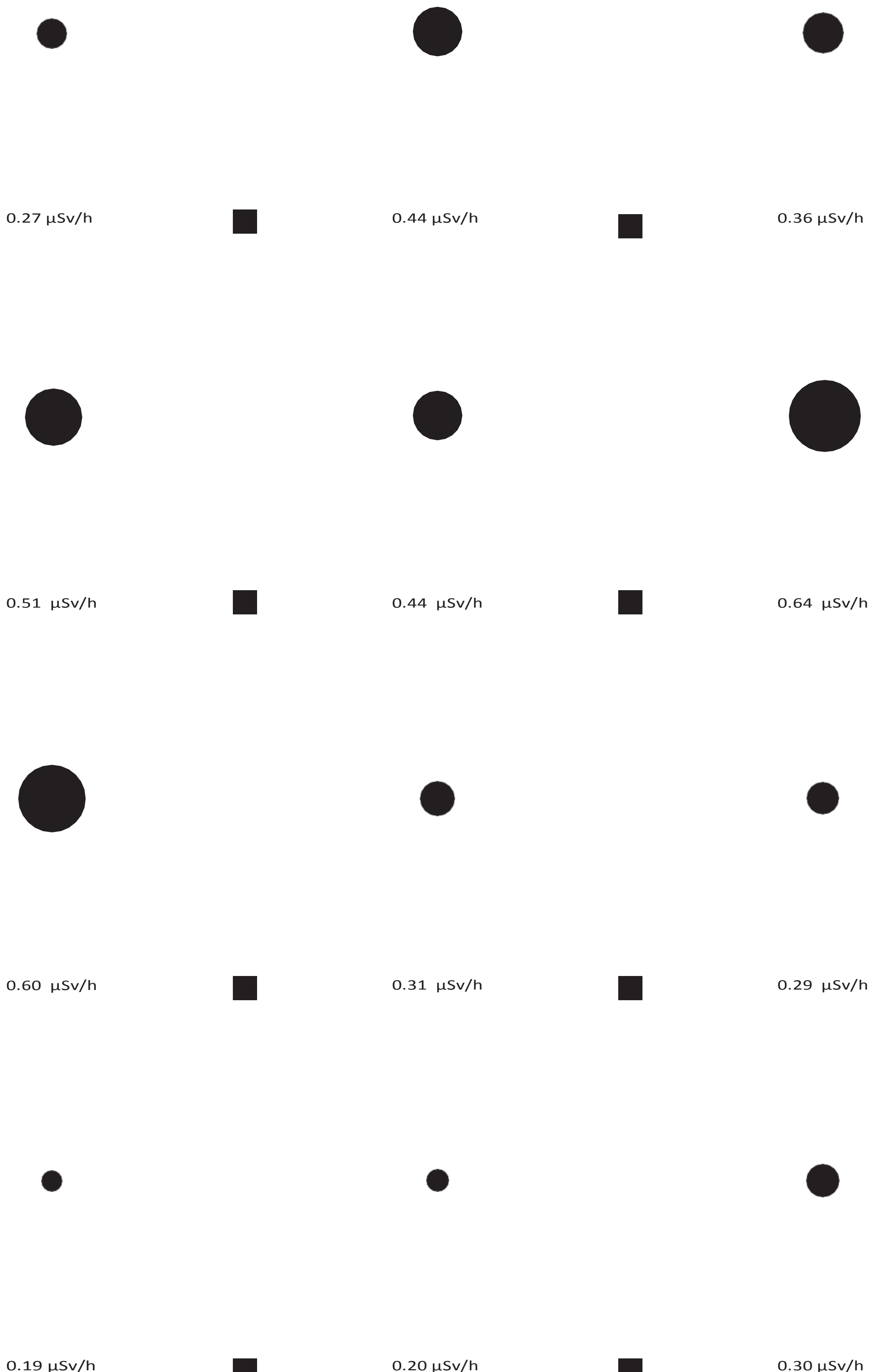

0.17 µSv/h
0.57 µSv/h
0.97 µSv/h
0.21 µSv/h
2.80 µSv/h
1.07 µSv/h
0.15 µSv/h
2.29 µSv/h
2.48 µSv/h
0.43 µSv/h
15.61 µSv/h
1.77 µSv/h

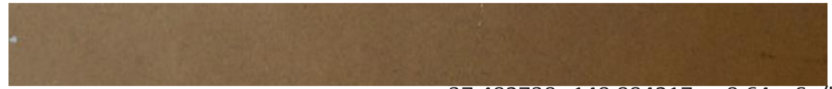
37.357038, 141.010215 2.48 µSv/h

37.504860, 140.997102   0.15 µSv/h

[3]


0.38 μSv/h
0.24 μSv/h
0.51 μSv/h
0.46 μSv/h
0.27 μSv/h
0.24 μSv/h
0.64 μSv/h
0.30 μSv/h
0.15 μSv/h
0.18 μSv/h
0.38 μSv/h
0.21 μSv/h


0.27 μSv/h
0.44 μSv/h
0.36 μSv/h
0.51 μSv/h
0.44 μSv/h
0.64 μSv/h
0.60 μSv/h
0.31 μSv/h
0.29 μSv/h
0.19 μSv/h
0.20 μSv/h
0.30 μSv/h



37.492730, 140.994217 0.64 µSv/h

37.492806, 140.994167 0.60 µSv/h

[2] A boat that was carried several kilometers inland by the tsunami.

[3] A calendar inside a house marks the time the residents were evacuated.

08 Consequences

For People, Environment, and Economy

People

After the meltdown of the reactors at the Fukushima Daiichi power plant, an area of 1,257 square kilometers with a radius of 20 kilometers was closed. A few days later, the Japanese government extended the zone by 20 kilometers, adding the areas affected by wind and precipitation. Some 160,000 people had to leave their homes and move into emergency shelters. Even if the radiation did not directly kill anybody, the consequences were fatal for many. Sick and elderly people died during the evacuations because they were cut off from adequate medical care, and there was insufficient help in the emergency shelters. In addition, many lost their livelihoods, social environment, and homeland, leading to alcohol addiction, depression, and suicide. Even the oldest inhabitant of Iitate, aged 102, ended his life in April 2011 to avoid evacuation.

According to the World Nuclear Association, approximately 2,000 deaths were due to the consequences of evacuations. 122,000 people have now been allowed to return home, and 32,600 are still waiting. However, many people are not sure if they should return●

15,895

Number of people killed due to the disaster

6,000

Number of people injured by the disaster

2,539

Number of people still missing after the disaster in 2018

104–105

300,
000

Number of people forced to evacuate due to the disaster

174,
000

Number of people still displaced after March 2016

73,349

Number of people still displaced as of March 2018

11

In 10,000 People
Suicide rate in Fukushima
Prefecture in 2014

2

In 10,000 People
Suicide rate in Japan
in 2014

“This accident has brought fear you can’t see. We need to make it visible. We need to make it digitalized.”

Numeo Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

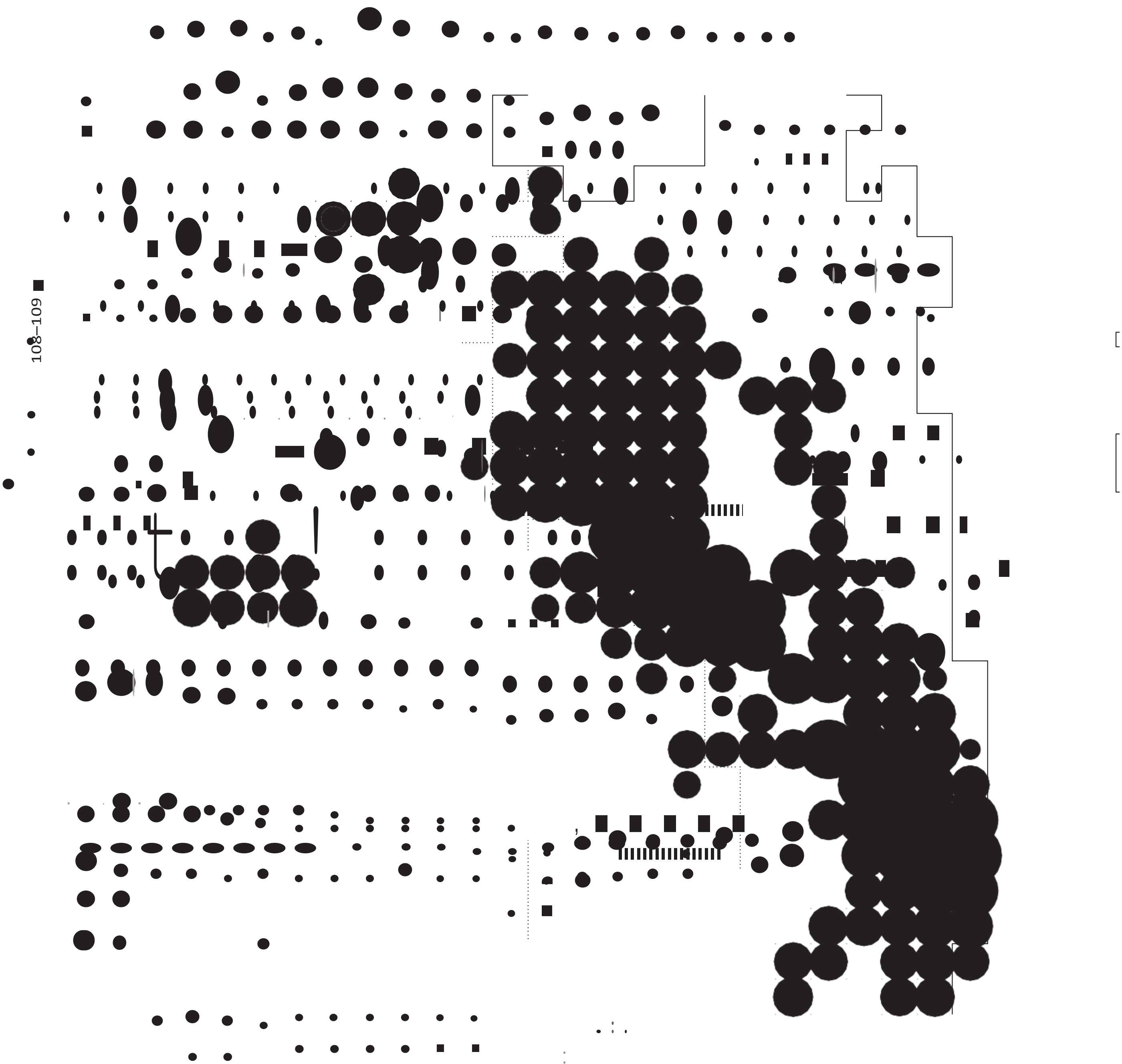
Radiation Map
Fukushima 2014

10–60 µSv/h

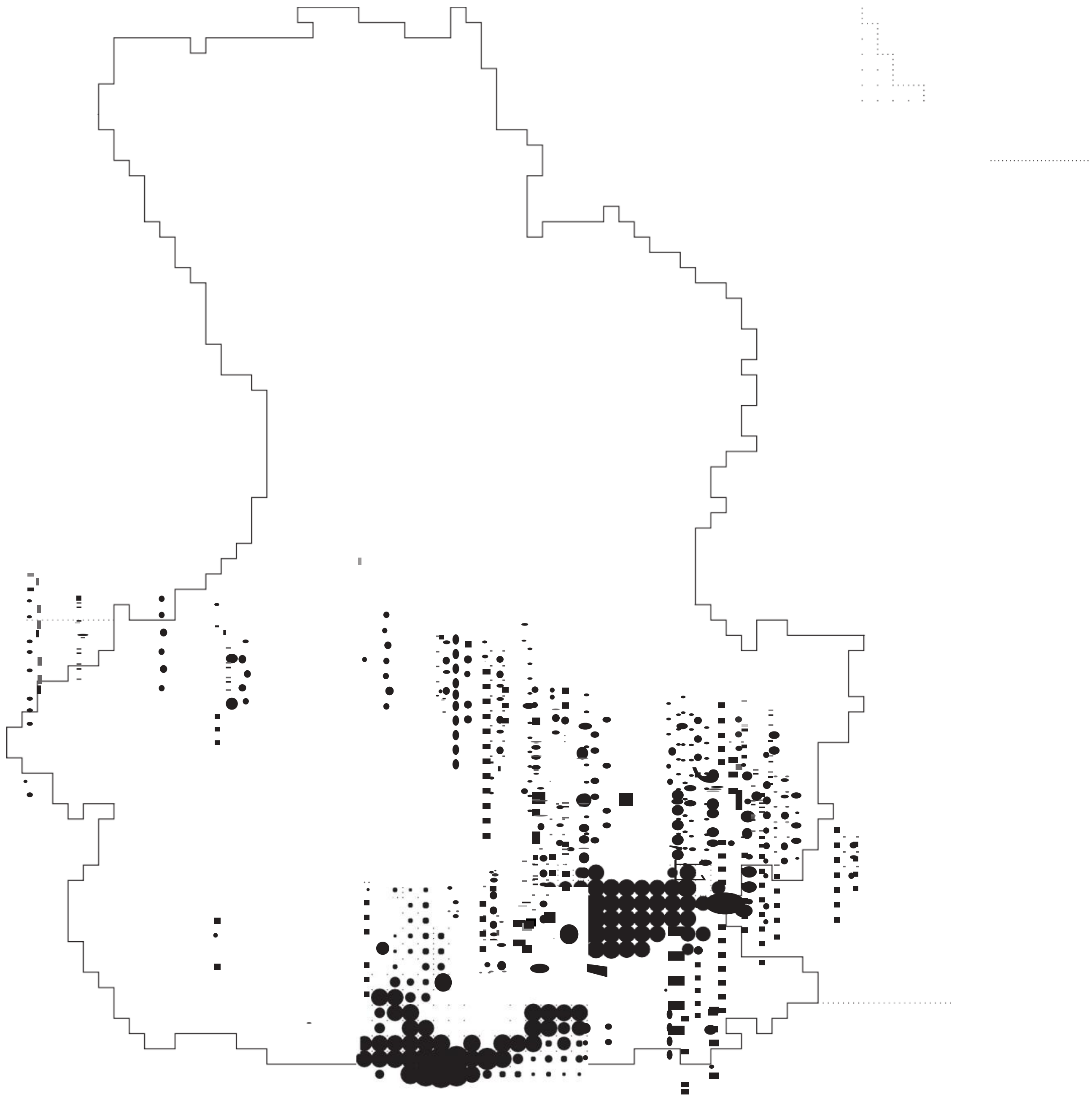
1–10 µSv/h

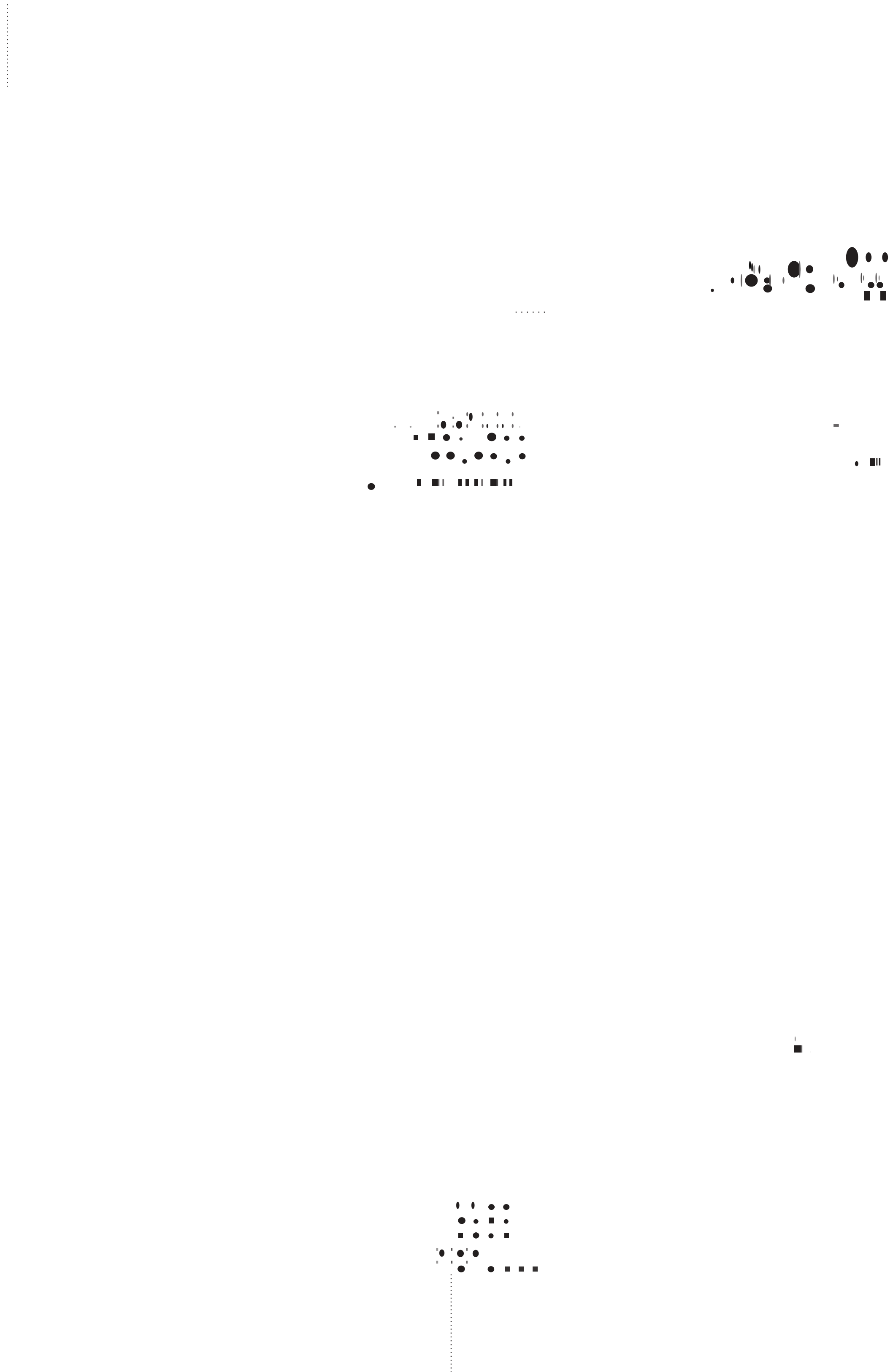
0–1 µSv/h

2.5 km



108–109





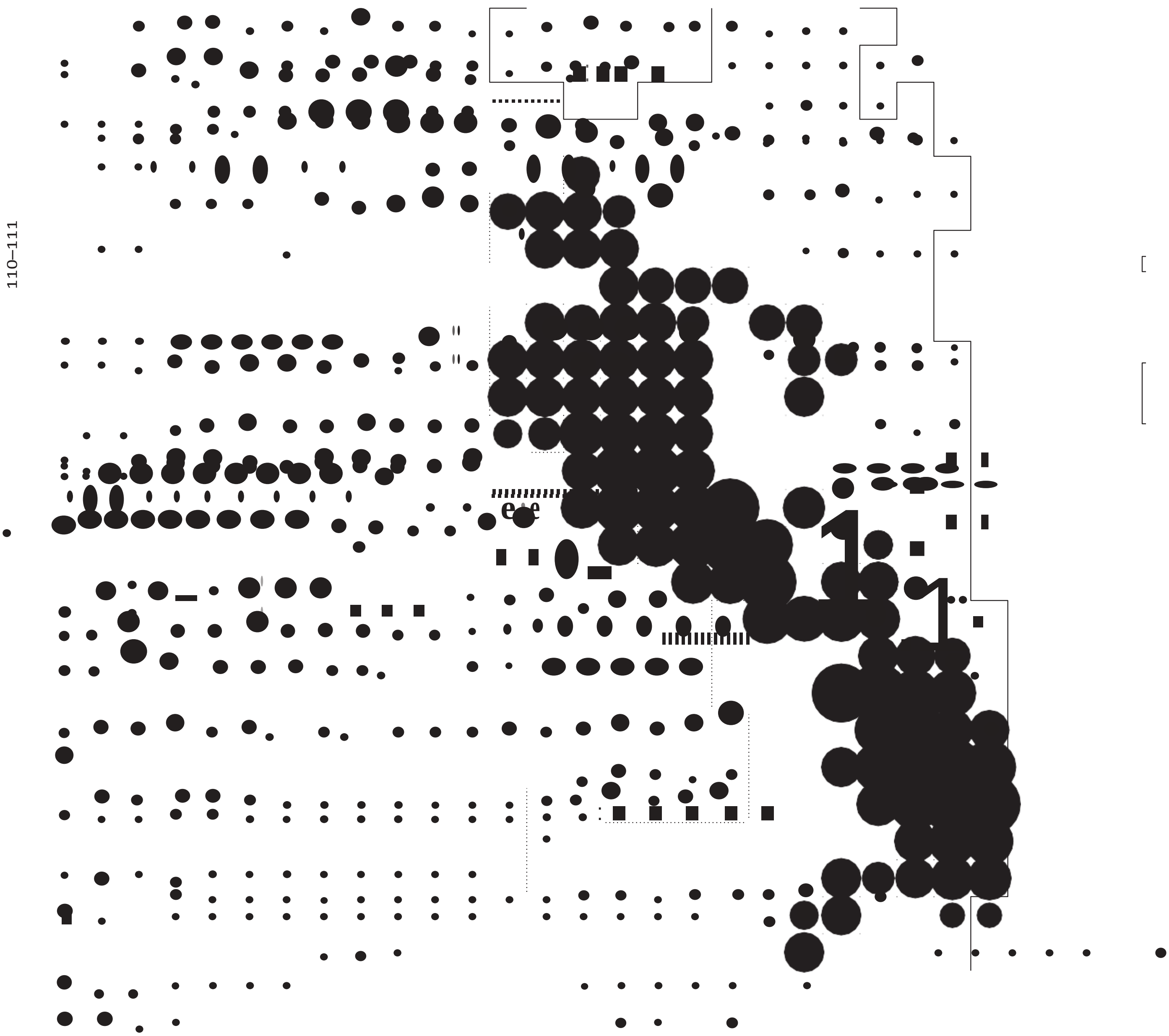
Radiation Map
Fukushima 2016

10–60 µSv/h

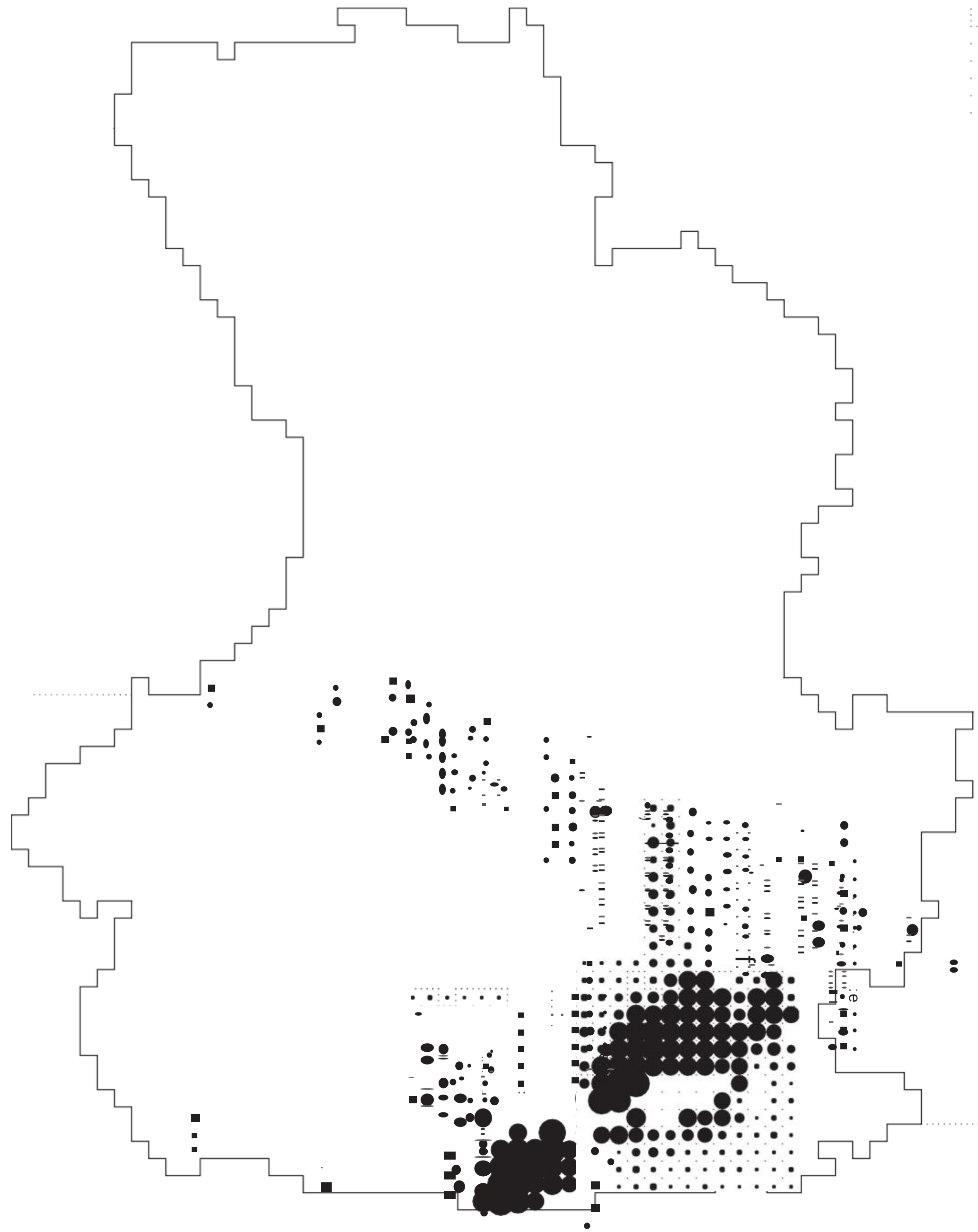
1–10 µSv/h

0–1 µSv/h

2.5 km



e



Environment

The absence of human activity in the restricted areas changed the habitat of the wildlife there. The cliché about nature, spread by Chernobyl myths, that “it takes its place back” and finds “new strength” without destructive human intervention, does not ring true in Fukushima Prefecture. Populations of wild pigs, bears, and Japanese tanuki there have increased about fivefold because they’re contaminated and can’t be hunted, but animals like birds, cicadas, and butterflies face sharp reduction in their populations due to radiation.

In contrast, farm animals and cultivated plants are successfully recovering. Farmers have fully decontaminated their cows, sheep, and horses by feeding them non-radioactive crops. Studies show that this method can clear milk of all radioactivity in just 2–8 weeks. Crops like peaches and rice meet all safety standards, too. A good portion of the harvest has reached undetectable radioactive levels. Still, one problem remains: radioactivity tests take a while to be done, and by the time they are, many goods are spoiled ●

100

Percent
Area in Fukushima Prefecture that was affected by the disaster

70

Percent
Area in Fukushima Prefecture that is mountainous forest

8.8

Percent
Area in Fukushima Prefecture that is farmland

54

Number of nuclear reactors that provided energy in Japan in 2010

0

Number of nuclear reactors that provided energy in Japan in 2012

12

Number of nuclear reactors set to provide energy in Japan in 2020

Economy

The nuclear accident at the Fukushima Daiichi power plant was also an absolute disaster for the Japanese economy. According to an estimate by the government, the so-called disaster-related costs totaled 21.5 trillion yen (about 188 billion USD) in 2016. Due to public pressure to shut down all of the nuclear power plants, the Japanese government faced unforeseen expenses. To maintain the power supply of the country, they had to increase fossil fuel imports by 26% in 2013 alone.

In the areas affected by the radiation, entire branches of industry collapsed as a result of the disaster. Agriculture, fish farming, and tourism were long abandoned in many parts of Fukushima Prefecture. The region is still so stigmatized that people consider visiting an act of bravery.

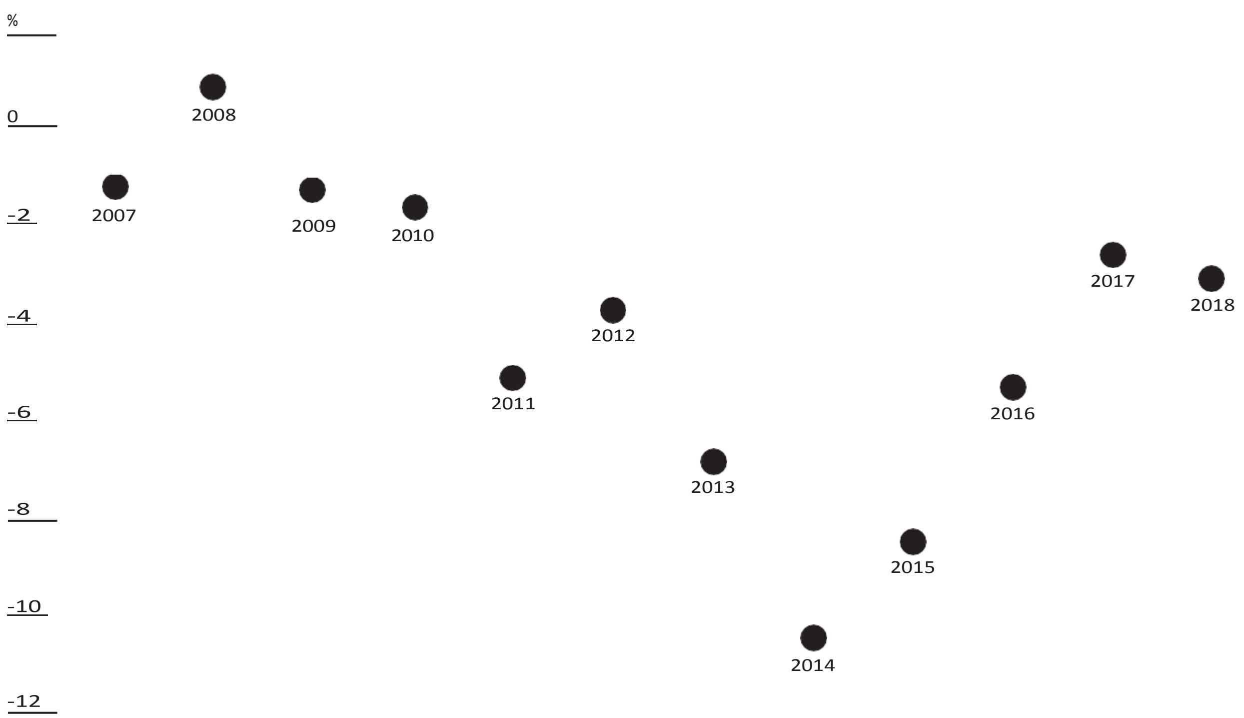
The situation is improving, but the import of certain products from Fukushima Prefecture is prohibited in 24 countries. Taiwan, South Korea, and China have even imposed a complete import ban on food from Fukushima Prefecture, although most products meet safety regulations and others are no longer contaminated.

"After the nuclear accident, the rice grown in Fukushima prefecture got thrown off the market and sold just as animal food. After taking many measures, such as decontamination, the test results no longer show radioactivity, but the reputational damage is still continuing."

Shoichi Miura, Director,
Kobo Hirose Rice Factory,
Fukushima Prefecture

Rice Price

Difference between the price of Fukushima-grown rice and the national average.



"Since the main industry of the village of Iitate is agriculture, the biggest issue is that the soil has been contaminated. The government decontaminated the farmland by replacing the top 5–10 centimeters of the soil with dirt from the mountains. But successful farming depends on soil that has been fertilized over decades. The soil taken from the mountains doesn't have enough nutrients for farming. So growers are forced to rebuild the soil from scratch, which is extremely difficult to do.

Another big issue is the millions of black bags piled up all around the area which contain the contaminated soil that was removed from the farmland. This takes away even more land from the farmers."

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

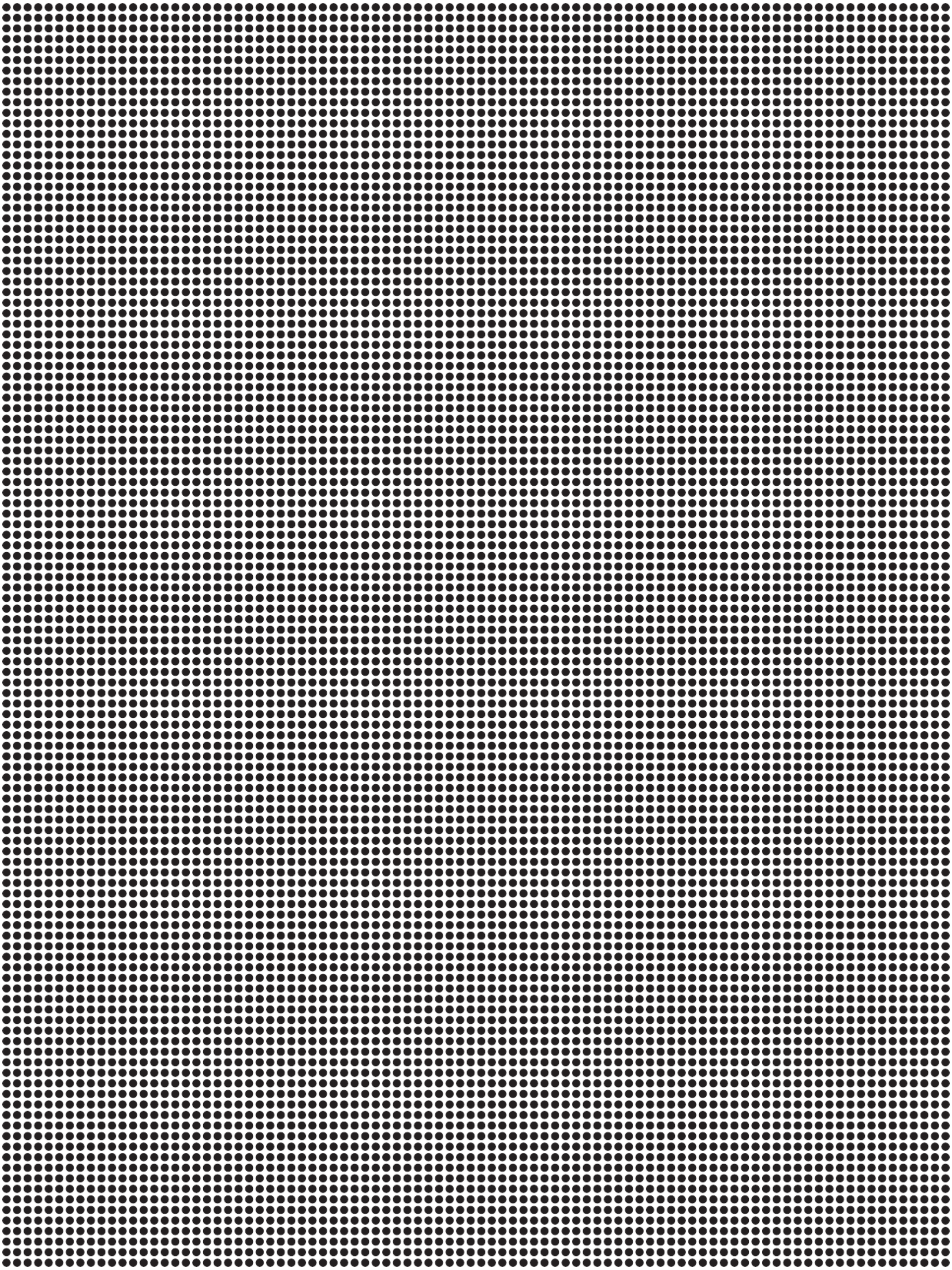
16,
000,
000

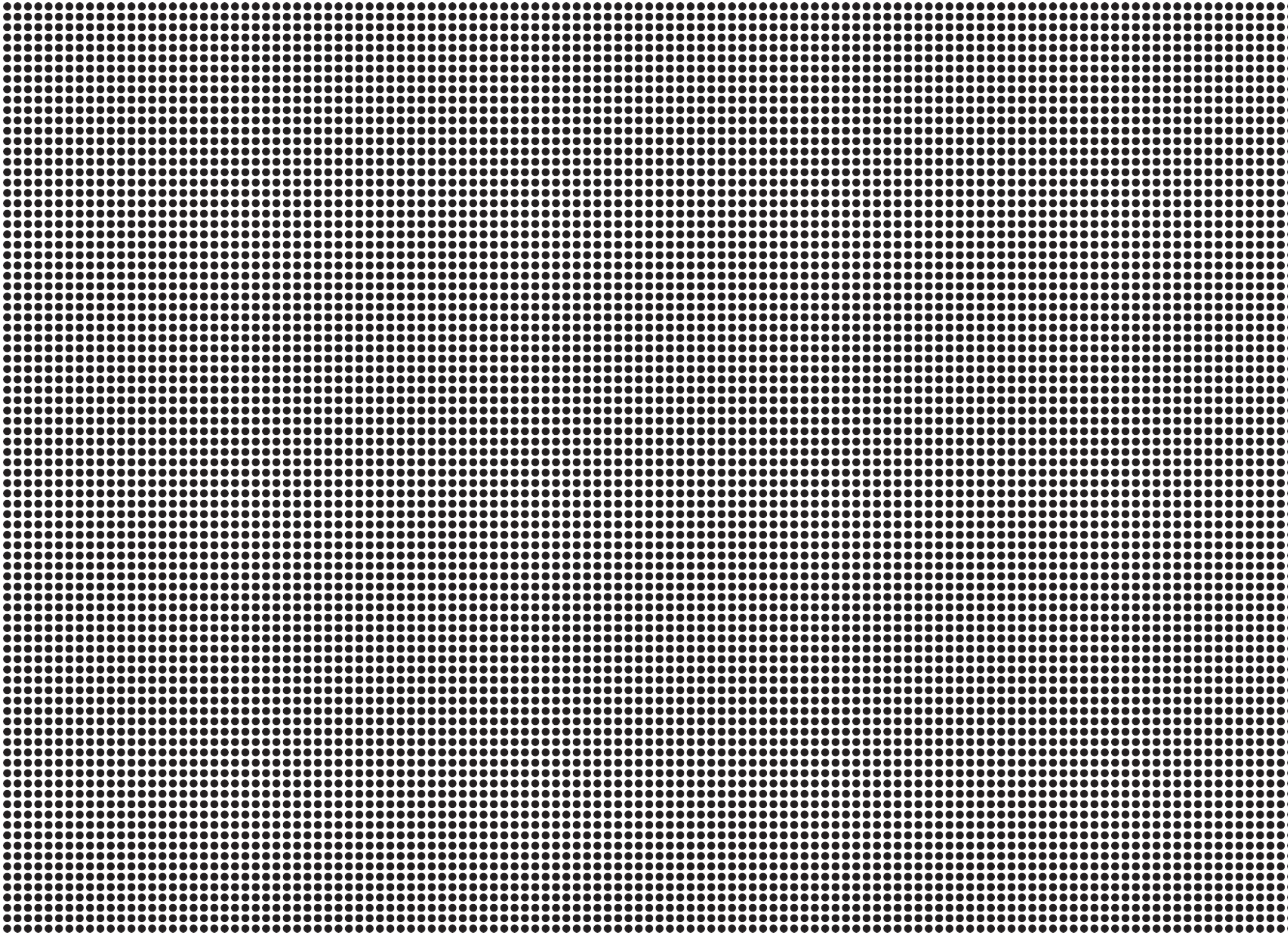
m^3
Amount of contaminated soil stored in temporary storage locations across Fukushima Prefecture

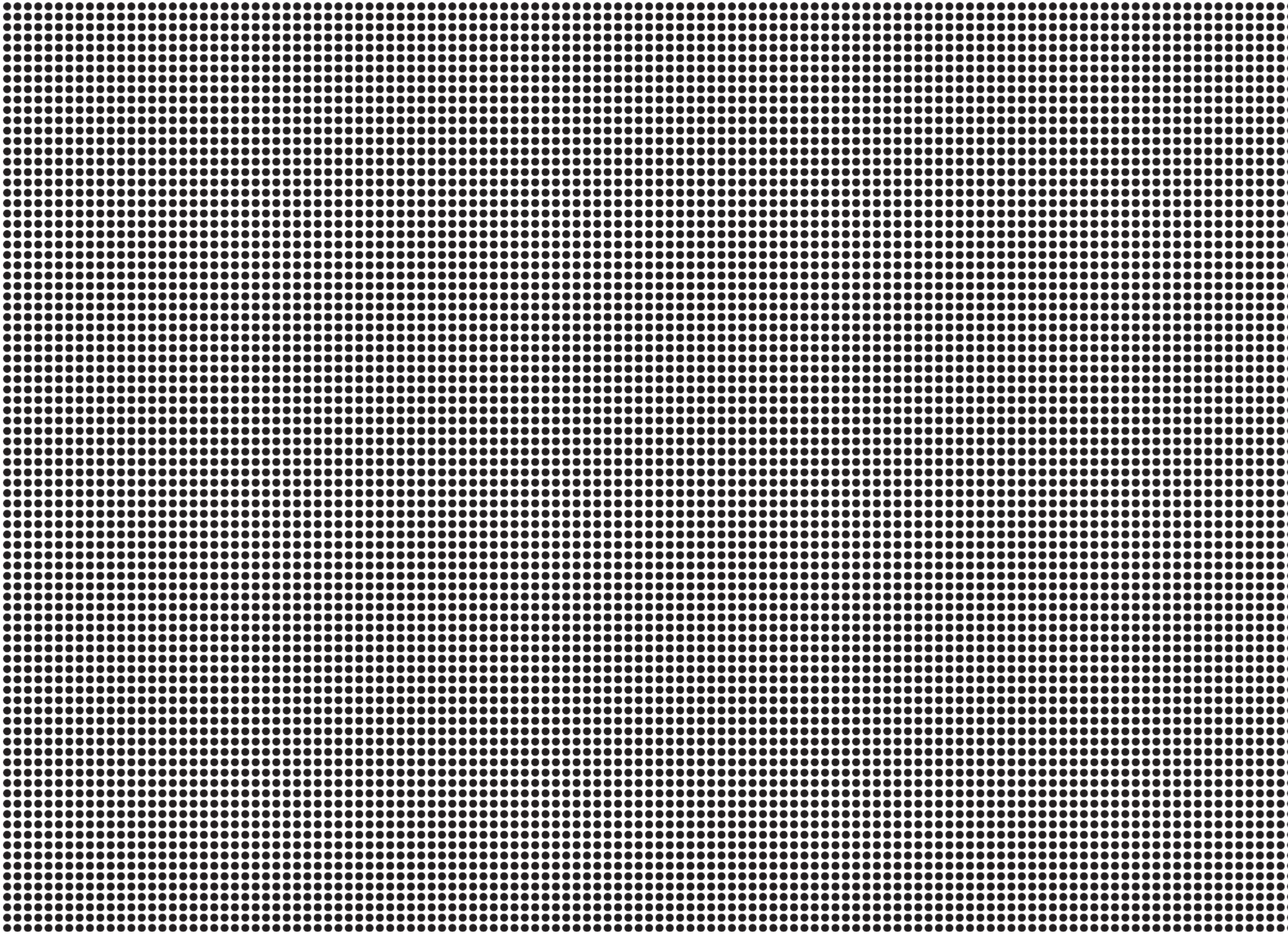
438

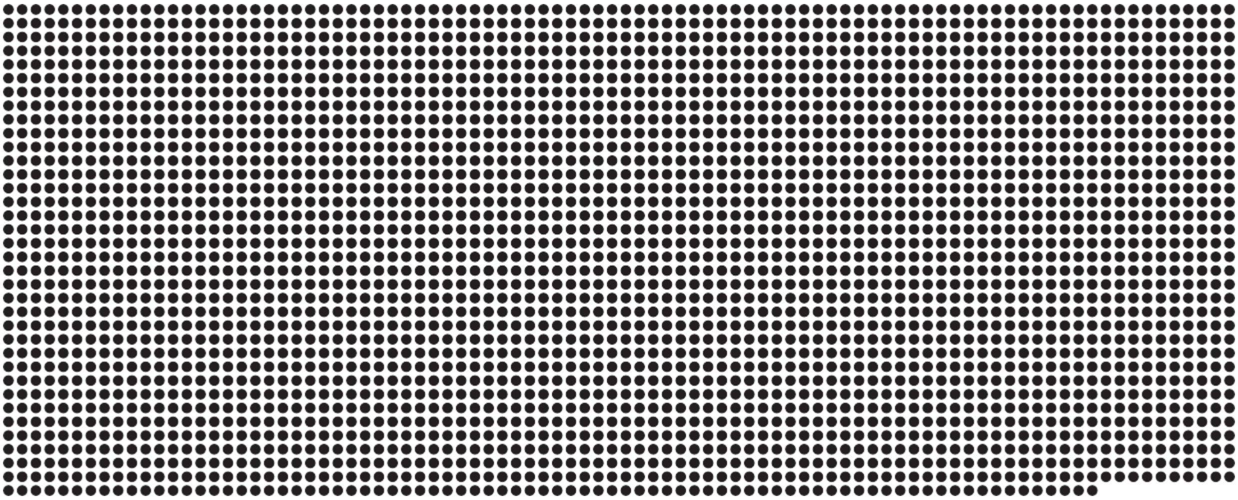
m^3
Cargo volume of Boeing 767 freight plane

The amount of contaminated soil equals a cargo volume of 36,530 freight planes.





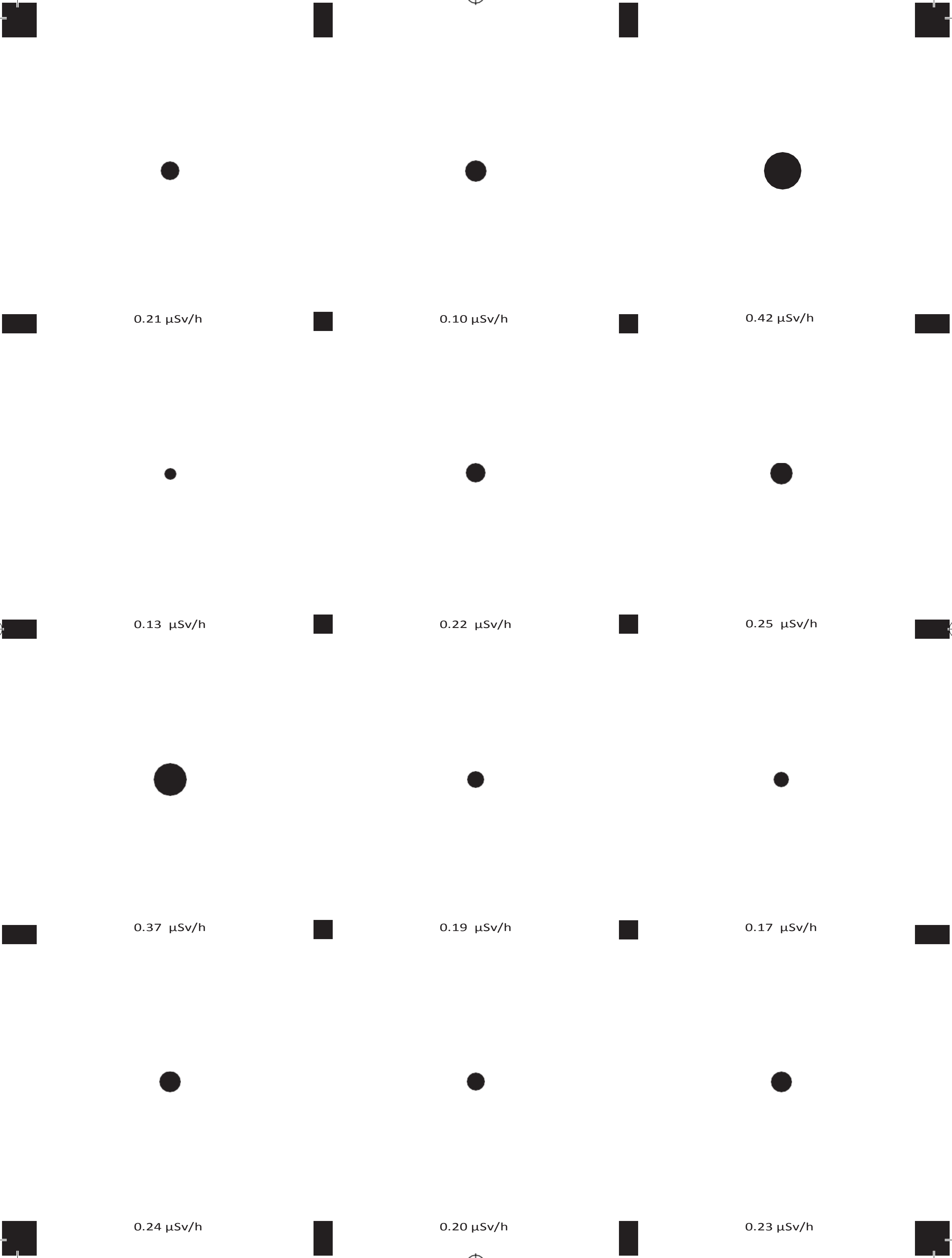


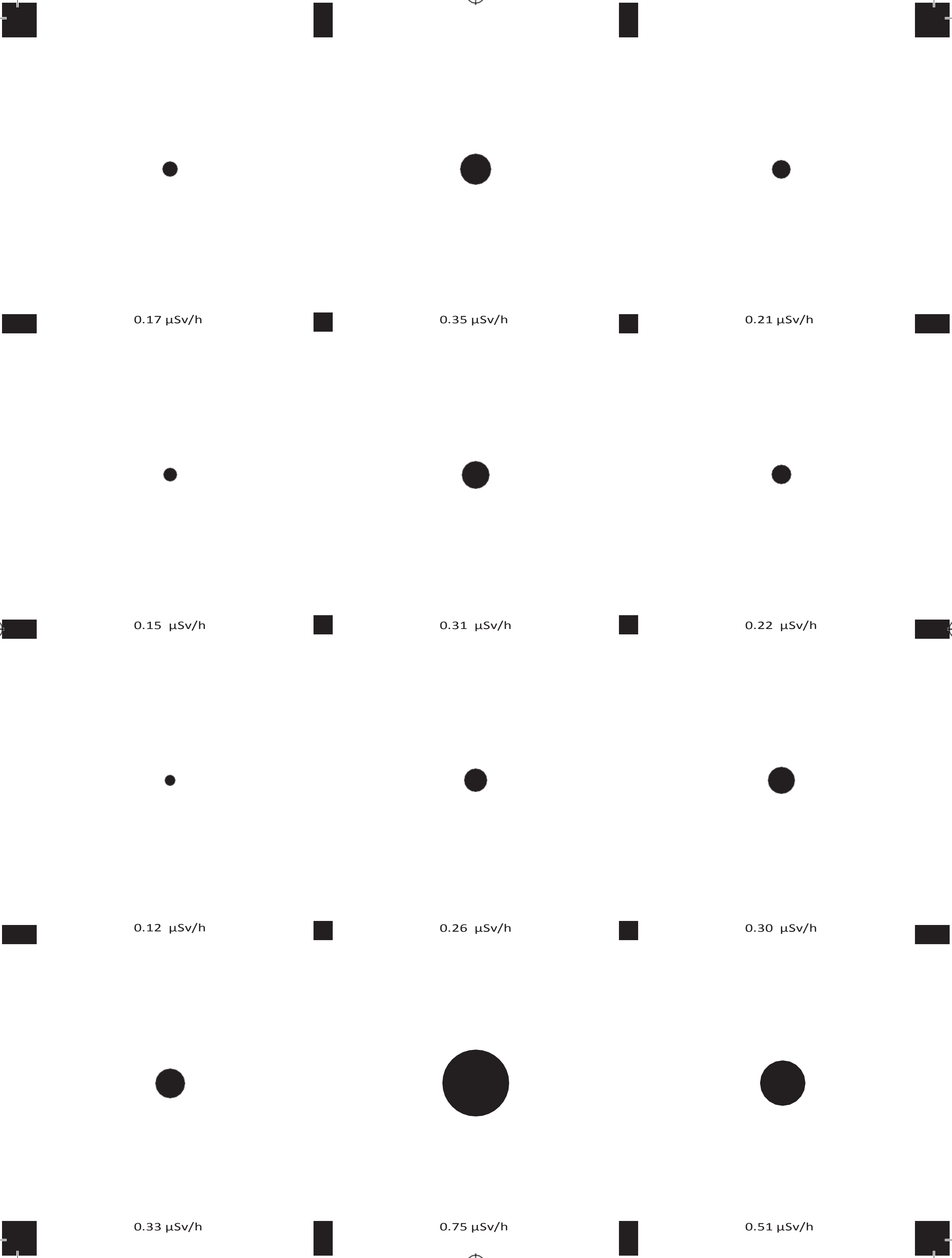


Bags containing radioactive waste are often covered to fit into the surroundings.

Farmland is being decontaminated by removing the topsoil with heavy machinery.

37.331410, 141.025154 0.22 µSv/h


0.21 μSv/h
0.10 μSv/h
0.42 μSv/h
0.13 μSv/h
0.22 μSv/h
0.25 μSv/h
0.37 μSv/h
0.19 μSv/h
0.17 μSv/h
0.24 μSv/h
0.20 μSv/h
0.23 μSv/h

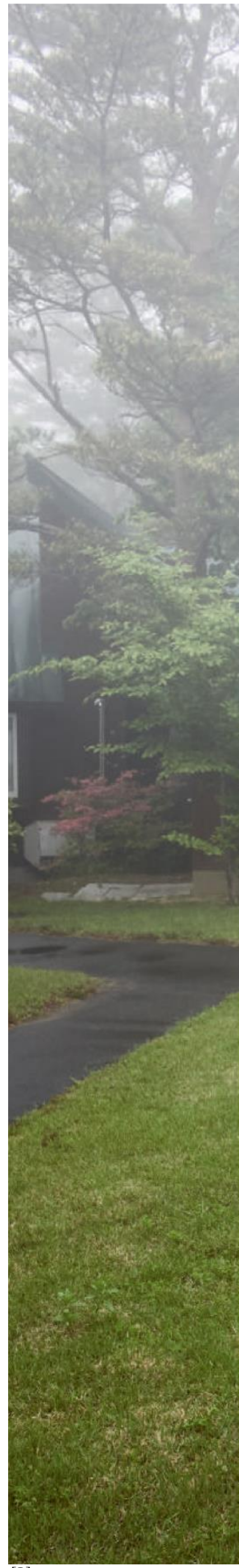


0.17 µSv/h
0.35 µSv/h
0.21 µSv/h
0.15 µSv/h
0.31 µSv/h
0.22 µSv/h
0.12 µSv/h
0.26 µSv/h
0.30 µSv/h
0.33 µSv/h
0.75 µSv/h
0.51 µSv/h

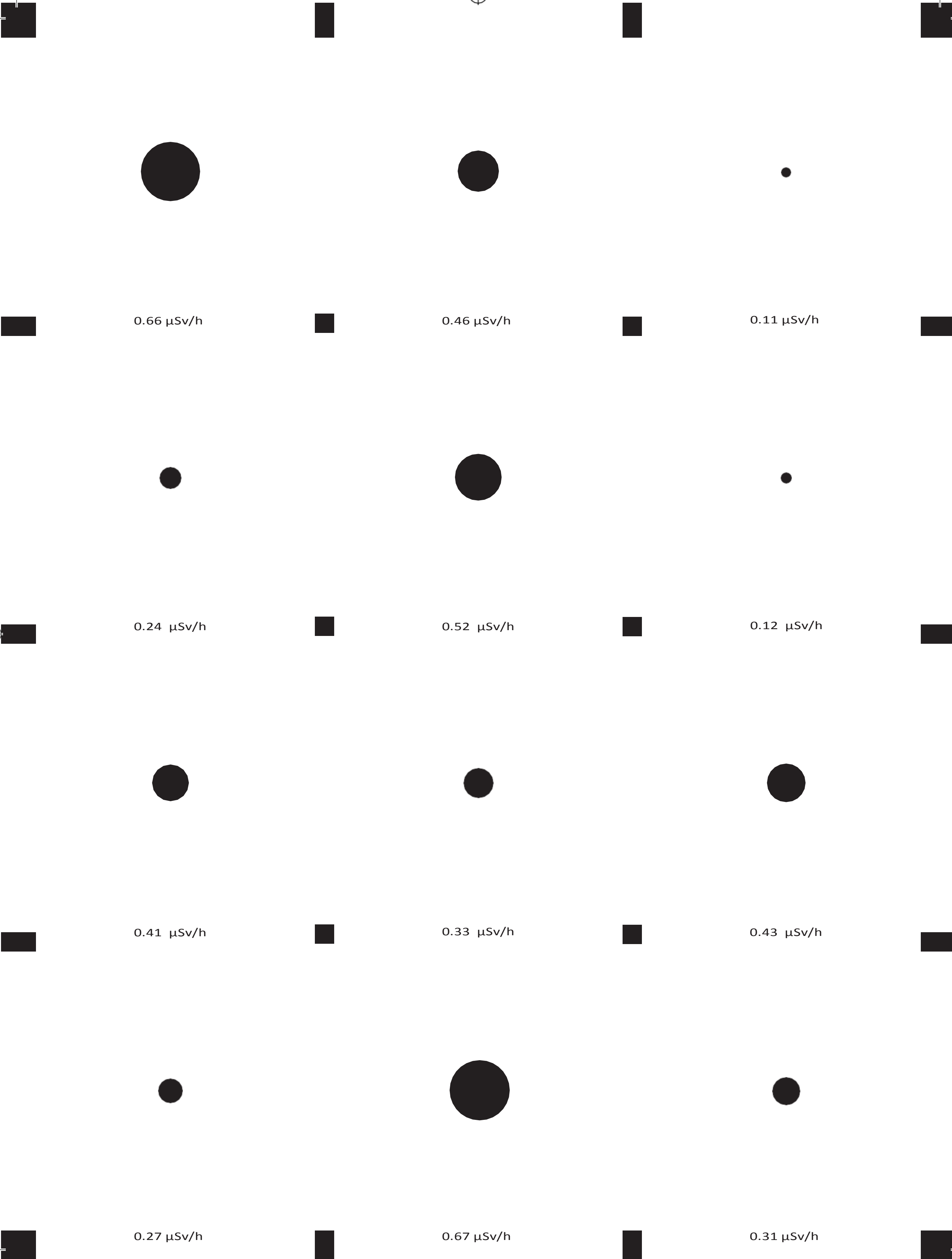
37.330644, 141.024508 0.22 µSv/h

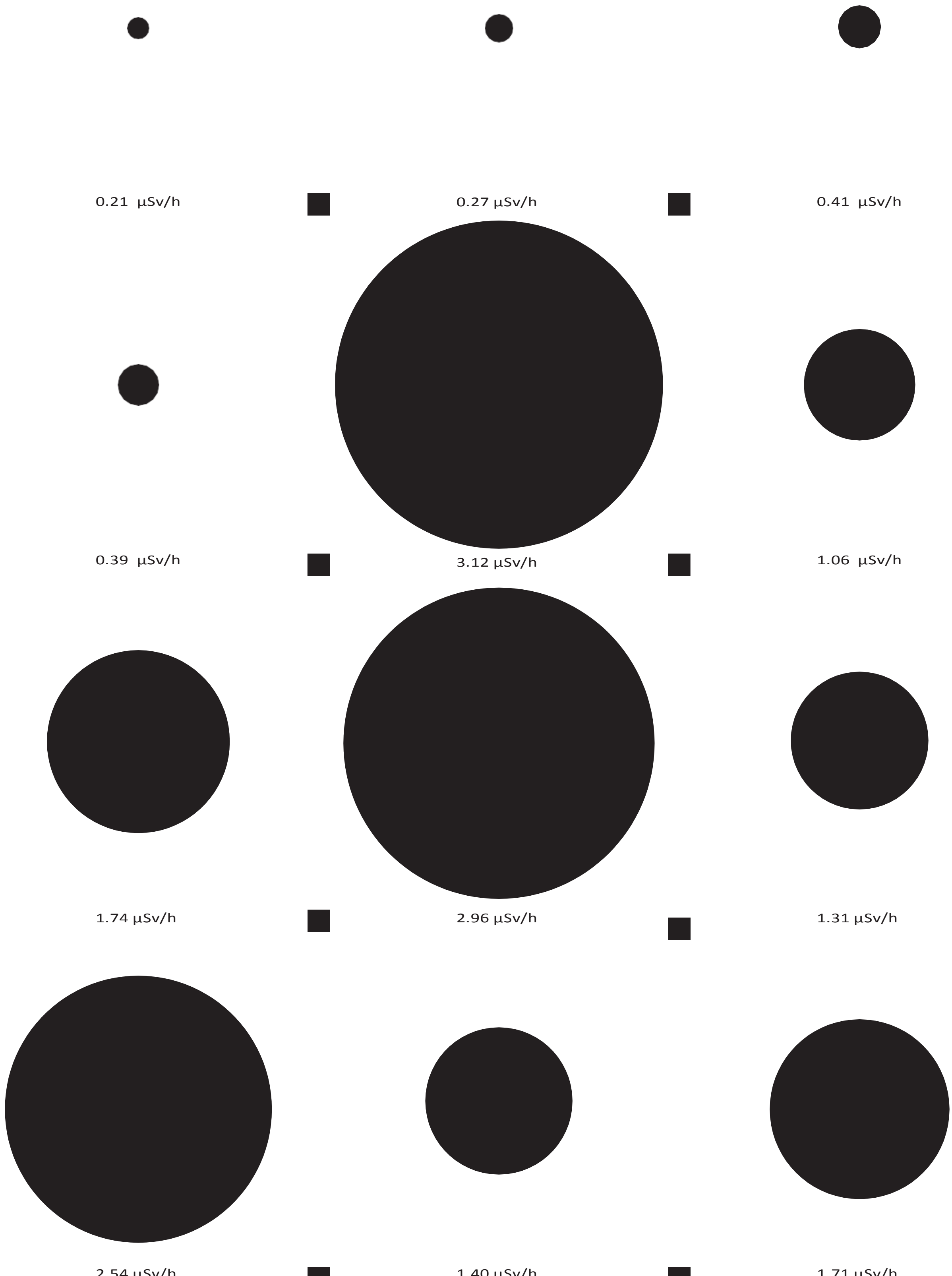
[1]

141.003944



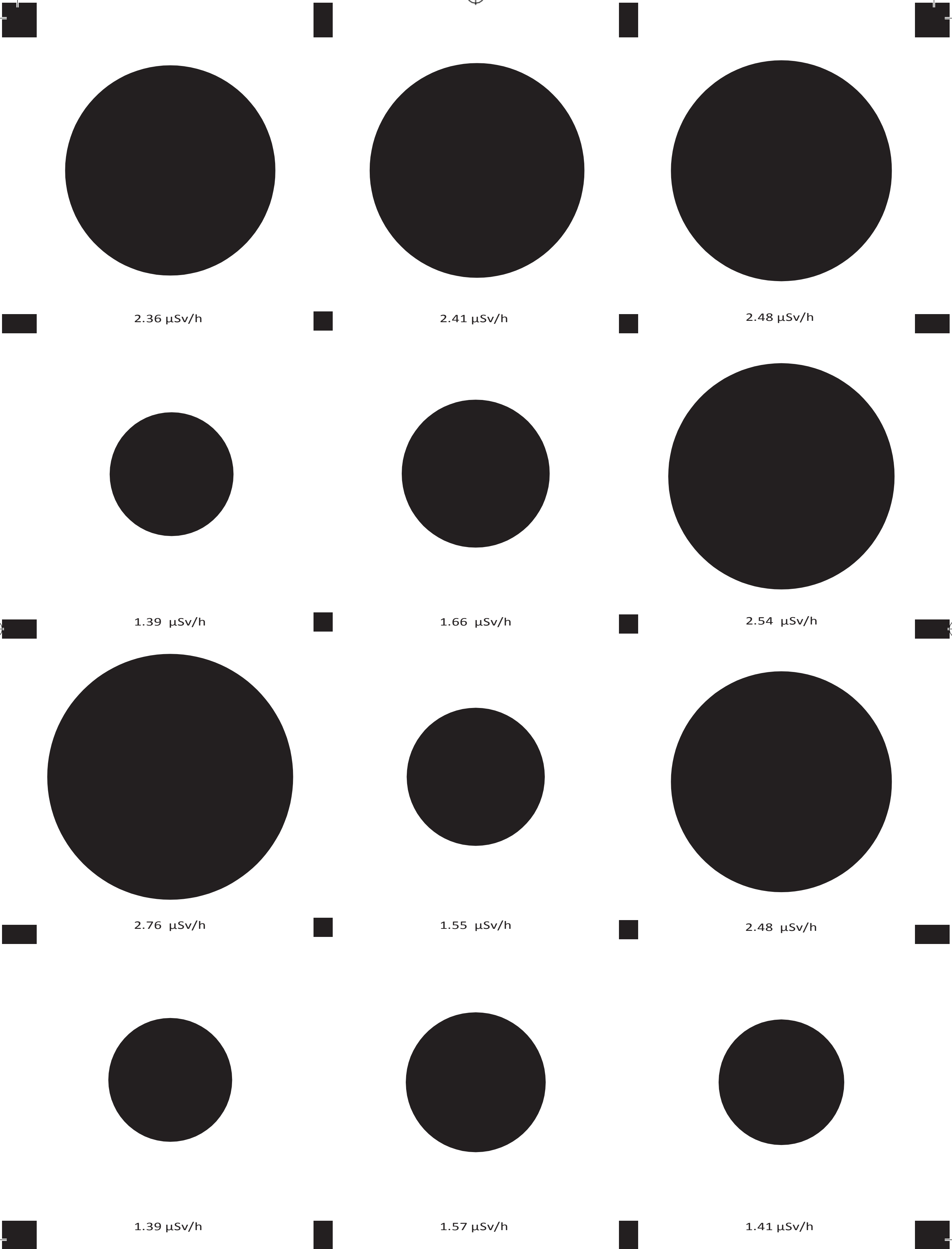
[2]

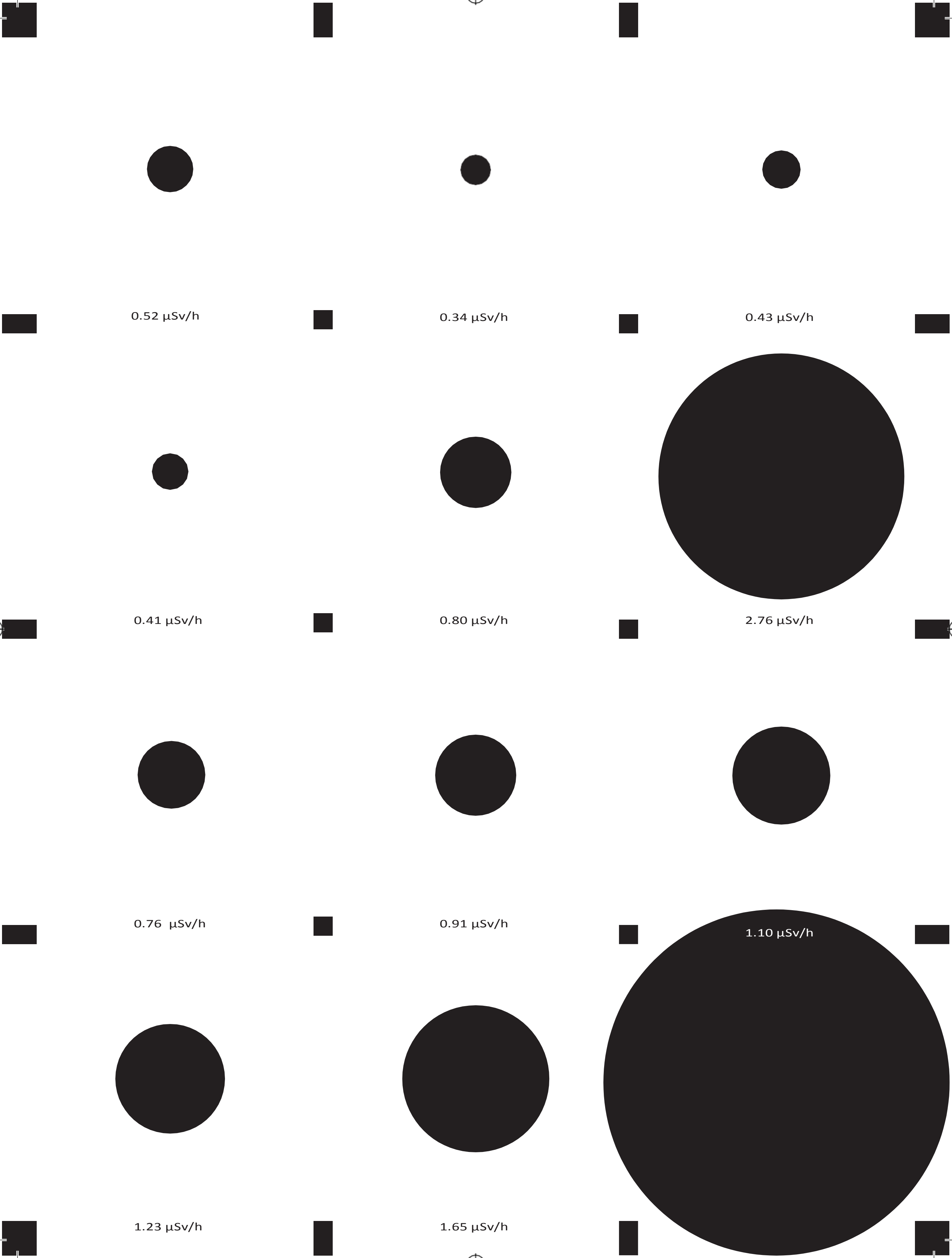

0.66 μSv/h
0.46 μSv/h
0.11 μSv/h
0.24 μSv/h
0.52 μSv/h
0.12 μSv/h
0.41 μSv/h
0.33 μSv/h
0.43 μSv/h
0.27 μSv/h
0.67 μSv/h
0.31 μSv/h


0.21 μSv/h
0.27 μSv/h
0.41 μSv/h
0.39 μSv/h
3.12 μSv/h
1.06 μSv/h
1.74 μSv/h
2.96 μSv/h
1.31 μSv/h
2.54 μSv/h
1.40 μSv/h
1.71 μSv/h

140.615340 0.41

37.449861, 141.009194   2.54 µSv/h

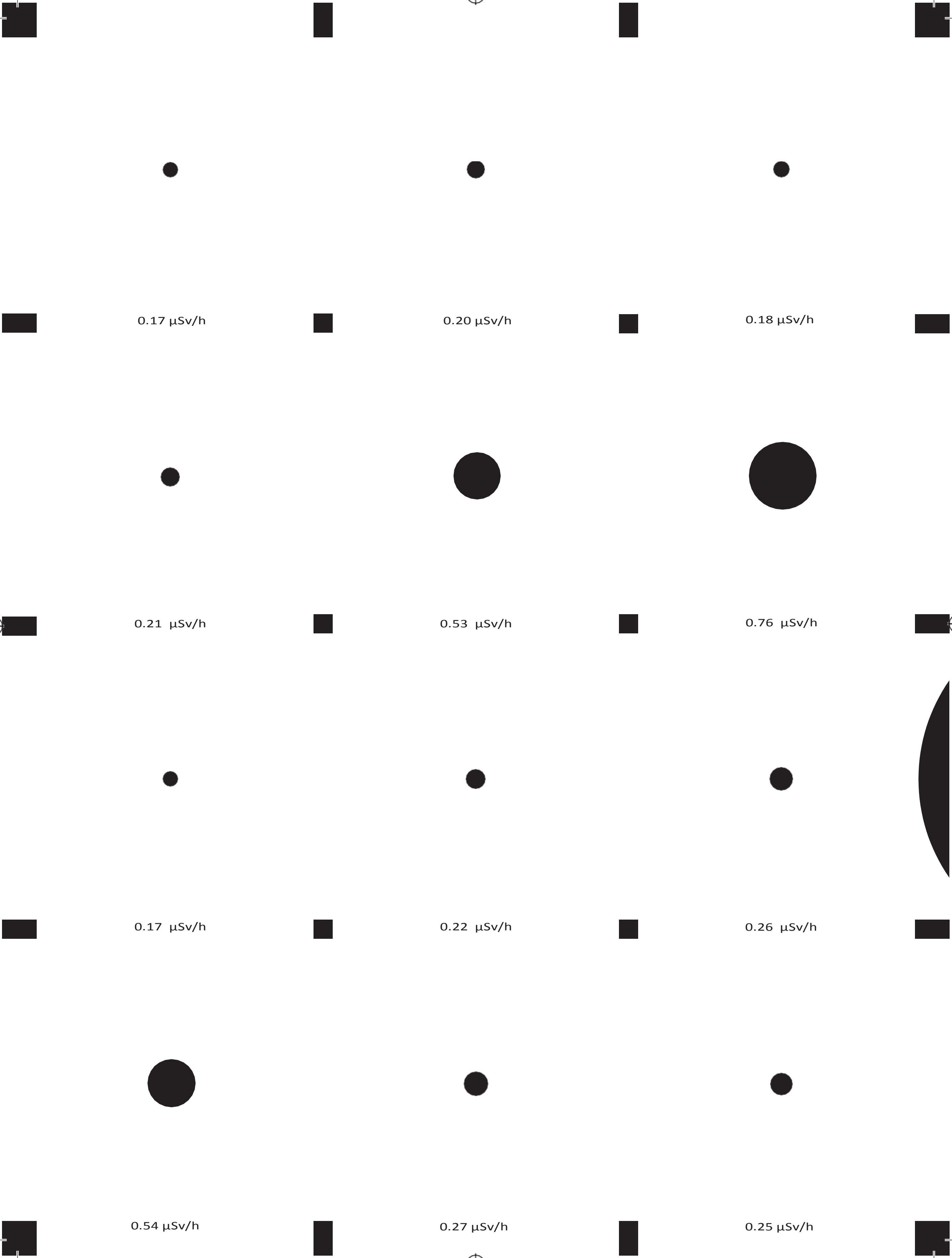

2.36 μSv/h
2.41 μSv/h
2.48 μSv/h
1.39 μSv/h
1.66 μSv/h
2.54 μSv/h
2.76 μSv/h
1.55 μSv/h
2.48 μSv/h
1.39 μSv/h
1.57 μSv/h
1.41 μSv/h

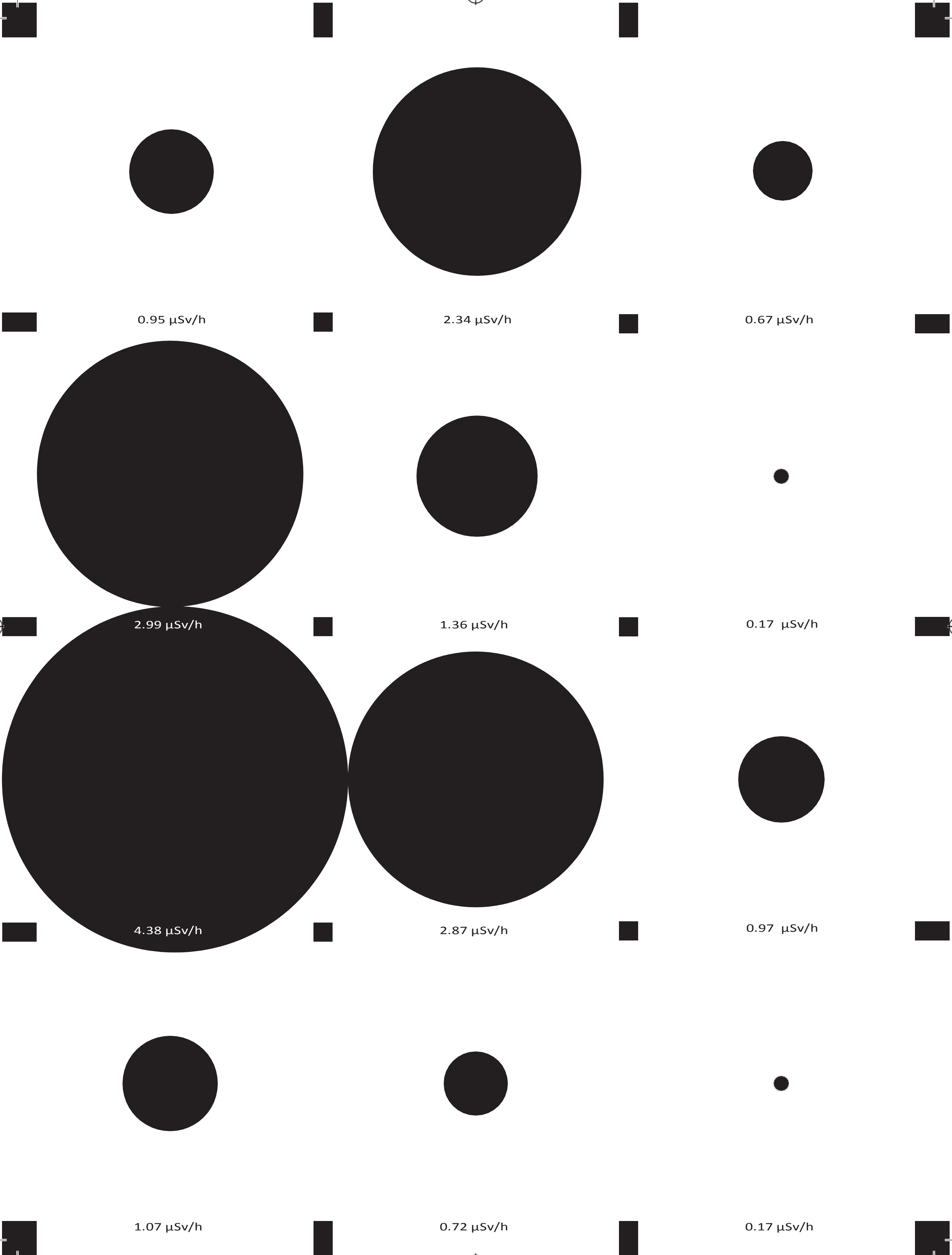

0.52 µSv/h
0.34 µSv/h
0.43 µSv/h
0.41 µSv/h
0.80 µSv/h
2.76 µSv/h
0.76 µSv/h
0.91 µSv/h
1.10 µSv/h
1.23 µSv/h
1.65 µSv/h

37.449667, 141.009222   2.76 µSv/h

37.493389, 140.993000   0.76 μSv/h

@ @

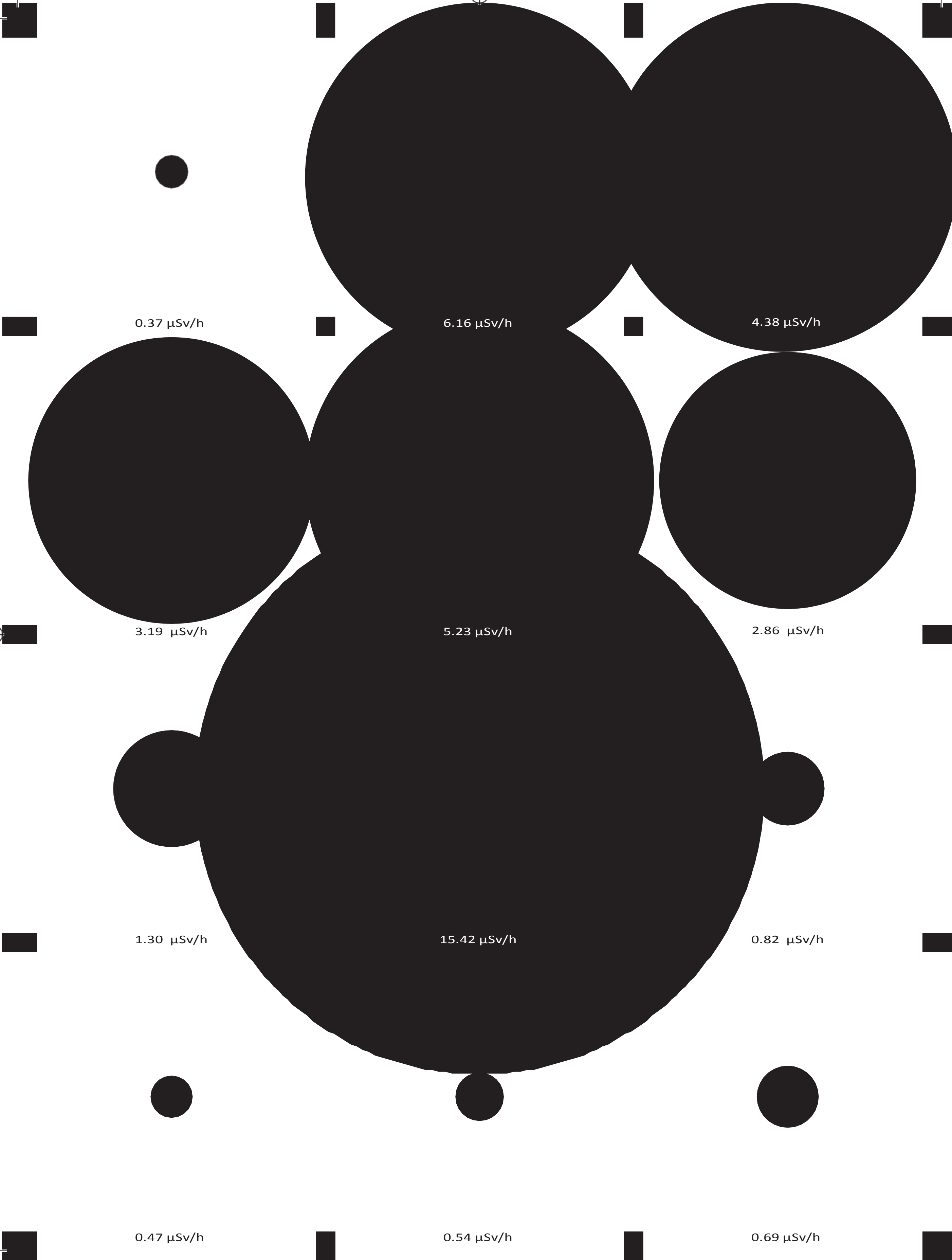

0.17 μSv/h
0.20 μSv/h
0.18 μSv/h
0.21 μSv/h
0.53 μSv/h
0.76 μSv/h
0.17 μSv/h
0.22 μSv/h
0.26 μSv/h
0.54 μSv/h
0.27 μSv/h
0.25 μSv/h

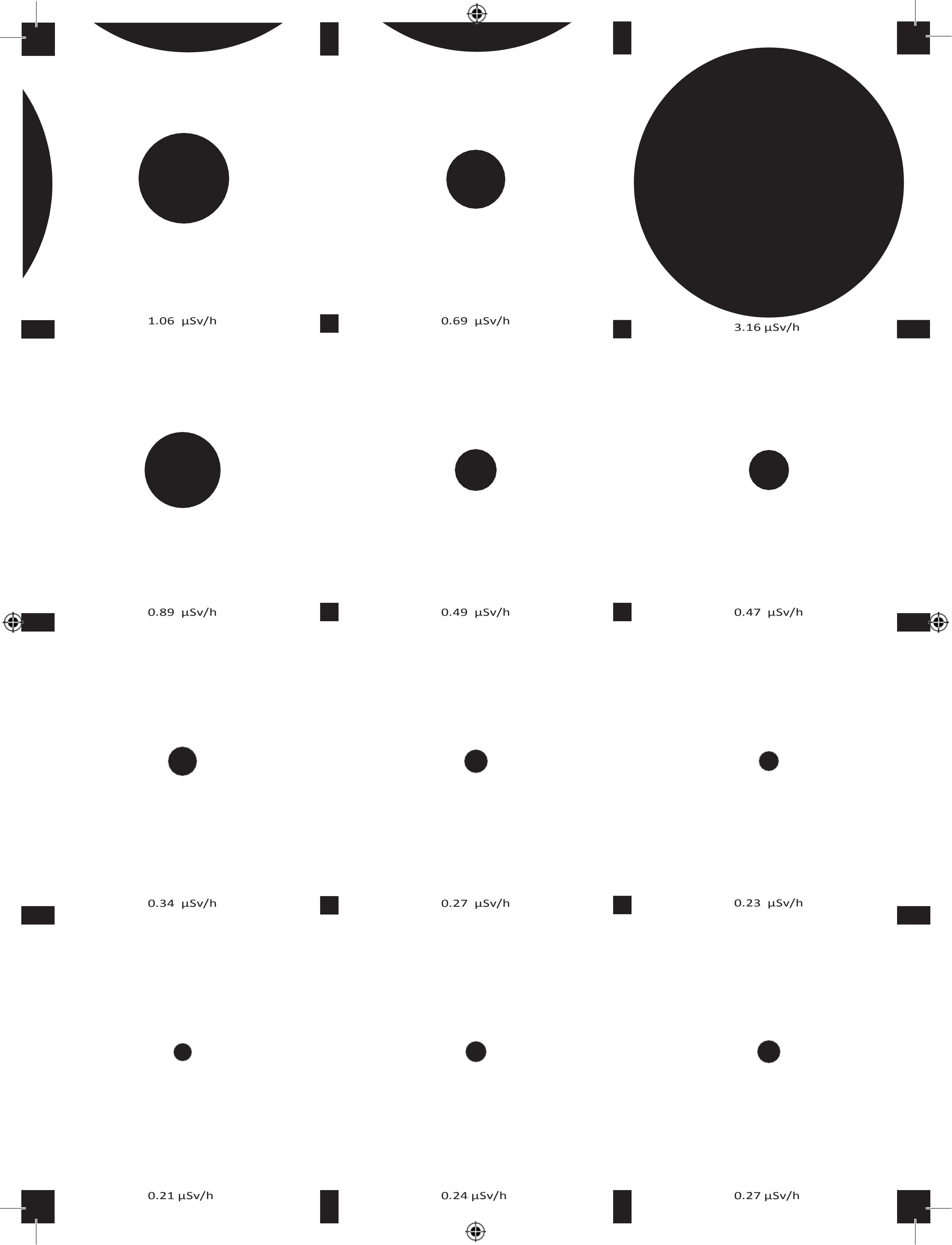

0.95 μSv/h
2.34 μSv/h
0.67 μSv/h
2.99 μSv/h
1.36 μSv/h
0.17 μSv/h
4.38 μSv/h
2.87 μSv/h
0.97 μSv/h
1.07 μSv/h
0.72 μSv/h
0.17 μSv/h

37.504472, 140.997111

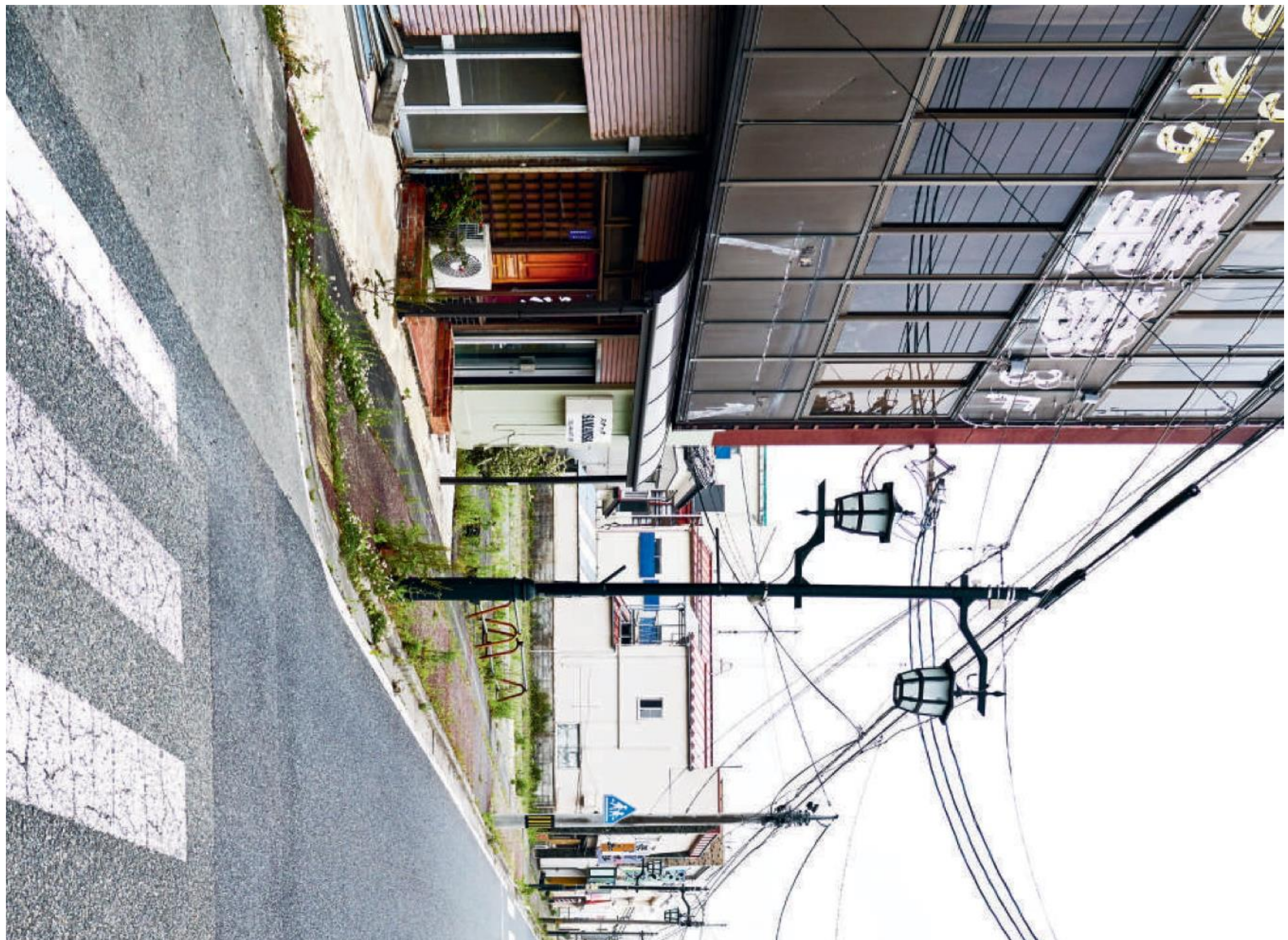
37.359892, 141.010251 4.38 µSv/h

[4]

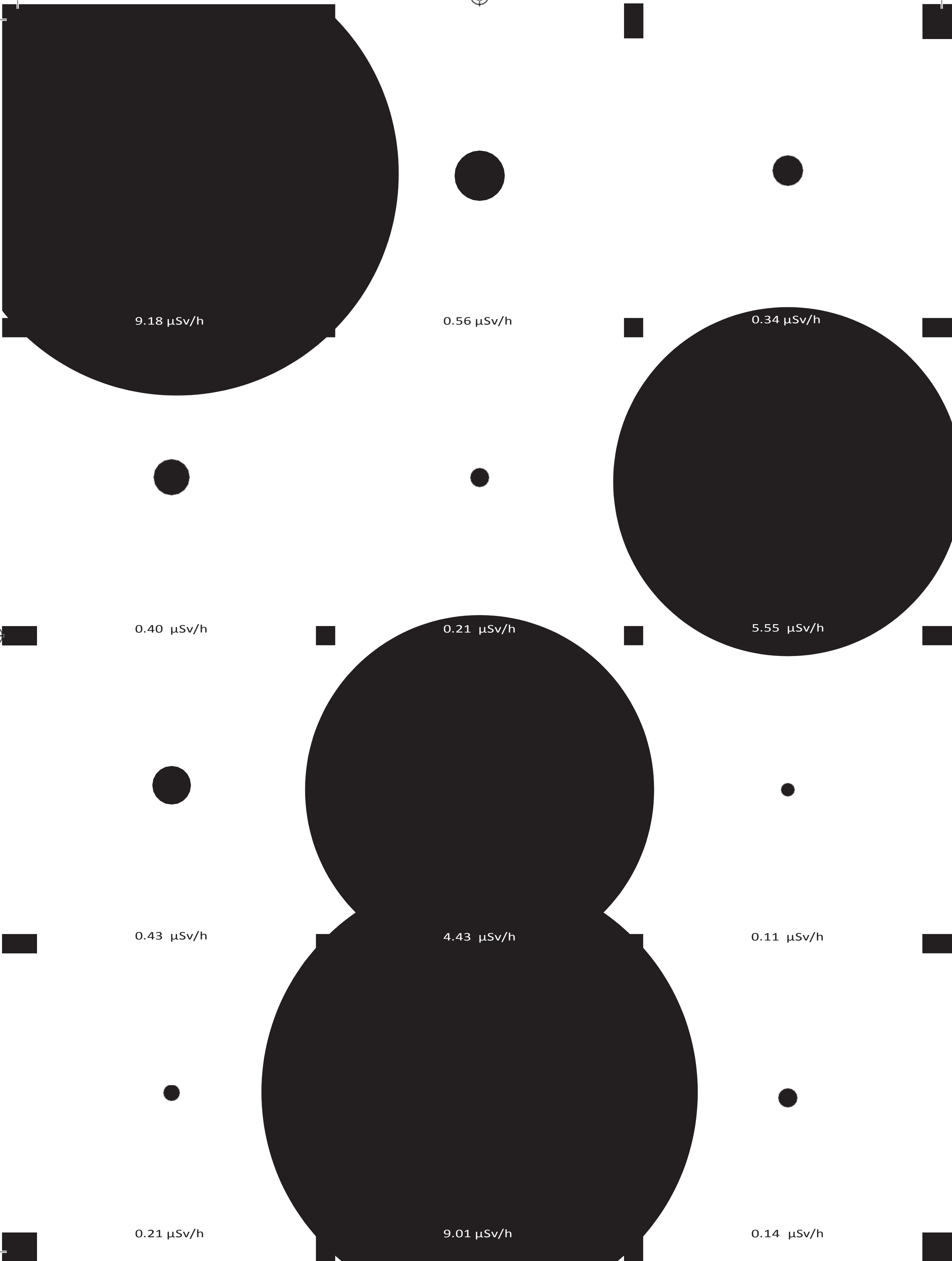

0.37 μSv/h
6.16 μSv/h
4.38 μSv/h
3.19 μSv/h
5.23 μSv/h
2.86 μSv/h
1.30 μSv/h
15.42 μSv/h
0.82 μSv/h
0.47 μSv/h
0.54 μSv/h
0.69 μSv/h

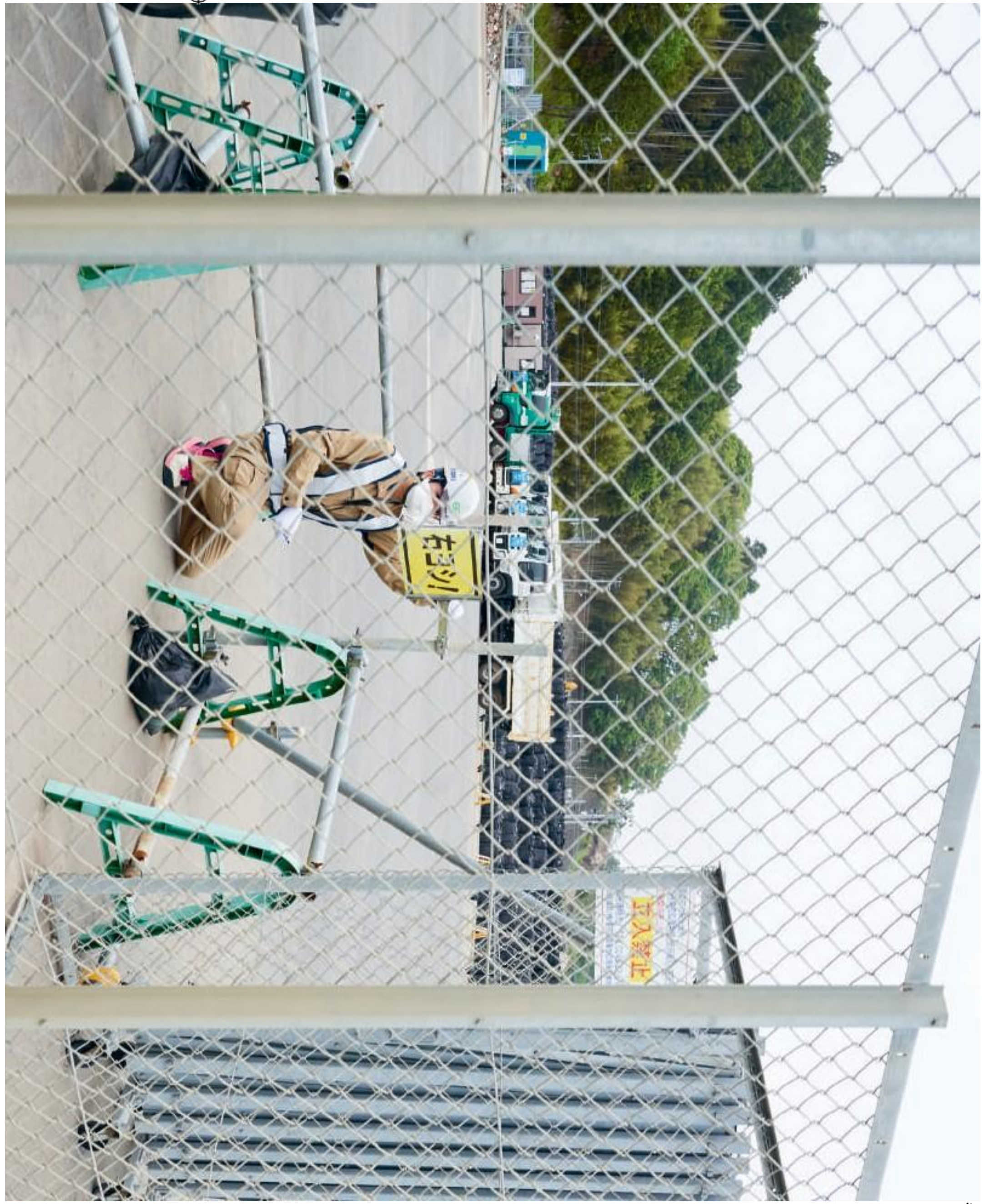

1.06 μSv/h
0.69 μSv/h
3.16 μSv/h
0.89 μSv/h
0.49 μSv/h
0.47 μSv/h
0.34 μSv/h
0.27 μSv/h
0.23 μSv/h
0.21 μSv/h
0.24 μSv/h
0.27 μSv/h

37.496000, 140.978639 0.47 μSv/h



37.494888, 140.994056   0.34 μSv/h


9.18 µSv/h
0.56 µSv/h
0.34 µSv/h
0.40 µSv/h
0.21 µSv/h
5.55 µSv/h
0.43 µSv/h
4.43 µSv/h
0.11 µSv/h
0.21 µSv/h
9.01 µSv/h
0.14 µSv/h



37.330684, 141.025128   0.21 µSv/h

[1] A promotional slogan on a storage location for contaminated soil.

[2] All over Fukushima Prefecture, Geiger counters show the radioactive dosage of the surrounding area.

[3] An abandoned arcade close to the power plant.

[4] The highly contaminated Kunimata shrine in Namie.

[5] This road leads to the Fukushima Daiichi power plant.

09 Japan’s Most Beautiful Contaminated Village

Iitate, Fukushima Prefecture

On March 15, 2011, wind direction and precipitation decided the fate of the small village of Iitate in Fukushima Prefecture, turning a village once honored as one of Japan’s most beautiful into a no-go zone. Although the village was located outside of the primary exclusion area, the name Iitate soon made headlines worldwide. Wind had carried radioactive particles toward Iitate, and, on March 15, they fell to the ground in the form of rain and snow. After a month of living under extremely high radiation levels, inhabitants were finally asked to evacuate.

In 2012, Mayor Norio Kanno gave his word that Iitate would be fully accessible by 2017. That year, the village was divided into three zones: areas in the east and west that had been reopened for business activities, the center, where visitors were limited to day visits, and the mountains in the south that were declared a no-go zone. On March 31, 2017, Mayor Norio Kanno fulfilled his promise. Excluding the third zone, Iitate was fully inhabitable once again. Nevertheless, it is far from being the home, business location, and travel destination that it was in the past. The fields and meadows are shaved bare and whole mountains of plastic bags filled with contaminated soil are piled up everywhere. A sign with an integrated sievert-measuring display is located at the entrance of the town saying: Welcome Home.

The biggest problem the town faces today is that few people feel at home. On the one hand, the youth prefer life in the city. Only eight percent of the Japanese population lives in the countryside. On the other hand, the village is heavily associated with radiation, which deters people from setting up their lives there. Iitate and all of Fukushima Prefecture are overshadowed by stigma. Consuming products from the region is a test of courage for many.

In 2017, when the five years had passed, Mayor Kanno said: "The village will never be the same as before the disaster, but perhaps it will develop in a whole new way. Life won't get any better if you just stay pessimistic." ●

6,209

Iitate population in 2010

261

Number of elder citizens that volunteered to clean up the Iitate area after the disaster

41

Iitate population in 2015

2,300

Hectares
Amount of farmland in
Iitate in use in 2010

20

Hectares
Amount of farmland in
Iitate in use in 2017

“I’d like the people of the world to know there are a lot of blessings of nature in the village of Iitate. Not being able to farm the blessings of the earth is like losing your life.”

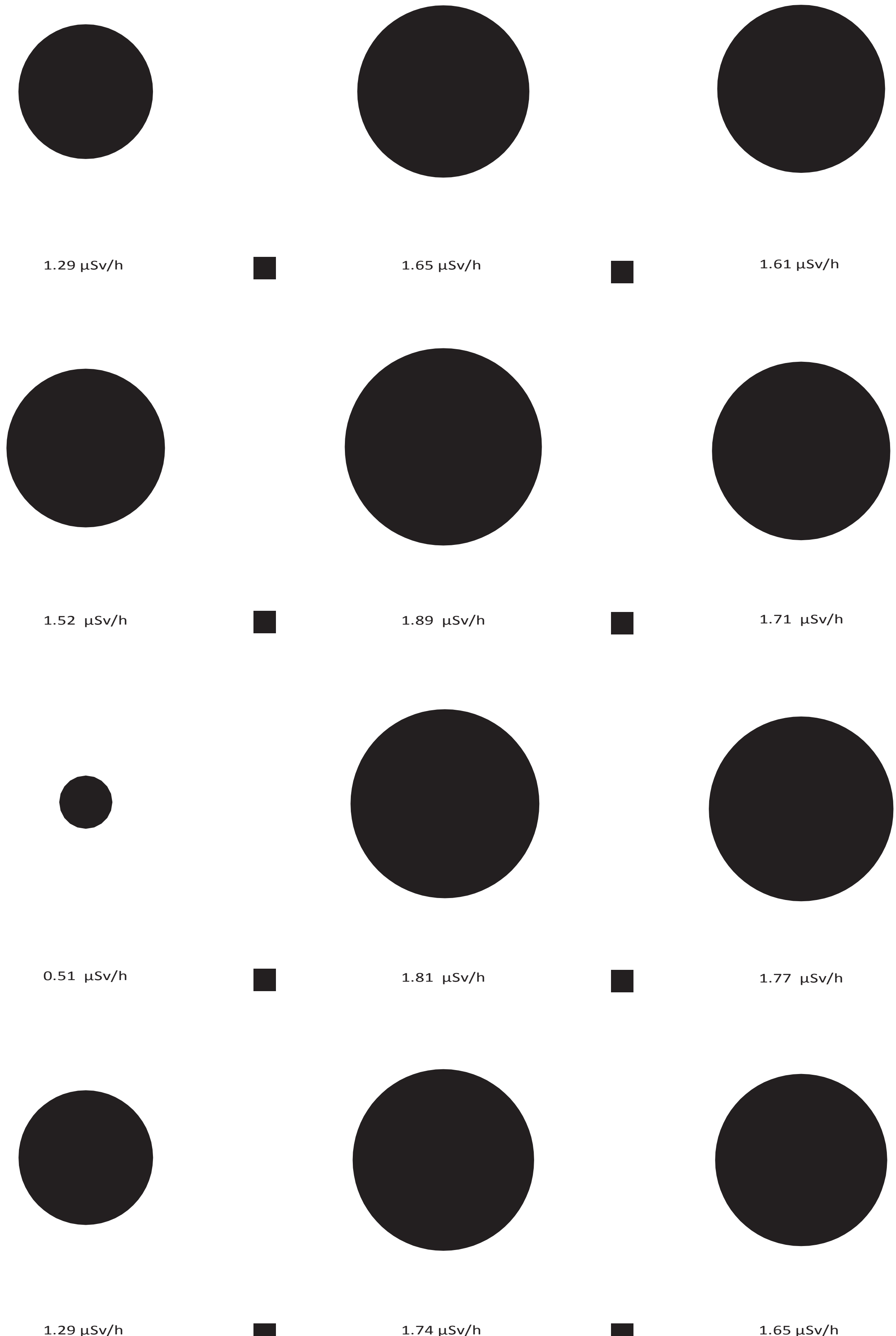
Numeo Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

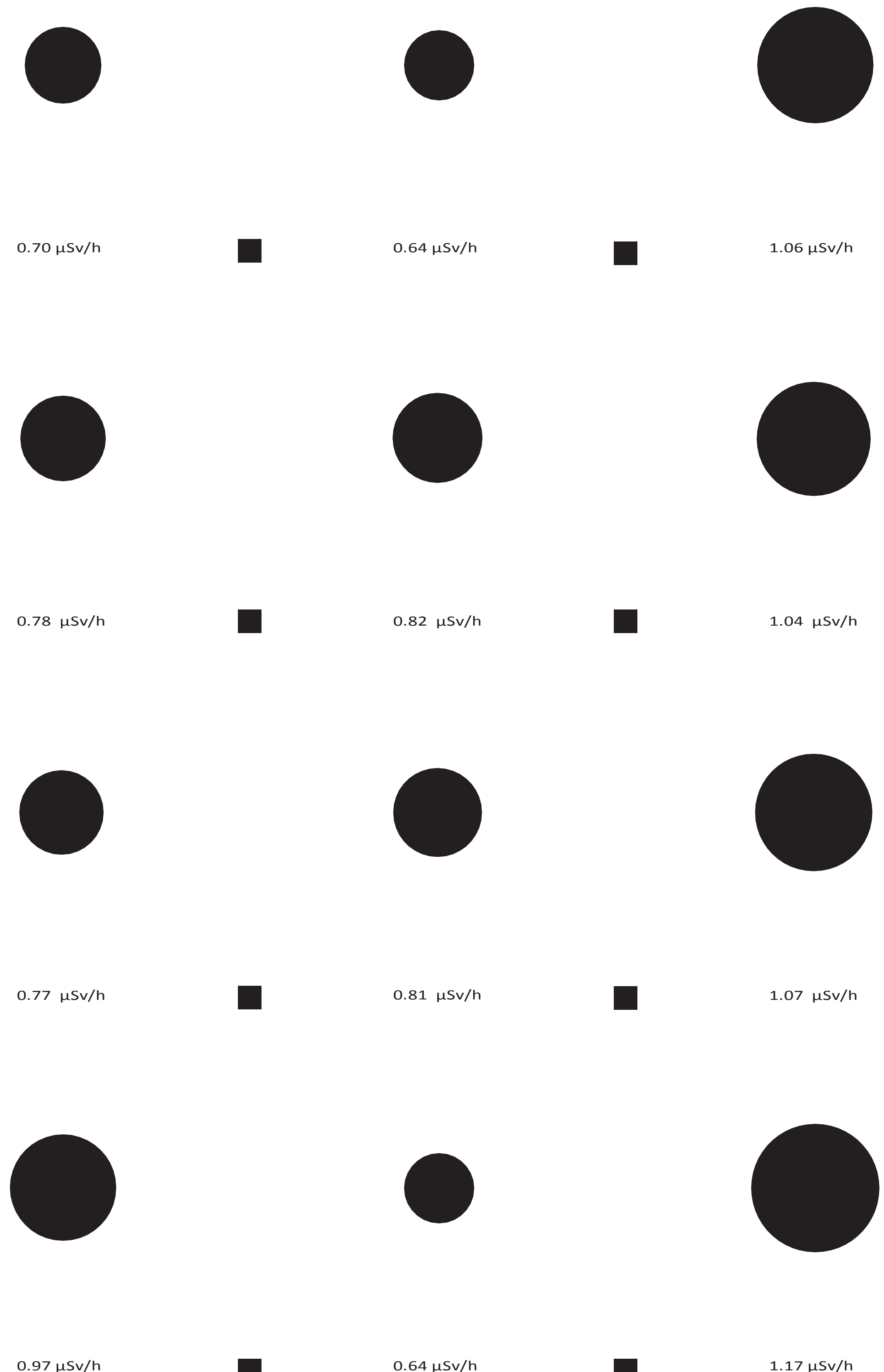
[1] Houses in Iitate are mostly kept in good shape despite no one living there.

[2] A newly opened ice-cream parlor in the center of Iitate.

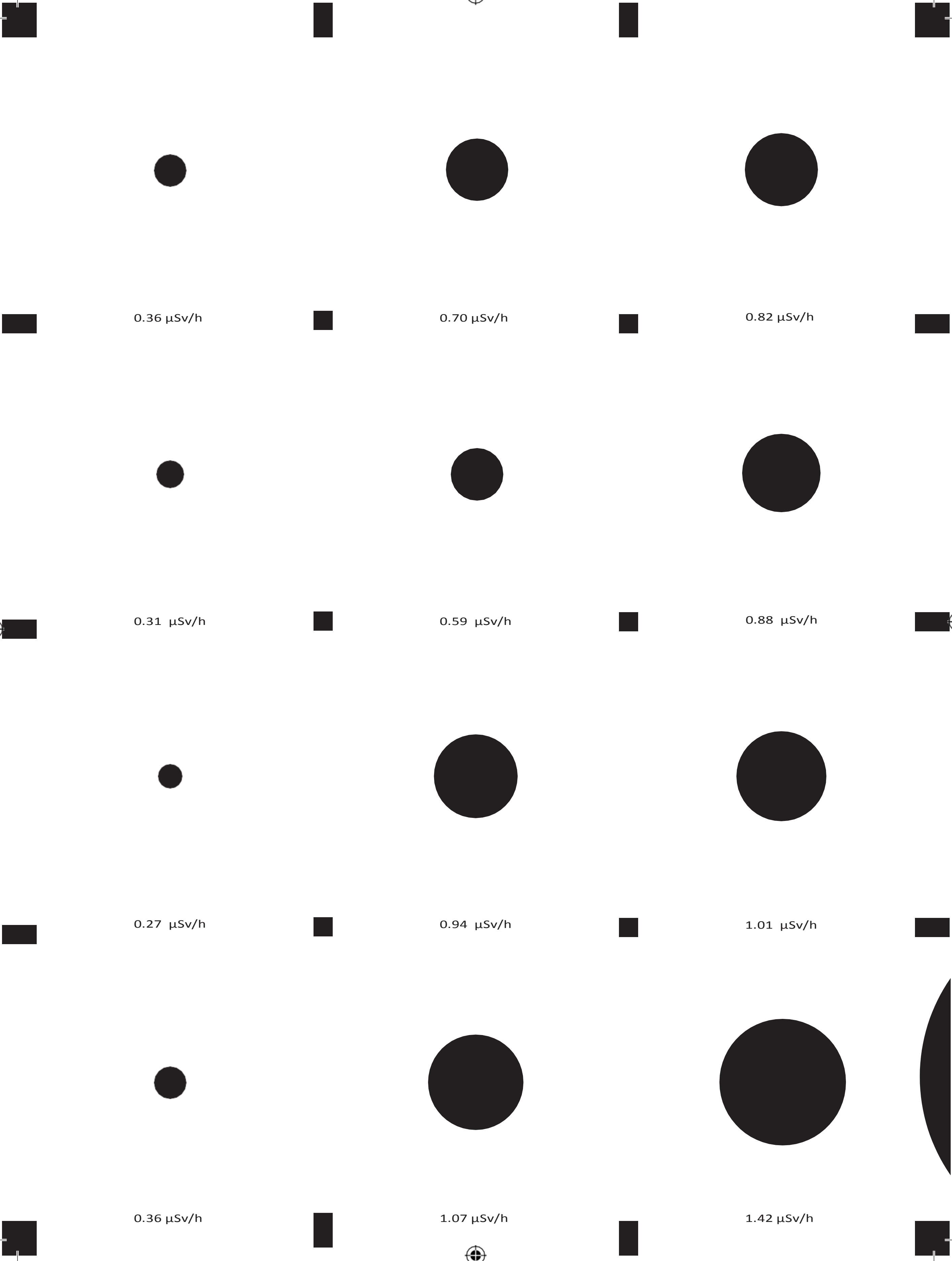
[1]

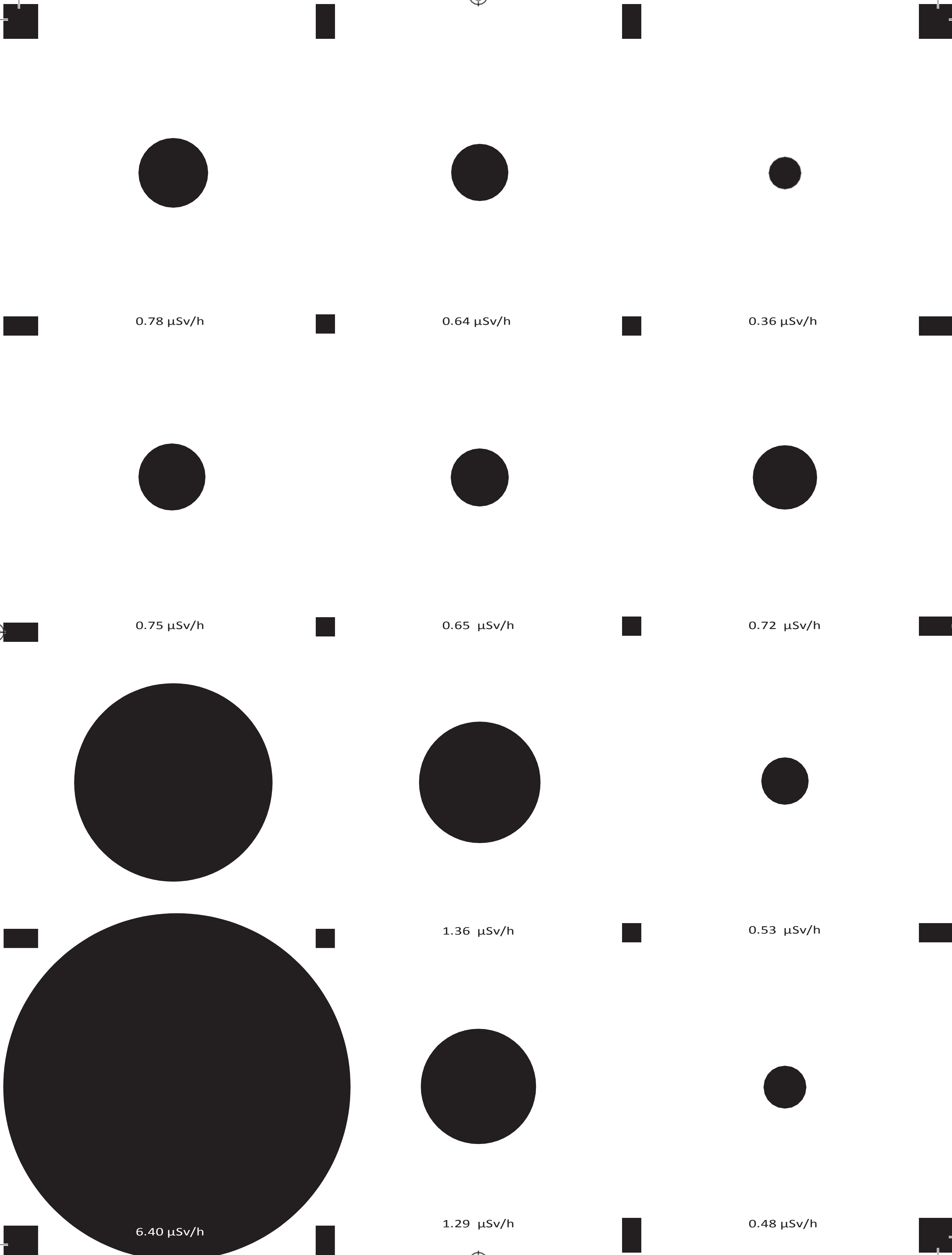
37.707444, 140.749140 1.89 µSv/h


1.29 μSv/h
1.65 μSv/h
1.61 μSv/h
1.52 μSv/h
1.89 μSv/h
1.71 μSv/h
0.51 μSv/h
1.81 μSv/h
1.77 μSv/h
1.29 μSv/h
1.74 μSv/h
1.65 μSv/h


0.70 µSv/h
0.64 µSv/h
1.06 µSv/h
0.78 µSv/h
0.82 µSv/h
1.04 µSv/h
0.77 µSv/h
0.81 µSv/h
1.07 µSv/h
0.97 µSv/h
0.64 µSv/h
1.17 µSv/h

37.690639, 140.834306 0.82 µSv/h


0.36 μSv/h
0.70 μSv/h
0.82 μSv/h
0.31 μSv/h
0.59 μSv/h
0.88 μSv/h
0.27 μSv/h
0.94 μSv/h
1.01 μSv/h
0.36 μSv/h
1.07 μSv/h
1.42 μSv/h


0.78 μSv/h
0.64 μSv/h
0.36 μSv/h
0.75 μSv/h
0.65 μSv/h
0.72 μSv/h
1.36 μSv/h
0.53 μSv/h
6.40 μSv/h
1.29 μSv/h
0.48 μSv/h

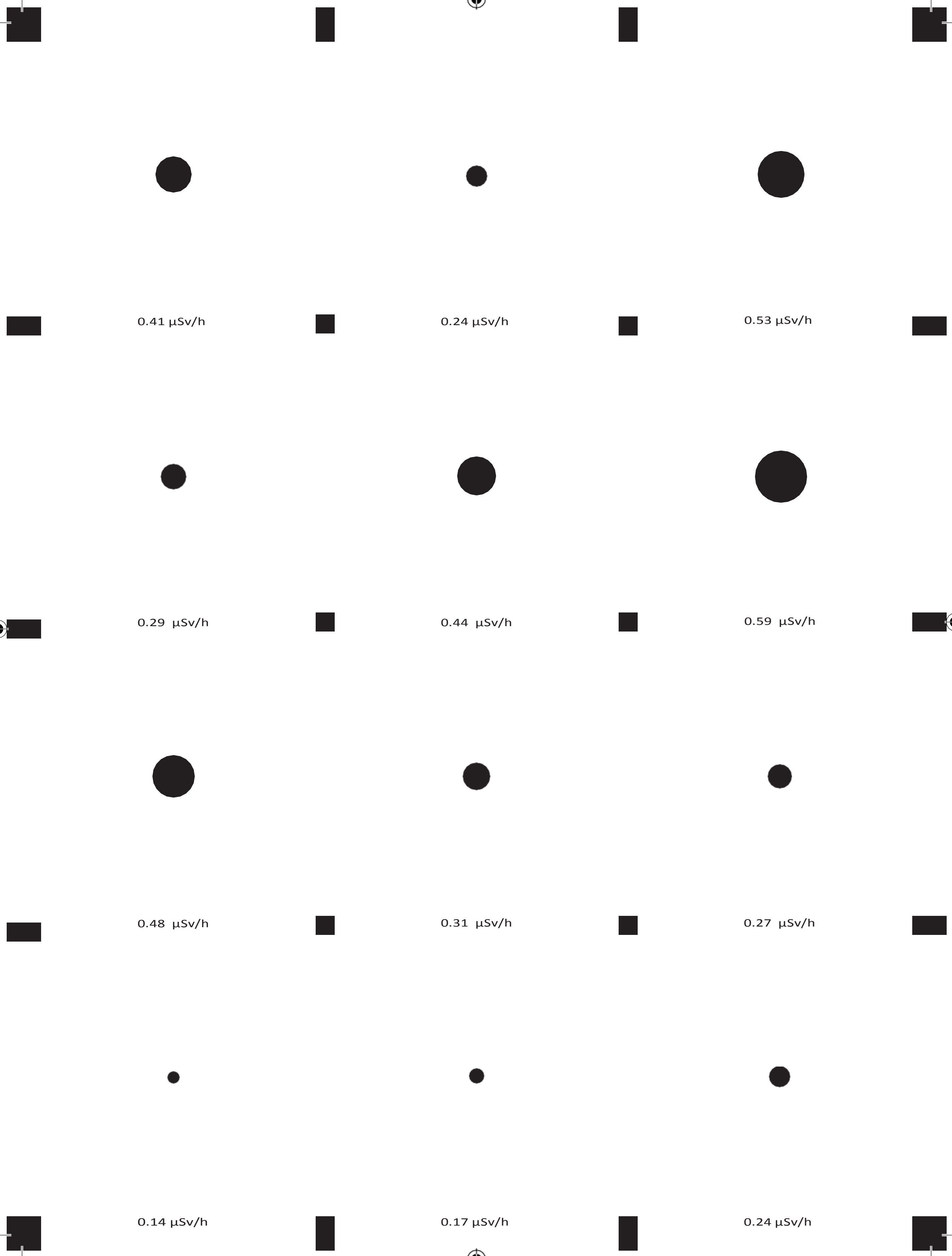
140.693673

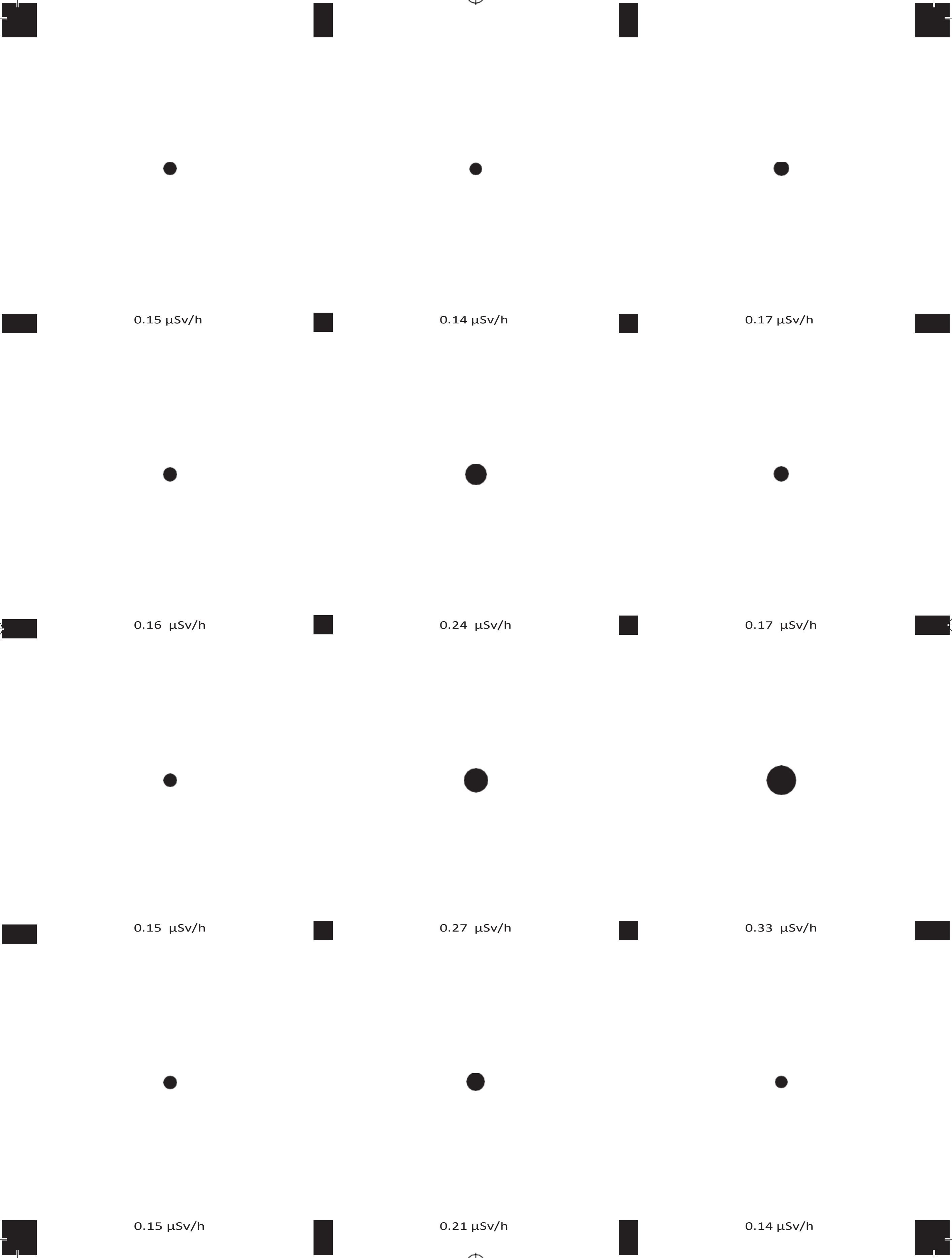
[3]

37.621417, 140.690972 6.40 / 0.53 µSv/h

[4]

[3] Mr. K. Kanno has decontaminated the grass he is standing on himself. The forest behind is still highly contaminated.


0.41 μSv/h
0.24 μSv/h
0.53 μSv/h
0.29 μSv/h
0.44 μSv/h
0.59 μSv/h
0.48 μSv/h
0.31 μSv/h
0.27 μSv/h
0.14 μSv/h
0.17 μSv/h
0.24 μSv/h



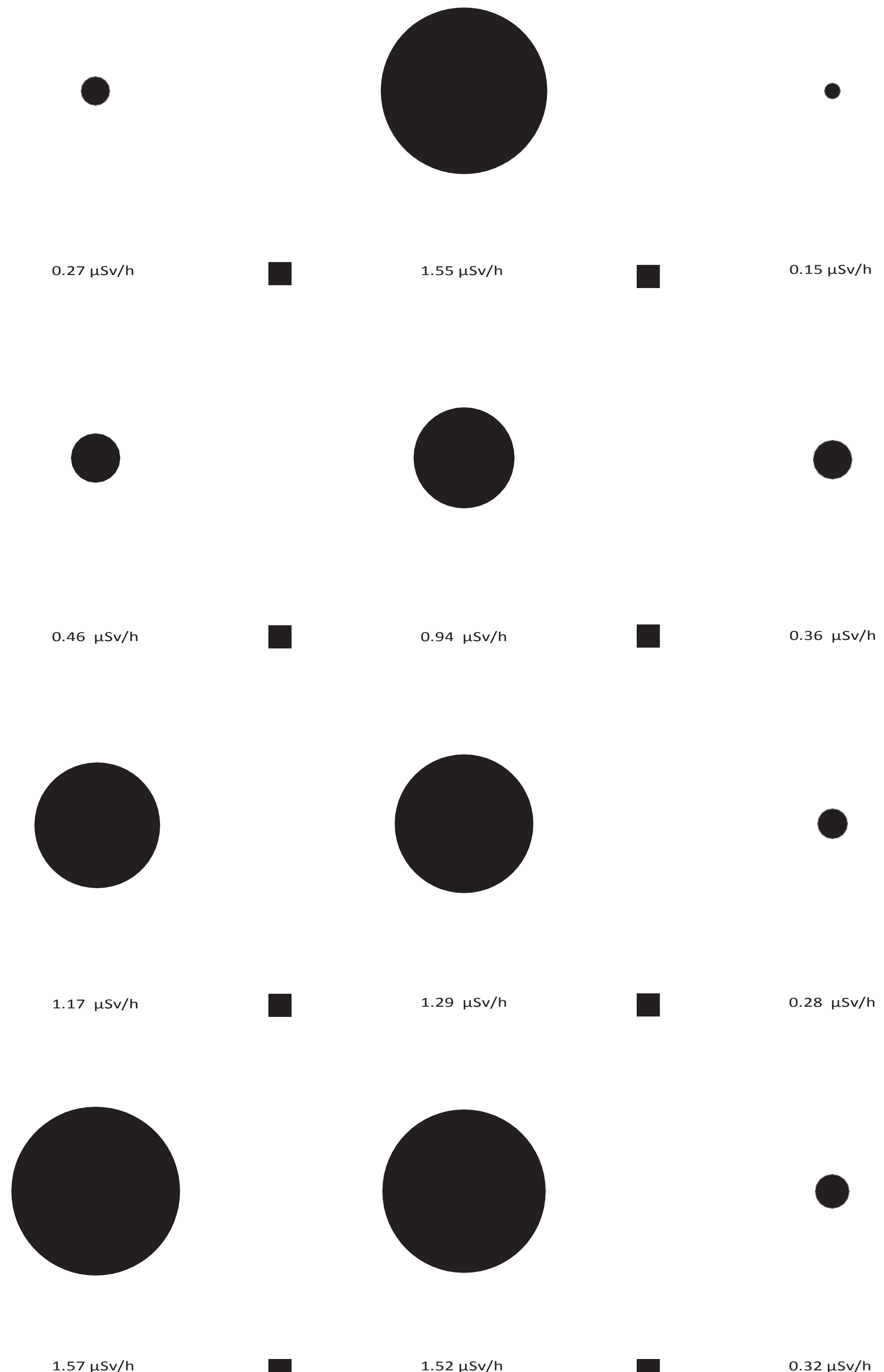
0.15 μSv/h
0.14 μSv/h
0.17 μSv/h
0.16 μSv/h
0.24 μSv/h
0.17 μSv/h
0.15 μSv/h
0.27 μSv/h
0.33 μSv/h
0.15 μSv/h
0.21 μSv/h
0.14 μSv/h

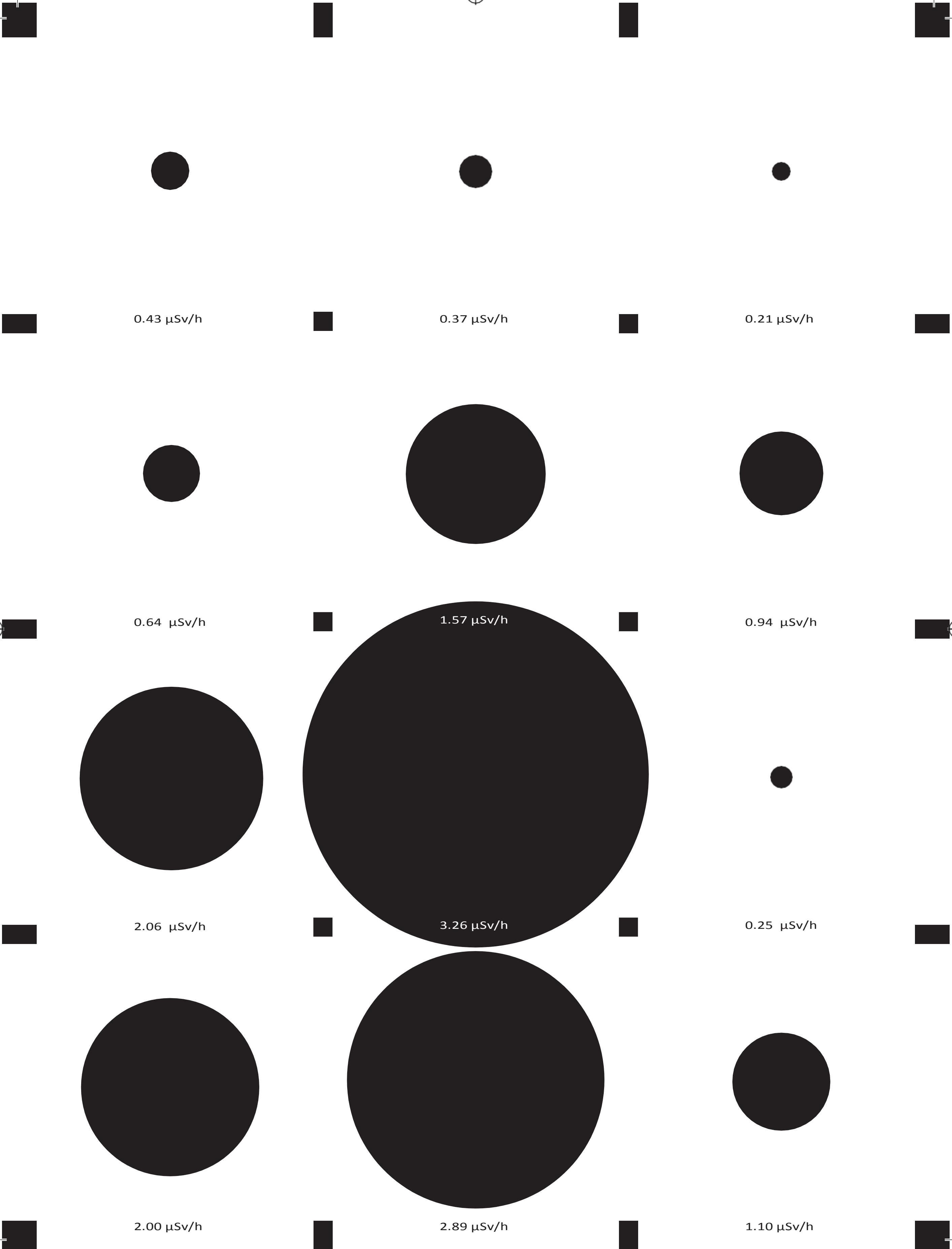
37.737528, 140.728194   0.14 μSv/h

[5]

37.737140, 140.726841 0.15 µSv/h

[9]


0.27 μSv/h
1.55 μSv/h
0.15 μSv/h
0.46 μSv/h
0.94 μSv/h
0.36 μSv/h
1.17 μSv/h
1.29 μSv/h
0.28 μSv/h
1.57 μSv/h
1.52 μSv/h
0.32 μSv/h


0.43 µSv/h
0.37 µSv/h
0.21 µSv/h
0.64 µSv/h
1.57 µSv/h
0.94 µSv/h
2.06 µSv/h
3.26 µSv/h
0.25 µSv/h
2.00 µSv/h
2.89 µSv/h
1.10 µSv/h

37.619722, 140.693722 1.57 µSv/h

[4] This field was one of the first that was decontaminated with the sustainable method.

[5] Mr. N. Kanno has been farming in Iitate all his life.

[6] A large part of Iitate remains abandoned.

10 Resurrection

Sustainable Decontamination and New Perspectives

154–155

Sustainable Decontamination

The sustainable decontamination method was introduced by Dr. Masaru Mizoguchi and fellow environmental scientists in 2011. It gives the farmers of Fukushima Prefecture the opportunity to harvest safe rice again on the fields inherited from their ancestors.

The soil-stripping method applied by the government uses heavy machinery to replace the fertile yet contaminated topsoil with infertile dirt from the mountains, which doesn't have enough nutrients to grow rice. The sustainable method instead decontaminates the field while keeping the fertile soil in place. It uses only available resources, so it can be easily applied by the farmers themselves.

The method is based on the discovery that radioactive cesium binds to clay particles. Clay also floats on water, and rice fields are regularly flood-irrigated. If the topsoil is stirred up with basic tools, such as rotary tillers or rakes, during irrigation, the clay-cesium compound is released from the soil and forms a suspension on top of the water. It can then be easily drained off into a pit next to the field, dried, and buried at a safe distance from the fields. The farmland is now decontaminated yet fertile enough to grow rice.

The sustainable decontamination method not only keeps the fertile soil but also dramatically reduces the resulting radioactive waste. Instead of dealing with huge amounts of contaminated soil, only the cesium-clay compound has to be stored. Extensive tests conducted by Dr. Mizoguchi showed that the contamination of the soil is reduced by more than half, and the rice produced on these fields is even below detection level.

Decontamination Process

Cesium
Clay
Soil
Water

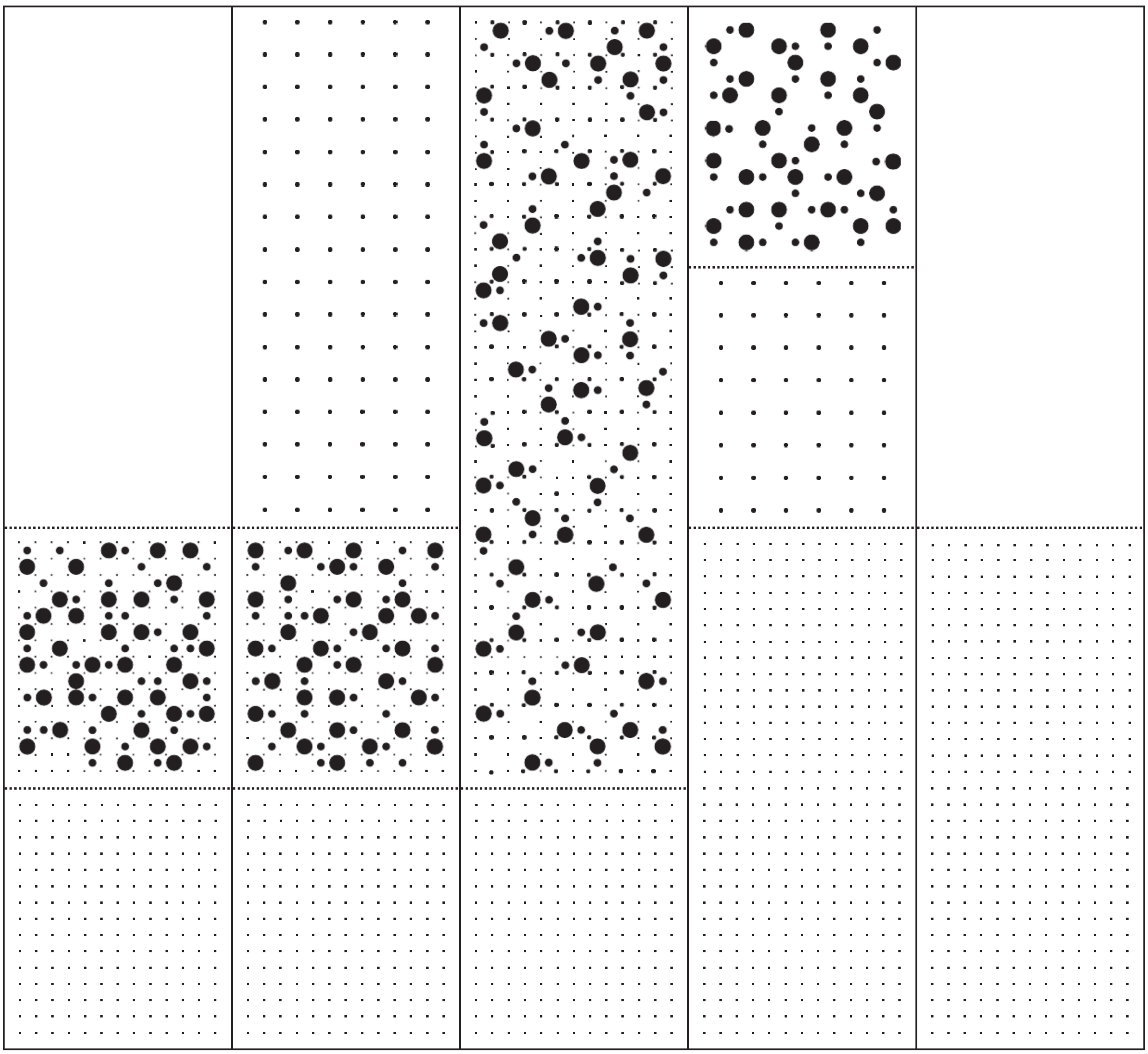
[1] The radioactive cesium binds to the clay in the topsoil.

[2] To remove both from the soil, the field is flooded.

[3] The topsoil is stirred up with basic tools.

[4] The clay-cesium compound rises to the top while the soil sinks back to the bottom.

[5] Clay and cesium are drained off with the water. The field is decontaminated.



[1] [2] [3] [4] [5]

1,000

m³
Amount of radioactive waste per hectare produced by soil-stripping decontamination method

34

Bq/kg
Radiocesium concentration in rice from contaminated field

50

m³
Amount of radioactive
waste per hectare
produced by sustainable
decontamination method

ND

Bq/kg
Radiocesium concentration
in rice from field
after sustainable
decontamination (not
detectable)

[1] The clay-cesium compound is drained into a pit next to the field to dry.

[2] volunteers harvest rice and take measurements on the decontaminated field.

[3] The harvested rice is collected to be tested for radiation.

[4] Through a pipe, Dr. Mizoguchi regularly measures contamination of the buried cesium.

[1]

[4]

[2]

[3]

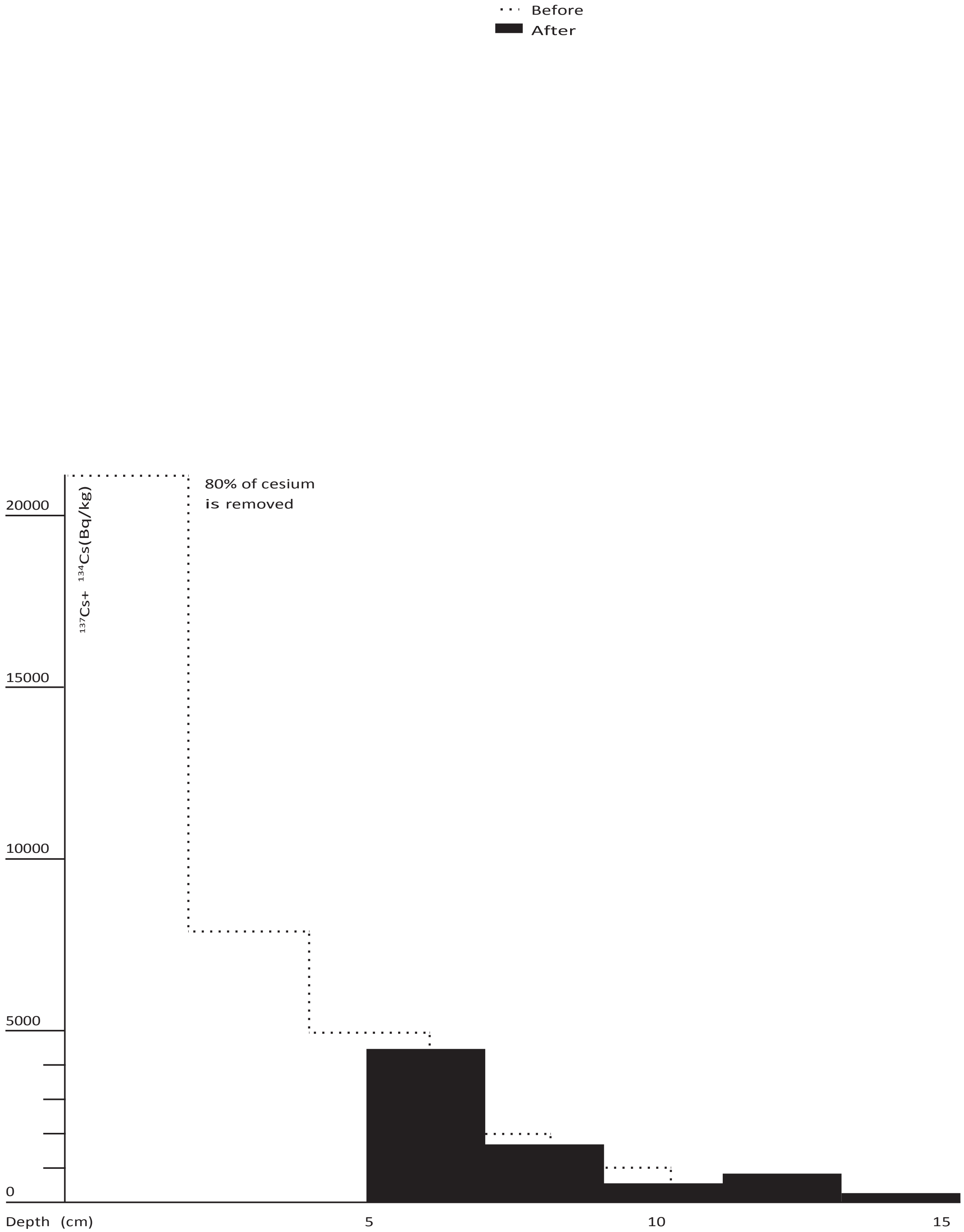
“80% of radioactive cesium can be removed by this method. As a result, the harvested rice passed the official inspection.”

162–163

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

Decontamination Results

Amount and distribution of cesium in soil before and after sustainable decontamination.

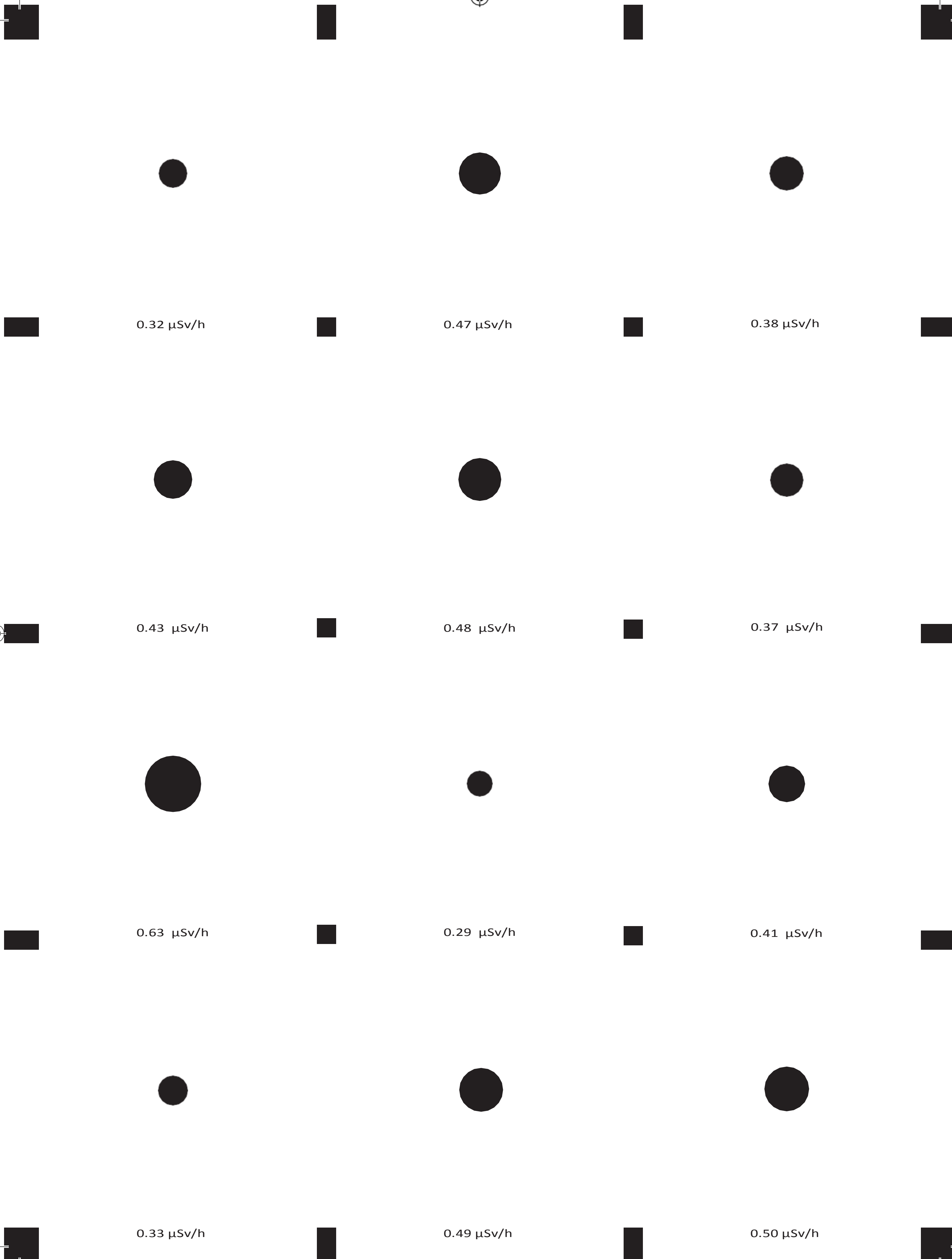


164–165

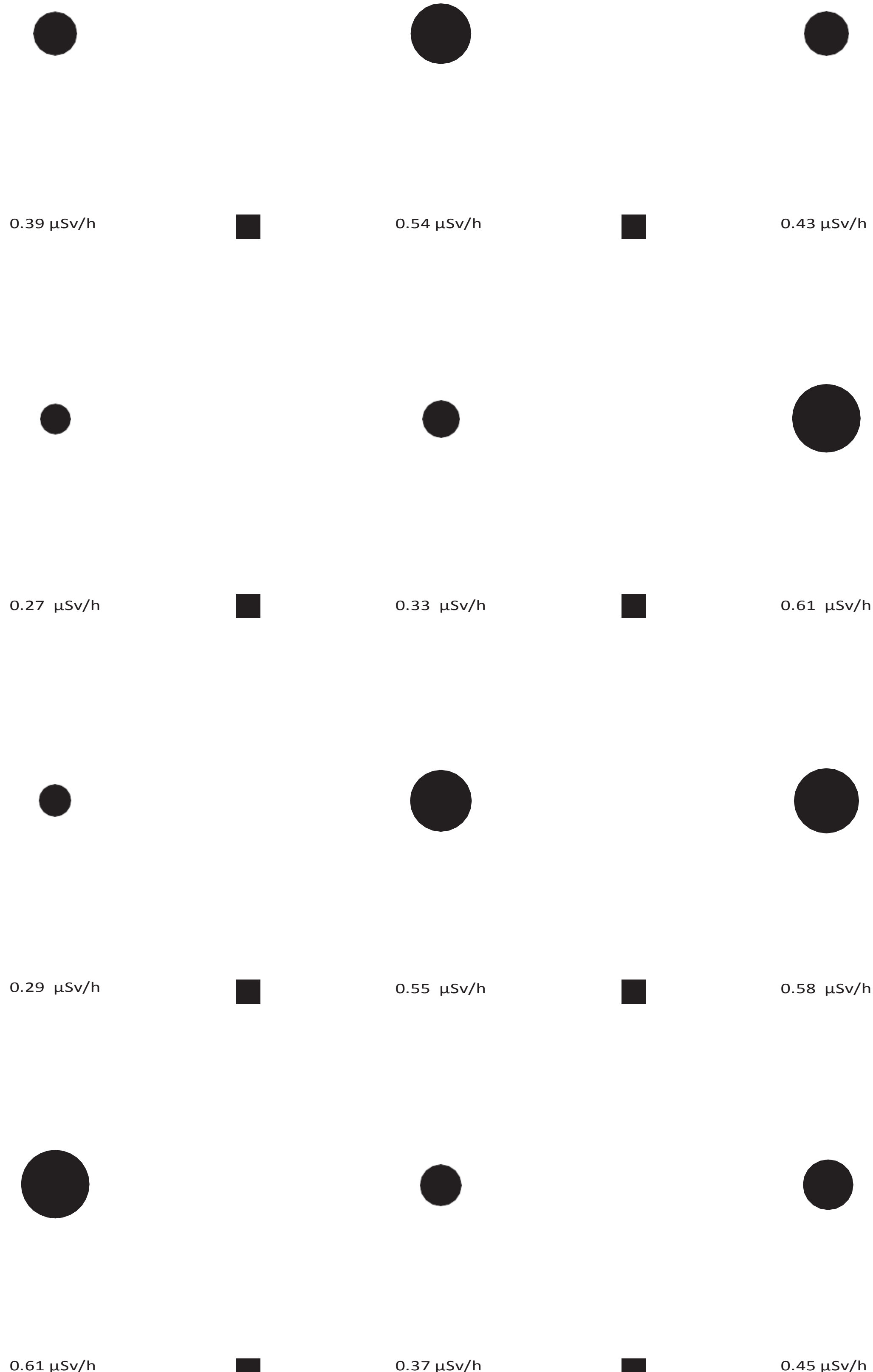
[1] A farmer plants rice on his decontaminated field.

[1]

37.734778, 140.692389   0.38 μSv/h

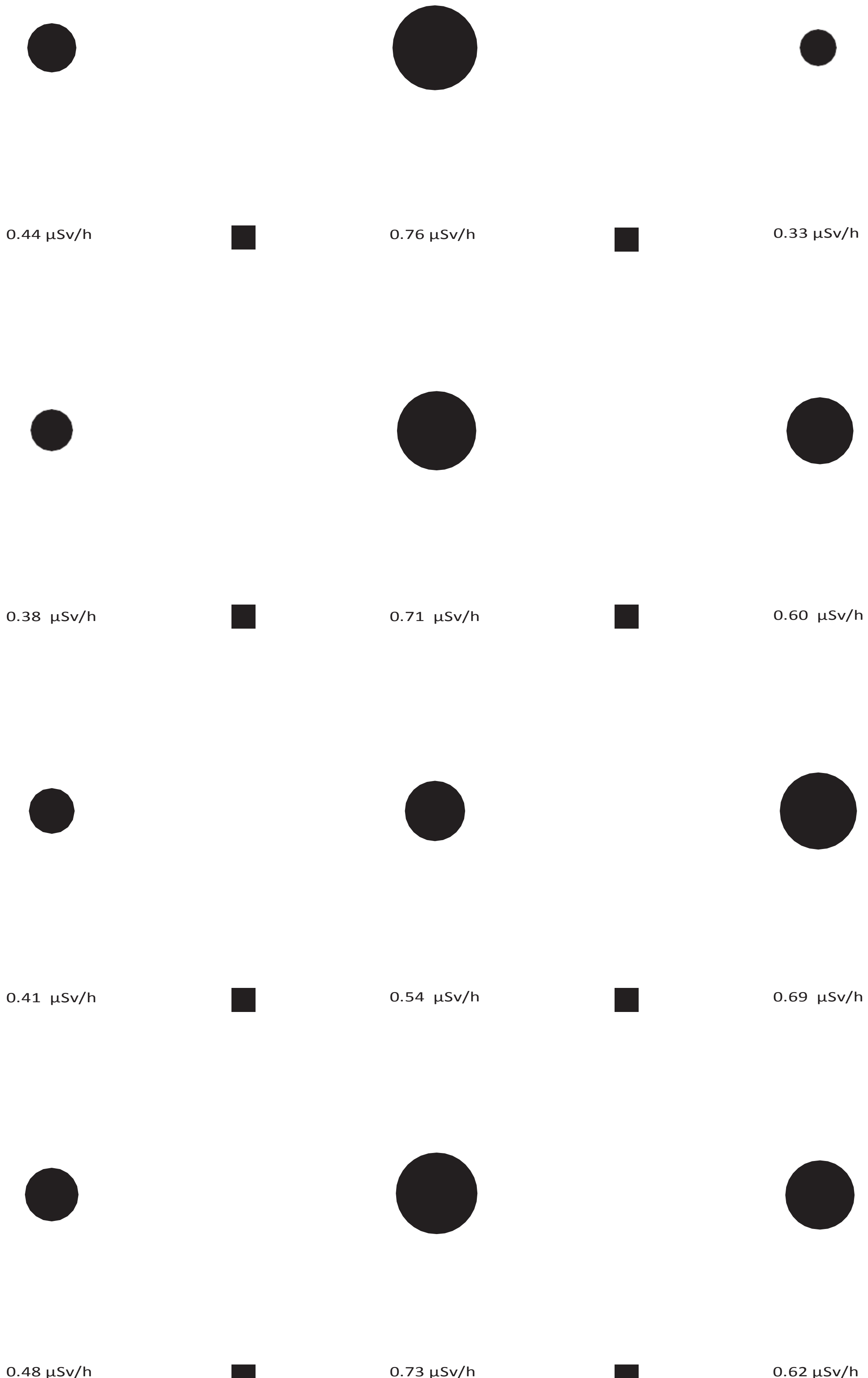


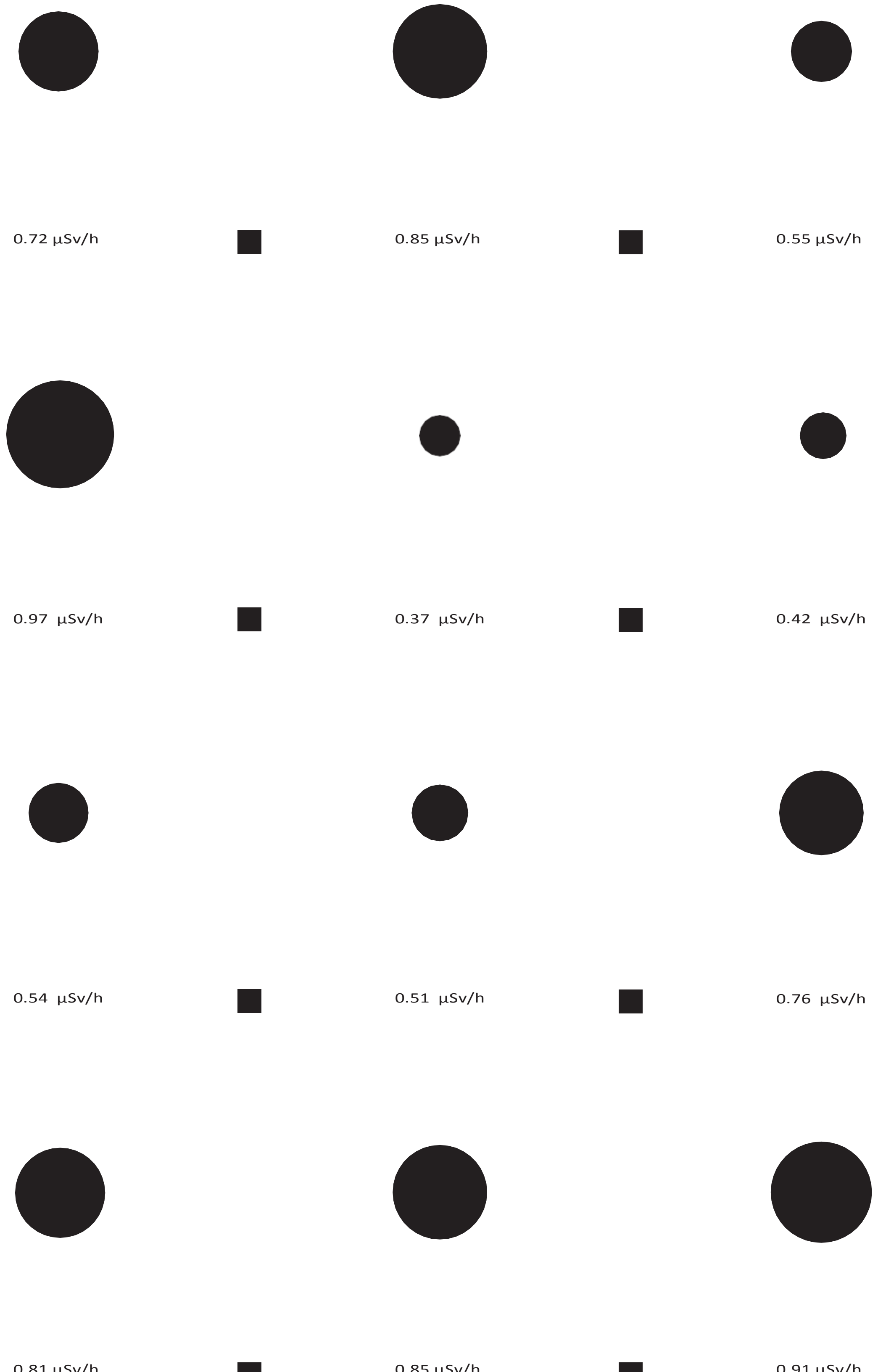
0.32 μSv/h
0.47 μSv/h
0.38 μSv/h
0.43 μSv/h
0.48 μSv/h
0.37 μSv/h
0.63 μSv/h
0.29 μSv/h
0.41 μSv/h
0.33 μSv/h
0.49 μSv/h
0.50 μSv/h


0.39 µSv/h
0.54 µSv/h
0.43 µSv/h
0.27 µSv/h
0.33 µSv/h
0.61 µSv/h
0.29 µSv/h
0.55 µSv/h
0.58 µSv/h
0.61 µSv/h
0.37 µSv/h
0.45 µSv/h

37.733880, 140.690858 0.33 µSv/h

37.690539, 140.727098 0.48 µSv/h


0.44 µSv/h
0.76 µSv/h
0.33 µSv/h
0.38 µSv/h
0.71 µSv/h
0.60 µSv/h
0.41 µSv/h
0.54 µSv/h
0.69 µSv/h
0.48 µSv/h
0.73 µSv/h
0.62 µSv/h


0.72 µSv/h
0.85 µSv/h
0.55 µSv/h
0.97 µSv/h
0.37 µSv/h
0.42 µSv/h
0.54 µSv/h
0.51 µSv/h
0.76 µSv/h
0.81 µSv/h
0.85 µSv/h
0.91 µSv/h

[3]

37.690474, 140.727034 0.37 µSv/h

[2] Dr. Mizoguchi in front of the museum he built to educate visitors about soil science.

[3] Dr. Mizoguchi and Dr. Campbell demonstrate the physical trick behind their decontamination method.

Greenhouse Farming

Some farmers in Fukushima Prefecture have started using the greenhouse method to further their agricultural pursuits. This method, known by the term “controlled environment agriculture”, creates an isolated, decontaminated environment for crops to flourish and grow and gets rid of water and soil erosion problems. Some have also switched to building “plant factories”: airtight and artificially lighted buildings that don’t have a lot to do with what one considers when thinking of a regular greenhouse. Crops are grown in thousands of pods stacked on top of each other under high ceilings. There is no off-season, so farmers can grow crops year-round under stable and controlled conditions

“The important thing about greenhouse farming is to know when to water. In the past, the timing was decided by the farmer checking the color of the leaves. Sensors allow us to decide the timing by looking at the objective numbers. Creating the ideal irrigation system here can lead Japanese agriculture into the future. This is our chance.”

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

1,000

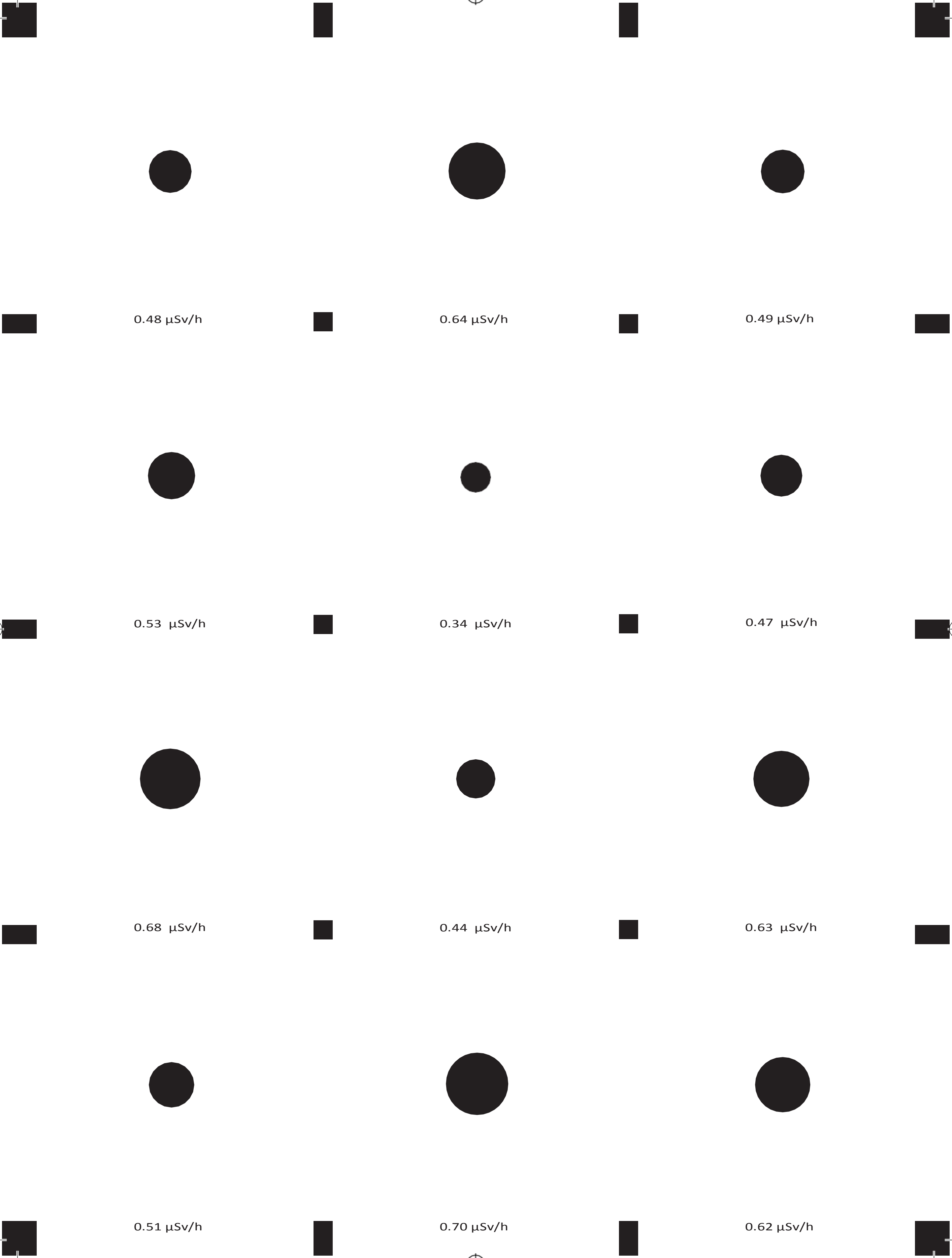
Percent
Yield increase in greenhouse farming compared to traditional farming

24/7/365

Control of growing process through greenhouse farming

[1]

37.621602, 140.691234 0.34 µSv/h


0.48 μSv/h
0.64 μSv/h
0.49 μSv/h
0.53 μSv/h
0.34 μSv/h
0.47 μSv/h
0.68 μSv/h
0.44 μSv/h
0.63 μSv/h
0.51 μSv/h
0.70 μSv/h
0.62 μSv/h

0.24 μSv/h

0.17 μSv/h

0.13 μSv/h

0.18 μSv/h

0.22 μSv/h

0.15 μSv/h

0.19 μSv/h

0.16 μSv/h

0.12 μSv/h

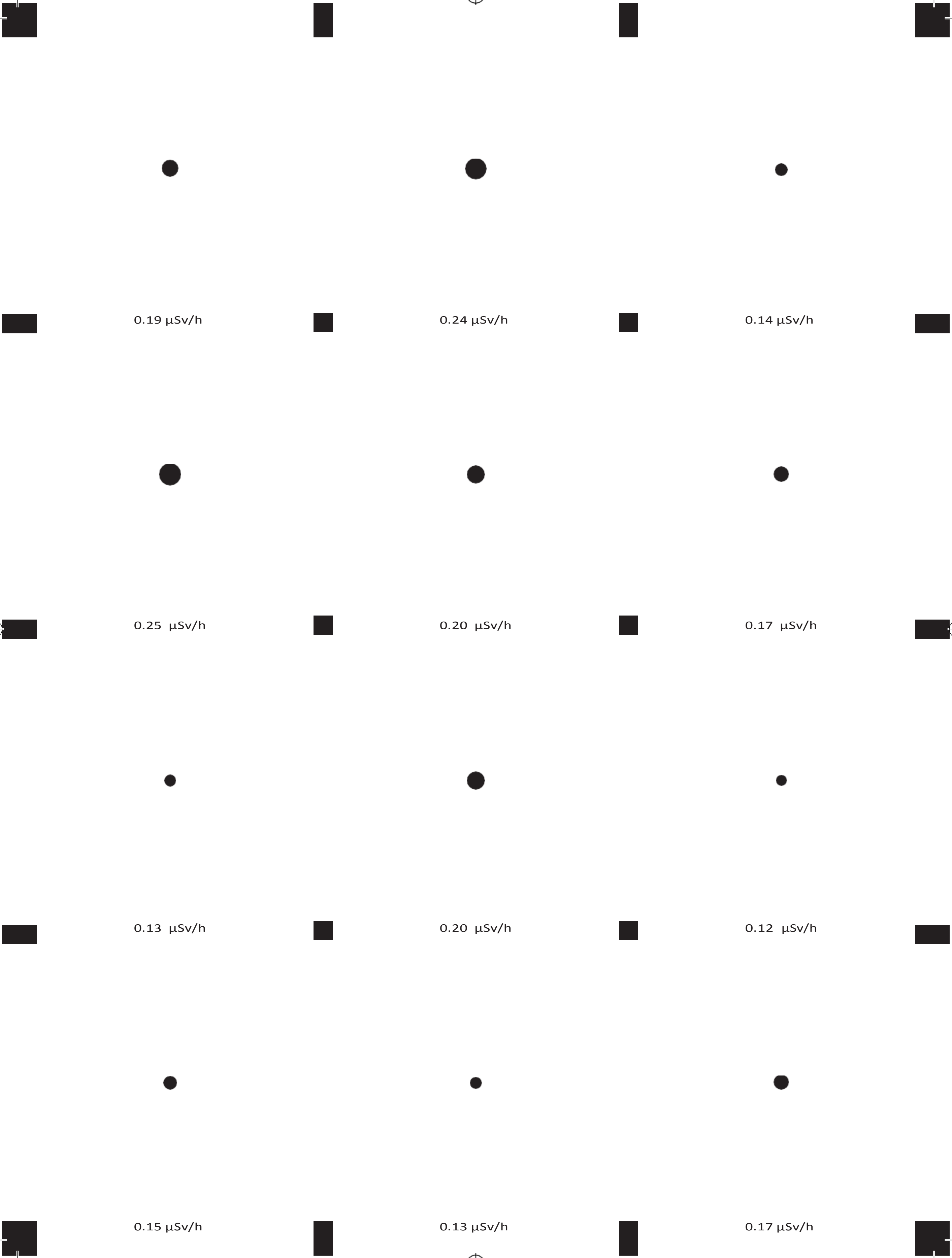
0.19 μSv/h

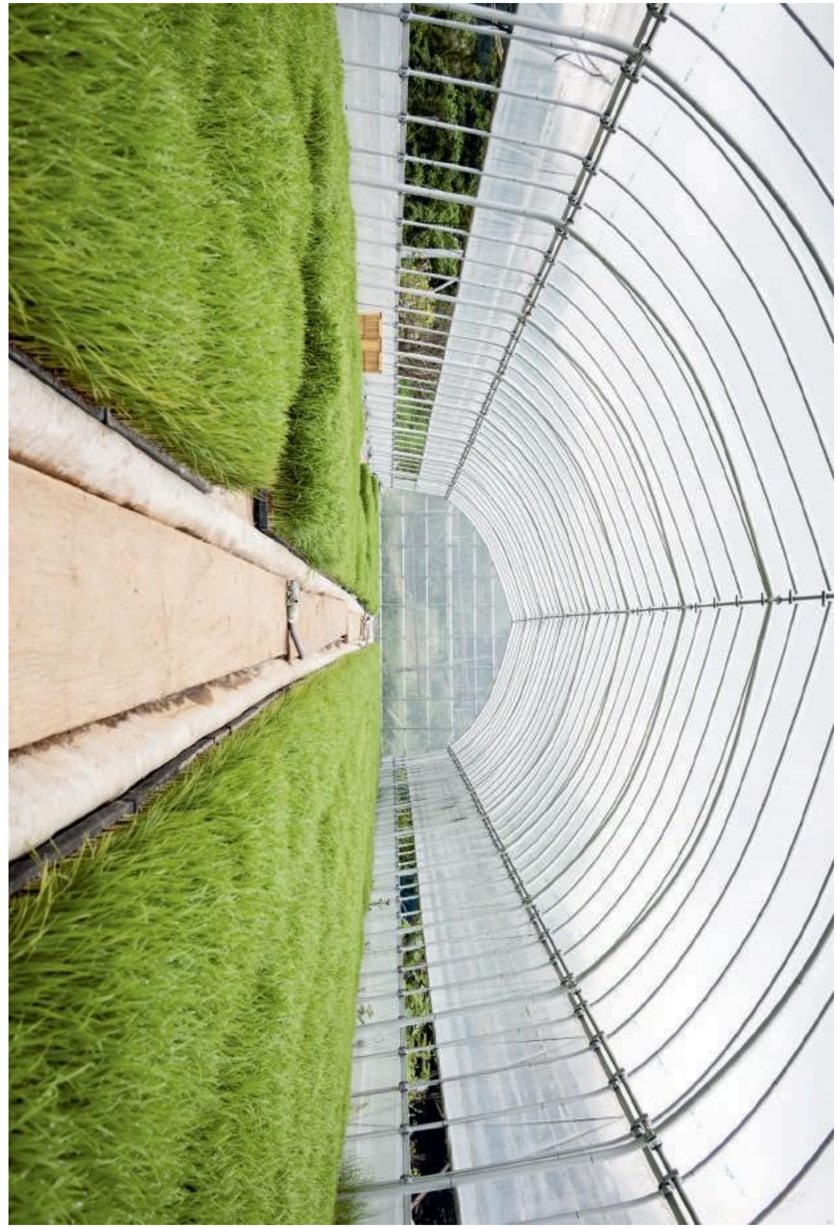
0.14 μSv/h

0.18 μSv/h

37.913111, 140.595415   0.22 µSv/h

0.14 µSv/h	0.18 µSv/h	0.22 µSv/h
0.15 µSv/h	0.11 µSv/h	0.21 µSv/h
0.13 µSv/h	0.14 µSv/h	0.17 µSv/h
0.20 µSv/h	0.25 µSv/h	0.15 µSv/h


0.19 μSv/h
0.24 μSv/h
0.14 μSv/h
0.25 μSv/h
0.20 μSv/h
0.17 μSv/h
0.13 μSv/h
0.20 μSv/h
0.12 μSv/h
0.15 μSv/h
0.13 μSv/h
0.17 μSv/h



37.913124, 140.595559   0.20 μSv/h

[1] Mr. K. Kanno takes a break in front of his workshop.

[2] Dr. Mizoguchi with Mr. K. Kanno in his new greenhouse.

A newfound sense of community is restoring hope across Fukushima. In 2011, researchers, volunteers, and Fukushima residents joined forces to create the Resurrection of Fukushima non-profit group. This organization provides support, professional help, and medical care to all residents who were affected by the disaster. It brings the community together through regular dinners and provides farmers with the tools to restore their livelihoods. Students from all over Japan are also joining. Interest in the region continues to grow and many volunteer regularly. On their visits, students learn more about agriculture, and work to help the farmers●

“Working together is deeply rooted in Japanese culture. People share water for rice paddies and work together for many tasks. But, because not many people have returned, I have to do it on my own. It’s a big issue that we have to grow rice with just a few people instead of people from the entire area.”

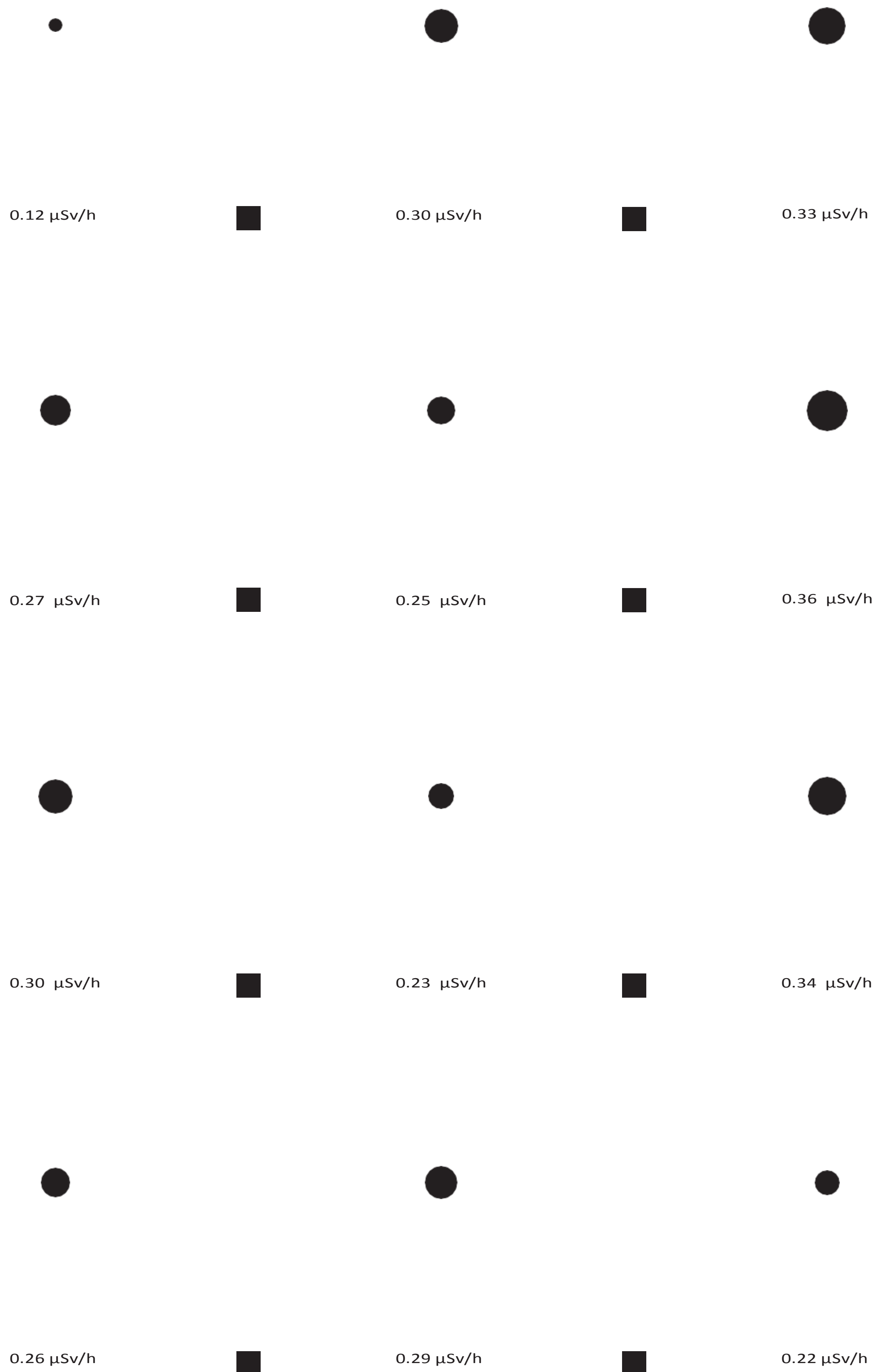
Keiichi Kanno,
Rice Farmer, Iitate,
Fukushima Prefecture

[1] Members of the Iitate citizens' initiative meet regularly to prepare dinner together.

[2] While local products are used whenever possible, mushrooms, which are prone to contamination, are imported.

[1]

37.765772, 140.739967   0.25 µSv/h

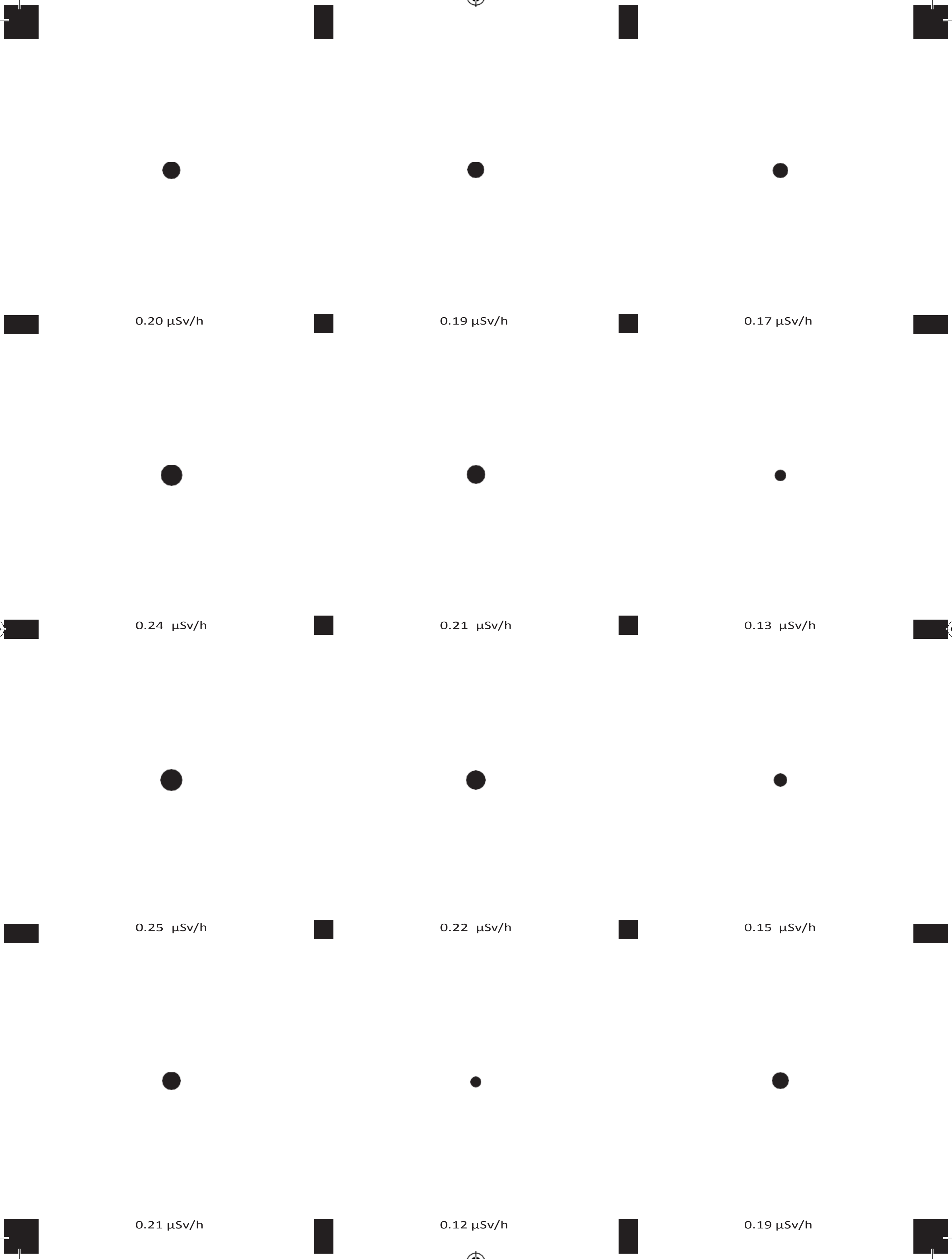

0.12 μSv/h
0.30 μSv/h
0.33 μSv/h
0.27 μSv/h
0.25 μSv/h
0.36 μSv/h
0.30 μSv/h
0.23 μSv/h
0.34 μSv/h
0.26 μSv/h
0.29 μSv/h
0.22 μSv/h

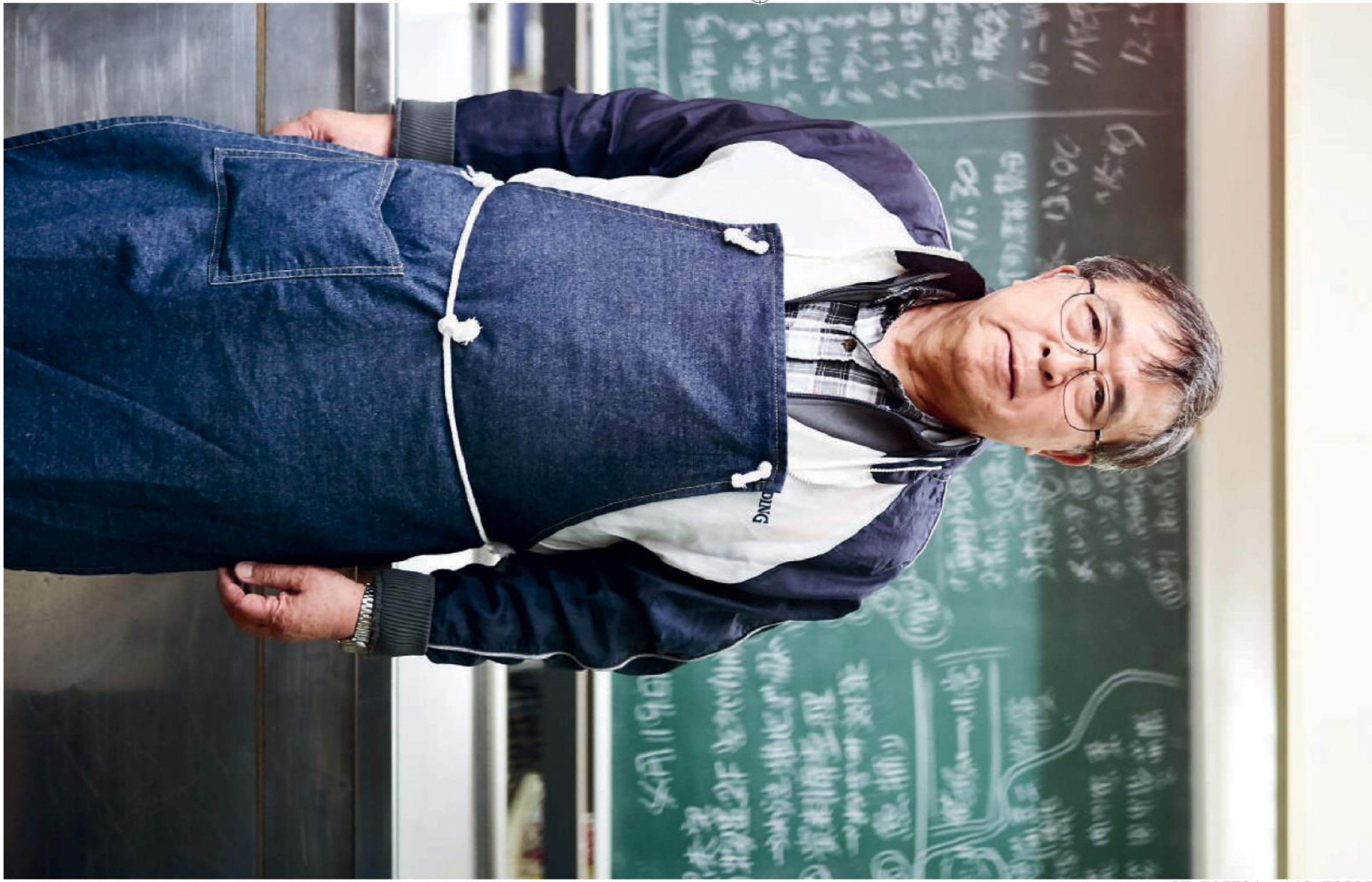
0.25 µSv/h	0.19 µSv/h	0.26 µSv/h
0.21 µSv/h	0.16 µSv/h	0.27 µSv/h
0.22 µSv/h	0.18 µSv/h	0.24 µSv/h
0.33 µSv/h	0.36 µSv/h	0.22 µSv/h

37.765758, 140.739935　　0.16 µSv/h

37.765742, 140.739975 0.18 μSv/h

0.15 μSv/h	0.24 μSv/h	0.26 μSv/h
0.18 μSv/h	0.11 μSv/h	0.19 μSv/h
0.15 μSv/h	0.17 μSv/h	0.18 μSv/h
0.23 μSv/h	0.33 μSv/h	0.19 μSv/h


0.20 µSv/h
0.19 µSv/h
0.17 µSv/h
0.24 µSv/h
0.21 µSv/h
0.13 µSv/h
0.25 µSv/h
0.22 µSv/h
0.15 µSv/h
0.21 µSv/h
0.12 µSv/h
0.19 µSv/h

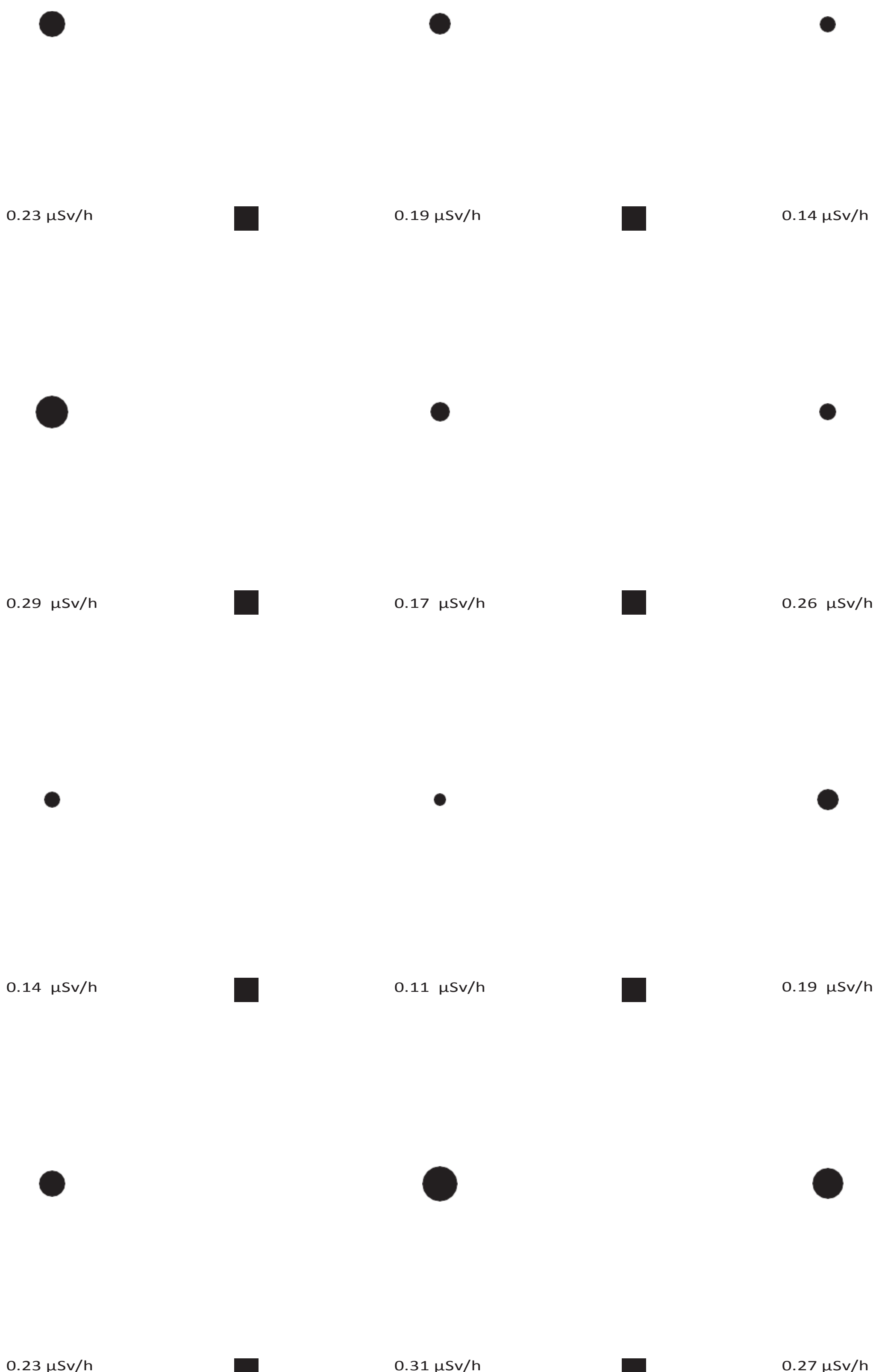


37.765734, 140.739953   0.15 μSv/h

37.765722, 140.739933 0.25 μSv/h

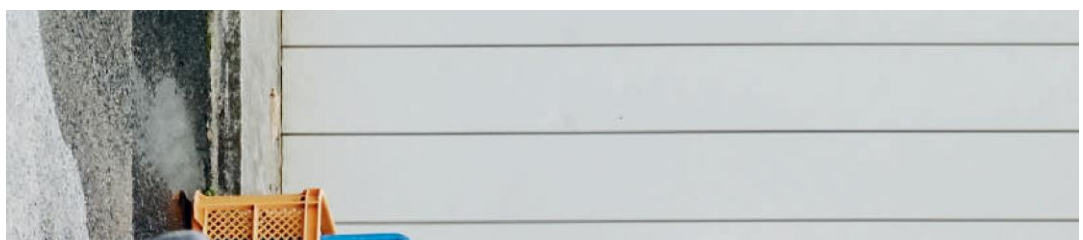
[2]

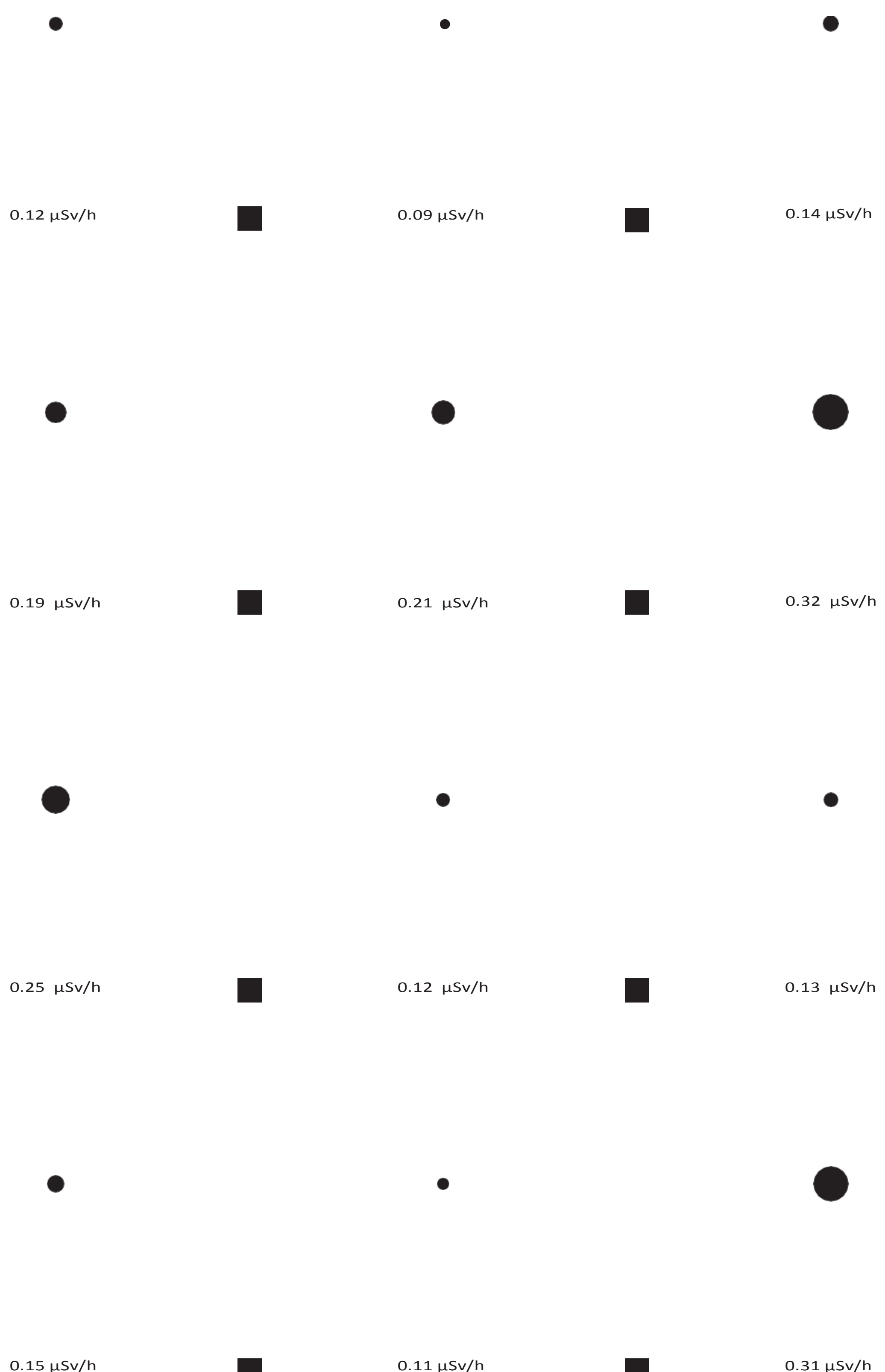
0.21 μSv/h	0.26 μSv/h	0.19 μSv/h
0.24 μSv/h	0.17 μSv/h	0.27 μSv/h
0.19 μSv/h	0.14 μSv/h	0.25 μSv/h
0.20 μSv/h	0.19 μSv/h	0.16 μSv/h

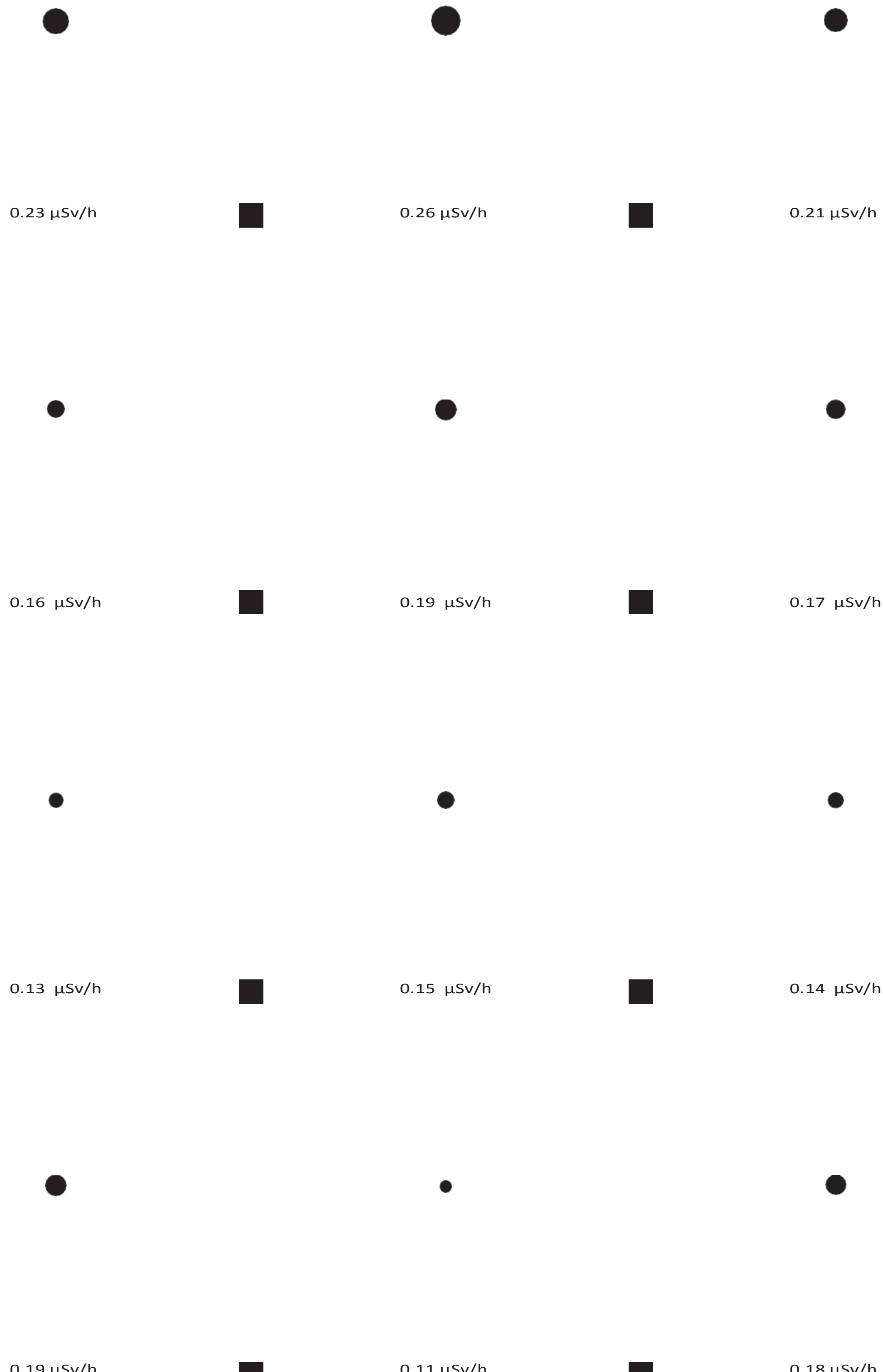

0.23 μSv/h
0.19 μSv/h
0.14 μSv/h
0.29 μSv/h
0.17 μSv/h
0.26 μSv/h
0.14 μSv/h
0.11 μSv/h
0.19 μSv/h
0.23 μSv/h
0.31 μSv/h
0.27 μSv/h

37.765714, 140.739956   0.19 µSv/h

37.765721, 140.739984 0.14 µSv/h




0.12 μSv/h
0.09 μSv/h
0.14 μSv/h
0.19 μSv/h
0.21 μSv/h
0.32 μSv/h
0.25 μSv/h
0.12 μSv/h
0.13 μSv/h
0.15 μSv/h
0.11 μSv/h
0.31 μSv/h


0.23 µSv/h
0.26 µSv/h
0.21 µSv/h
0.16 µSv/h
0.19 µSv/h
0.17 µSv/h
0.13 µSv/h
0.15 µSv/h
0.14 µSv/h
0.19 µSv/h
0.11 µSv/h
0.18 µSv/h

37.851089, 140.605702 0.15 μSv/h

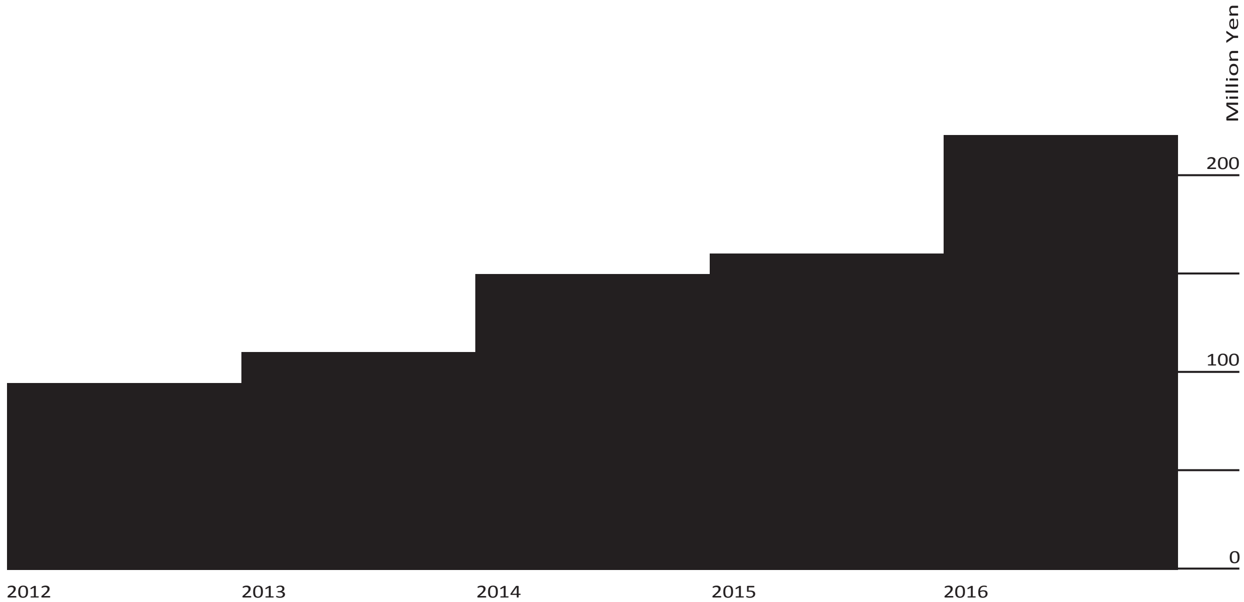
Growth

Despite the stigma that products from Fukushima Prefecture carry, the sake industry continues to grow. Fukushima sake is consistently voted Japan's best and receives many awards. Sales have reached an all-time high. Some hope that this faith in sake will open up doors for other products from Fukushima Prefecture. Shoichi Miura is one of them. His Kobo Hirose Rice Factory provides opportunities for disabled people within the agricultural sector. It was founded in 2000 but has struggled ever since the triple disaster due to the products' reputational damage. Mr. Miura hopes that soon, the safety of products from Fukushima Prefecture will no longer be in question and quality will be judged only by taste again.

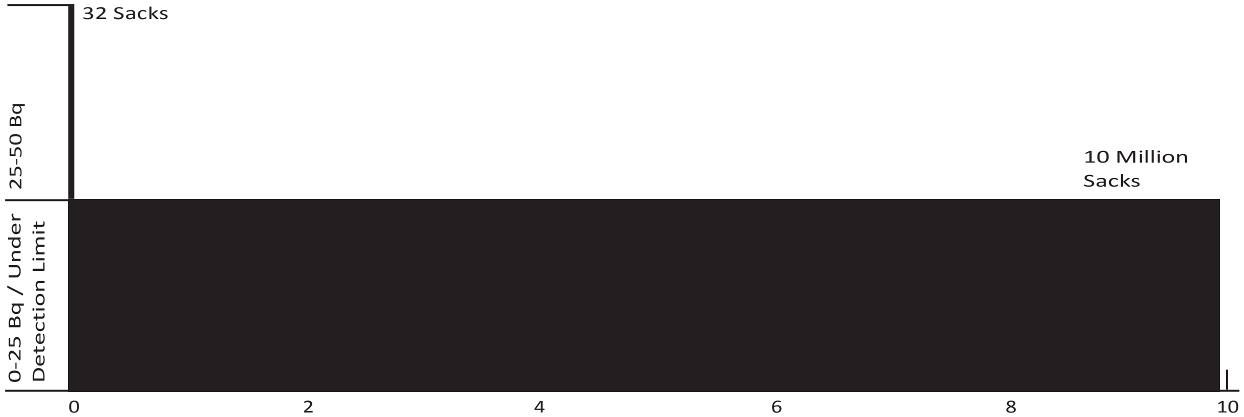
“With the help of many people, we have grown safe rice and brewed sake, here in the beautiful village of Iitate, once contaminated by radioactivity. Products such as this could be a chance to show the new Fukushima agriculture to the world.”

Dr. Masaru Mizoguchi,
Head of Global
Agricultural Sciences,
The University of Tokyo

Fukushima Sake Exports



Fukushima Rice Radiation Testing 2017

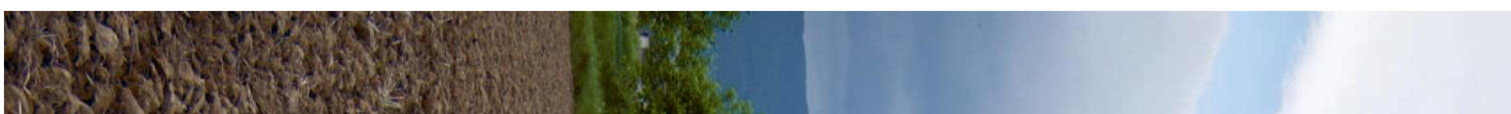


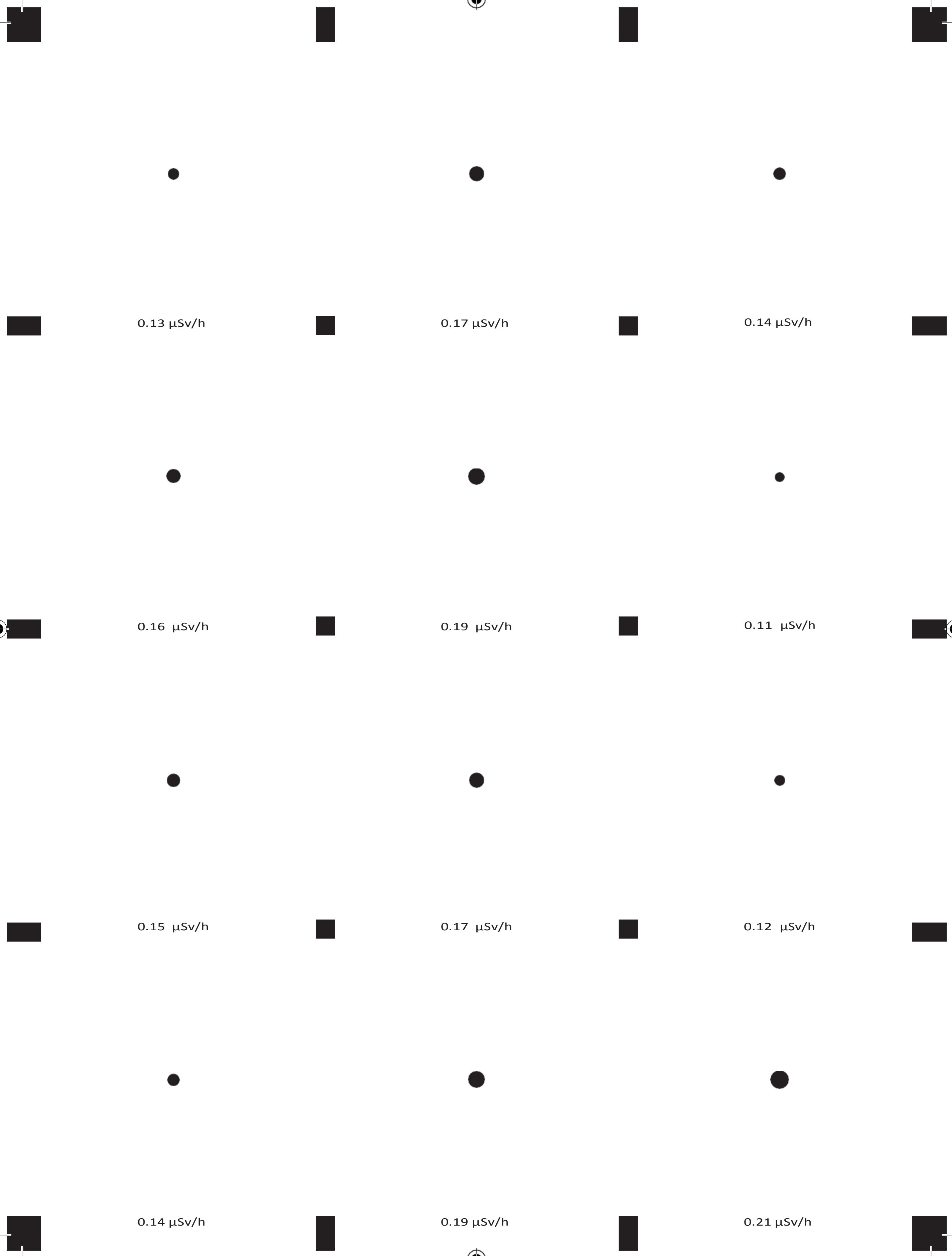
"All rice grown in Fukushima is checked for safety. Other prefectures do not conduct the test. Therefore, I can say with confidence that the rice grown in Fukushima is the safest."

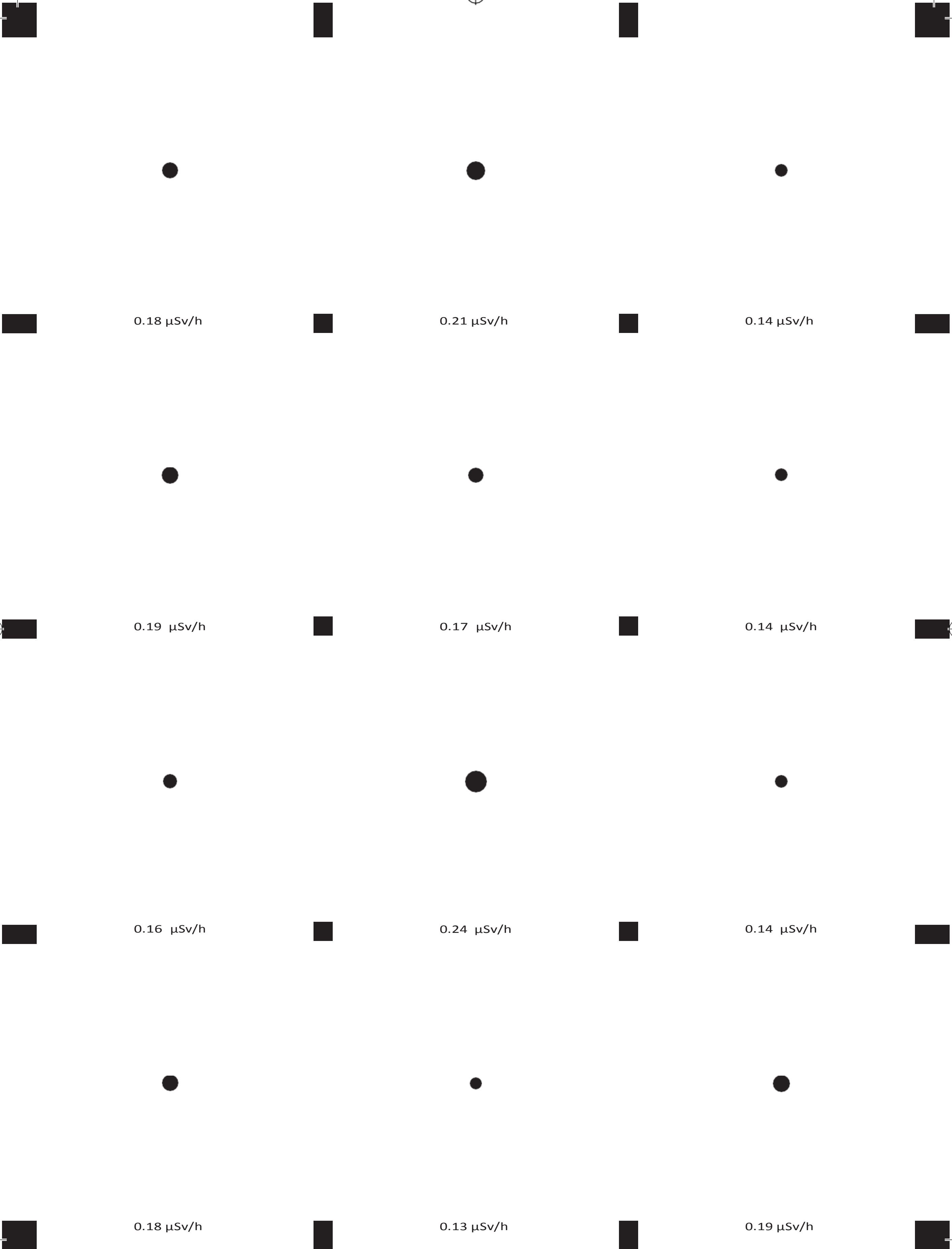
Shoichi Miura, Director,
Kobo Hirose Rice Factory,
Fukushima Prefecture

[1]

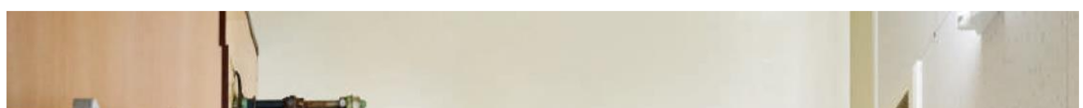
37.850992, 140.605730   0.19 µSv/h




0.13 μSv/h
0.17 μSv/h
0.14 μSv/h
0.16 μSv/h
0.19 μSv/h
0.11 μSv/h
0.15 μSv/h
0.17 μSv/h
0.12 μSv/h
0.14 μSv/h
0.19 μSv/h
0.21 μSv/h


0.18 μSv/h
0.21 μSv/h
0.14 μSv/h
0.19 μSv/h
0.17 μSv/h
0.14 μSv/h
0.16 μSv/h
0.24 μSv/h
0.14 μSv/h
0.18 μSv/h
0.13 μSv/h
0.19 μSv/h

37.849194, 140.598213   0.17 µSv/h



0.18 μSv/h	0.14 μSv/h	0.17 μSv/h
0.11 μSv/h	0.13 μSv/h	0.14 μSv/h
0.19 μSv/h	0.16 μSv/h	0.12 μSv/h
0.15 μSv/h	0.17 μSv/h	0.14 μSv/h

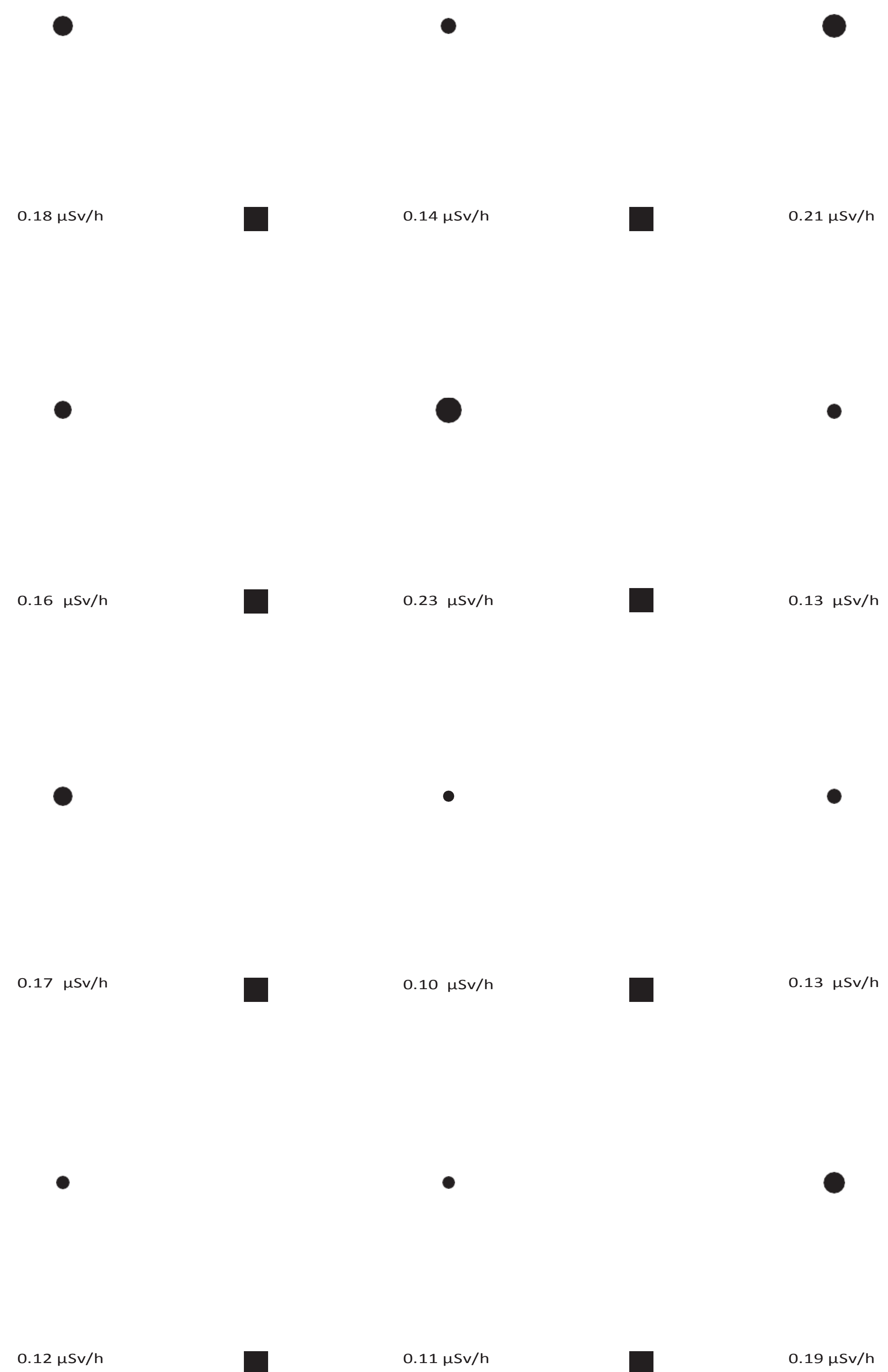
0.16 µSv/h	0.11 µSv/h	0.13 µSv/h
0.19 µSv/h	0.15 µSv/h	0.21 µSv/h
0.14 µSv/h	0.17 µSv/h	0.12 µSv/h
0.10 µSv/h	0.15 µSv/h	0.19 µSv/h


ふくしまの米

37.850985, 140.605749   0.15 μSv/h

[3]

0.13 µSv/h	0.12 µSv/h	0.14 µSv/h
0.11 µSv/h	0.16 µSv/h	0.22 µSv/h
0.10 µSv/h	0.13 µSv/h	0.15 µSv/h
0.17 µSv/h	0.12 µSv/h	0.21 µSv/h

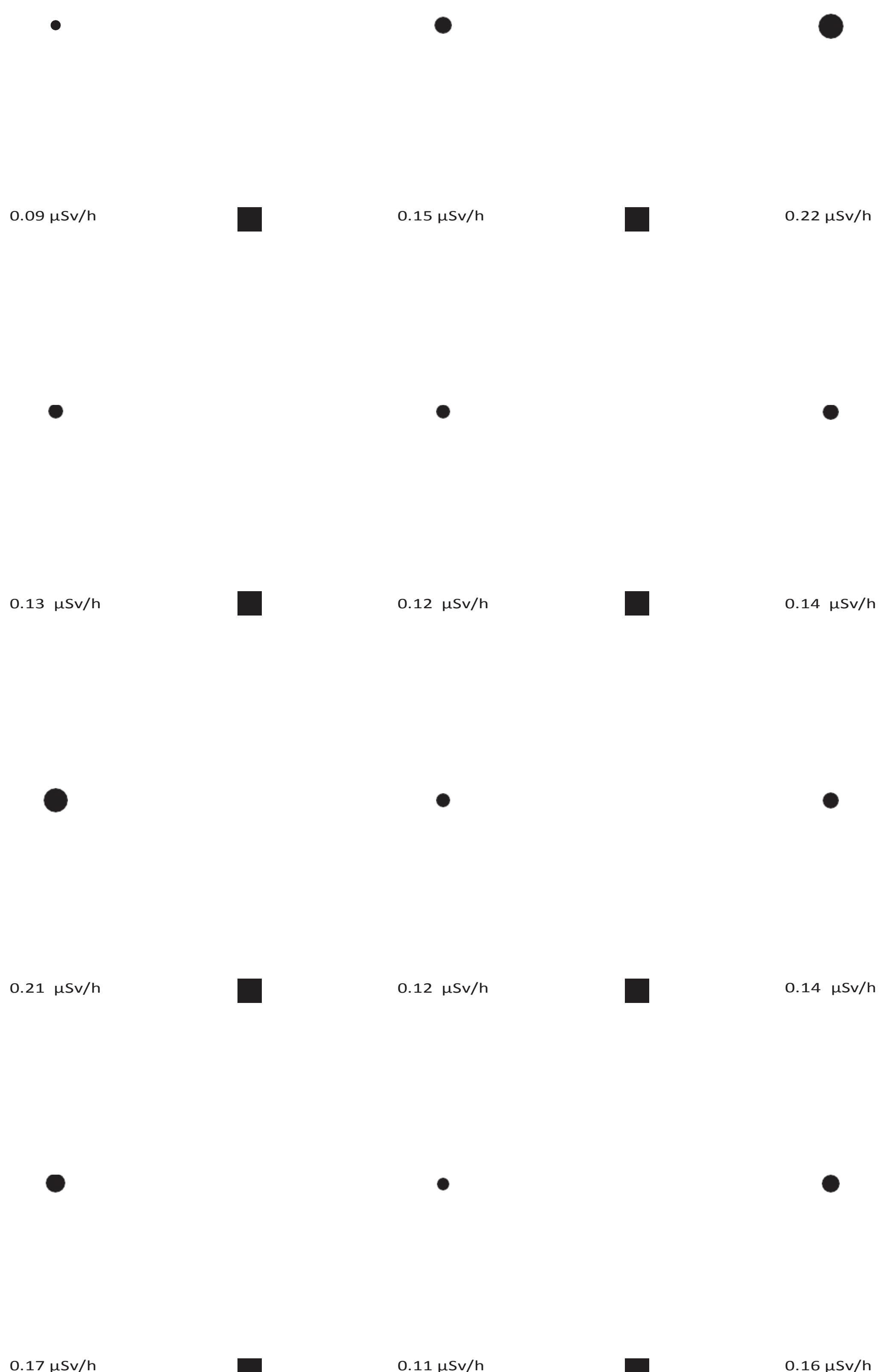

0.18 µSv/h
0.14 µSv/h
0.21 µSv/h
0.16 µSv/h
0.23 µSv/h
0.13 µSv/h
0.17 µSv/h
0.10 µSv/h
0.13 µSv/h
0.12 µSv/h
0.11 µSv/h
0.19 µSv/h

37.851061, 140.605800 0.13 μSv/h

37.850901, 140.605654 0.16 μSv/h

37.850941, 140.605726 0.11 µSv/h

0.17 μSv/h	0.14 μSv/h	0.21 μSv/h
0.24 μSv/h	0.11 μSv/h	0.13 μSv/h
0.15 μSv/h	0.10 μSv/h	0.21 μSv/h
0.18 μSv/h	0.12 μSv/h	0.19 μSv/h


0.09 µSv/h
0.15 µSv/h
0.22 µSv/h
0.13 µSv/h
0.12 µSv/h
0.14 µSv/h
0.21 µSv/h
0.12 µSv/h
0.14 µSv/h
0.17 µSv/h
0.11 µSv/h
0.16 µSv/h

37.850898, 140.605653   0.12 µSv/h

[1] Mr. Miura welcomes visitors to the Kobo Hirose Rice Factory.

[2] Mr. Miura on his rice field outside of Date in central Fukushima Prefecture.

[3] Kobo Hirose provides employment to people with disabilities.

[4] Products such as rice cakes are made from local produce.

11 Epilogue

Dr. Colin Campbell,
VP Environment, METER Group

Each visit back to Fukushima has brought changes – we contributed our knowledge and instruments to build greenhouses. Recently, we saw Wagyu cattle – which Iitate was famous for before the disaster – grazing on decontaminated soil. There's also a new restaurant serving food made with produce from the area.

Still, areas such as the forests are difficult to decontaminate because of their lush vegetation, tall canopies, and steep terrain. Some areas also have a high potential for erosion which can push contaminated sediment into the streams during heavy rains. METER instrumentation can help to show how these sediments are distributed.

Scientists can't turn back time. However, we can join forces and pool our expertise to solve problems, help deal with the consequences, and prevent future mistakes. What drives us is seeing the difference made by the volunteers rehabilitating the land in the eyes of those who lost so much. It is hard to know what the future holds for Iitate, but, judging by the determination of the residents and love of the volunteers, there's no reason to lose hope ●

12 Index

Sources, Images, Patterns, and Data

00

- Mizoguchi, Masaru. Interview.

- McCandless, David. "Radiation Dosage Chart". Information is Beautiful. February 19, 2019 [www.informationisbeautiful.net/visualizations/radiation-dosage-chart]

- Sievert. [www.sievert-system.org]

01

- "Access Washington Home". Access Washington Home. [www.access.wa.gov]

- Cohn, Scott. "This is America's Top State for Business in 2017". CNBC. July 14, 2017. [www.cnbc.com/2017/07/11/washington-is-americas-top-state-for-business-in-2017.html]

- "Farming on the edge: Sprawling Development Threatens America's Best Farmland: Washington". [www.farmland.org]

- Gaylord, David R., Alan J. Busacca, and Mark R. Sweeney. "The Palouse Loess and the Channeled Scabland: A Paired Ice-Age Geologic System". 2003.

- "Map of Oregon and Washington". On the World Map. [www.ontheworldmap.com/usa/state/oregon/map-of-oregon-and-washington.html]

- Nag, Oishimaya Sen. "The 10 Biggest Cities in Washington". World Atlas. January 29, 2019. [www.worldatlas.com/articles/the-10-biggest-cities-in-washington.html]

- Parker, Tim. "State Data". State Data. March 6, 2019. [data.ers.usda.gov/reports.aspx?ID=17854#P9aca4e3258ac447c9cb85db3562b58a9_3_39iT0]

- "quickFacts: Washington". U.S. Census Bureau. [www.census.gov/quickfacts/fact/table/wa/LND110210#LND110210]

- "The evergreen State". State Symbols USA. [www.statesymbolsusa.org/symbol/washington/state-nickname-state-quarter/evergreen-state]

- Tweedy, Doug. "Whitman County Profile". employment Security Department. October 2018. [www.esd.wa.gov/labormarketinfo/county-profiles/whitman]

- "visiting the Capitol". City of Olympia. [www.olympiawa.gov/community/visiting-the-capitol.aspx]

- "Washington Statistics". Farmland Information Center. [www.farmlandinfo.org/statistics/washington]

- Witmer, Stu. "Palouse Loess". earth Science Picture of the Day. August 30, 2010. [www.epod.usra.edu/blog/2010/08/palouse-loess.html]

02

- City of Pullman Washington. [www.pullman-wa.gov]

- MeTeR Group, Inc. USA.

- St. George, Donna. "National Origins: Washington-Idaho Border; America's Golden Land of Lentils". The New York Times. September 24, 1997. [www.nytimes.com/1997/09/24/dining/national-origins-washington-idaho-border-america-s-golden-land-of-lentils.html]

- "Washington Hops". Washington Beer Commision. [www.washingtonbeer.com/washington-hops]

- "Washington State University". Washington State University. [www.wsu.edu]

03

- Cary, Annette. "Hanford Blamed for Most of $110 Billion Bump in Federal Cleanup Costs". February 06, 2019. [www.tri-cityherald.com/news/local/hanford/article225229730.html]

- einan, David R., and Alexandra K. Smith. "2019 Hanford Lifestyle Scope, Schedule and Cost Report". PDF. Richland: Department of energy. January 31, 2019.

- "employees in Nuclear Waste Site". Digital image. Getty Images.[www.gettyimages.de/detail/nachrichtenfoto/employee-steve-flores-stands-nearby-as-radiation-nachrichtenfoto/635237745]

- "Fast Flux Test Facility". Digital image. Getty Images. [www.gettyimages.de/detail/nachrichtenfoto/an-atomic-bomb-of-the-type-nicknamed-fat-man-that-was-nachrichtenfoto/632669212]

- "Google Maps". [www.google.com/maps/dir/Pullman], WA, USA/Hanford Site, Washington, USA.

- "Hanford engineering Plant". Digital image. Getty Images. [www.gettyimages.com/detail/news-photo/one-of-the-areas-at-the-hanford-engineering-plant-near-news-photo/613507580?language=en-US]

- "Hanford Nuclear Reservation". Northwest Power and Conservation Council. [www.nwcouncil.org/reports/columbia-river-history/hanford]

- Lewis, Robert. "Hanford Site". encyclopædia Britannica. April 05, 2018. [www.britannica.com/topic/Hanford-engineer-Works]

- "Little Boy and Fat Man". Atomic Heritage Foundation. July 23, 2014. [www.atomicheritage.org/history/little-boy-and-fat-man]

- "N Reactor". Hanford Site. February 3, 2019. [www.hanford.gov/page.cfm/NReactor]

- "Plutonium Acquisitions". U.S. Department of energy Open Net. [www.osti.gov/opennet/forms?formurl=document/pu50yrs/pu50yc.html]

- "US Nuclear WWII Nagasaki". Digital image. Getty Images. [www.gettyimages.de/detail/nachrichtenfoto/an-atomic-bomb-of-the-type-nicknamed-fat-man-that-was-nachrichtenfoto/632669212]

- Wellerstein, Alex. "The Price of the Manhattan Project". Restricted Data: The Nuclear Secrecy Blog. May 17, 2013. [www.blog.nuclearsecrecy.com/2013/05/17/the-price-of-the-manhattan-project]

04

- “Alpha Particles”. ARPANSA. July 25, 2017. [www.arpansa.gov.au/understanding-radiation/what-is-radiation/ionising-radiation/alpha-particles]

- “Applications of Radioactivity”. Applications of Radioactivity. [www.corporate. engie-electrabel.be/local-player/nuclear-3/50-questions-and-answers-about-nuclear-energy-and-our-nuclear-power-plants/applications-of-radioactivity]

- “Atomic Bomb”. encyclopædia Britannica. November 10, 2017. [www.britannica.com/technology/atomic-bomb]

- “Atomic Bombing of Hiroshima”. Manhattan Project: The Atomic Bombing of Hiroshima, August 6, 1945. [www.osti.gov/opennet/manhattan-project-history/events/1945/hiroshima.htm]

- “Atomic Timeline 1985-1960”. [atomic.lindahall.org/timeline.html]

- “Becquerel (Bq)”. United States Nuclear Regulatory Commission. [www.nrc.gov/reading-rm/basic-ref/glossary/becquerel-bq.html]

- Brünglinghaus, Marion. “Nuclear Power Plants, World-Wide”. european Nuclear Society. [www.euronuclear.org/info/encyclopedia/n/nuclear-power-plant-world-wide.htm]

- “Can the Decay Half-life of a Radioactive Material be Changed?”. Science questions with Surprising Answers.[www.wtamu.edu/~cbaird/sq/2015/04/27/can-the-decay-half-life-of-a-radioactive-material-be-changed]

- “Colors from Ionizing Radiation”. California Institute of Technology. August 1, 2016. [www.minerals.gps.caltech.edu/COLOR_Causes/Radiate/index.html]

- “Could CT Scans Cause Cancer?”. Mayo Clinic. March 06, 2018. [www.mayoclinic.org/tests-procedures/ct-scan/expert-answers/ct-scans/faq-20057860]

- Denny, Shawn, Mike Pizzuti, Chelene Neal, Kate Bessiere, and environmental Information Services. “Advisory Committee on Human Radiation experiments Final Report”. [www.ehss.energy.gov/ohre/roadmap/achre/intro_9_2.html]

- “Discovery of Radioactivity”. Chemistry LibreTexts. February 23, 2019. [www.chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Nuclear_Chemistry/Radioactivity/Discovery_of_Radioactivity]

- Drum, Kevin. “Why did World War II end?”. Mother Jones. June 25, 2017. [www.motherjones.com/kevin-drum/2011/08/why-did-world-war- ii-end]

- “effects of Radiation of the Human Body”. Sputnik International. March 15, 2011. [www.sputniknews.com/infographics/20110315163019417]

- “Food Irradiation”. Better Health Channel. September 30, 2012. [www.betterhealth.vic.gov.au/health/HealthyLiving/food-irradiation]

- “Frédéric and Irène Joliot-Curie”. encyclopædia Britannica. November 18, 2016. [www.britannica.com/biography/Frederic-and-Irene-Joliot-Curie]

- “Greater-than-Class C Low-Level Radioactive Waste (GTCC LLW)”. energy. [www.energy.gov/em/waste-management/waste-and-materials-disposition-information/greater-class-c-low-level]

- “Half-life”. encyclopædia Britannica. May 22, 2018. [www.britannica.com/science/half-life-radioactivity]

- Hainke, Thomas. “Convert Millisievert to Microsievert”. Convert Millisievert to Microsievert (equivalent Dose). [www.convert-measurement-units.com/convert Millisievert to Microsievert.php]

- Helmenstine, Todd. “Which elements are Radioactive?”. ThoughtCo. January 27, 2019. [www.thoughtco.com/list-of-radioactive-elements-608644]

- Kelly, Martin. “The Manhattan Project Timeline”. ThoughtCo. February 03, 2019. [www.thoughtco.com/the-manhattan-project-timeline-4051979]

- “Ionizing Radiation”. World Health Organization. January 18, 2017. [www.who.int/ionizing_radiation/about/what_is_ir/en]

- Leach, Mark R. “The Internet Database of Periodic Tables”. Periodic Table Database | Chemogenesis. [www.meta-synthesis.com/webbook/35_pt/pt_database.php?PT_id=130]

- “List of Radioactive Isotopes by Half-life”. Wikipedia. [www.en.wikipedia.org/wiki/List_of_radioactive_isotopes_by_half-life]

- Long, Tony. “June 27, 1954: World's First Nuclear Power Plant Opens”. Wired. June 03, 2017. [www.wired.com/2012/06/june-27-1954-worlds-first-nuclear-power-plant-opens]

- “Marie Curie”. encyclopædia Britannica. April 05, 2019. [www.britannica.com/biography/Marie-Curie]

- “Marie Curie and Irène Curie on Radium”. encyclopædia Britannica. June 02, 2014. [www.britannica.com/topic/Marie-Curie-and-Irene-Curie-on-radium-1983710]

- McCandless, David, and Matt Hancock. “Radiation Dosage Chart”. Information is Beautiful. [www.informationisbeautiful.net/visualizations/radiation-dosage-chart]

- “Most Commonly Asked questions about Metal Detectors and x-ray Screening Machines”. Washington DC vA Medical Center. [www.washingtondc.va.gov/Most_Commonly_Asked_questions_Metal_Detectors.asp]

- “Notation of Nuclear Reactions”. Nuclear Power. October 29, 2014. [www.nuclear-power.net/notation-nuclear-reactions]

- “Periodic Table: Radioactive elements”. ePA. 2017. [www.epa.gov/sites/production/files/2017-11/periodic-table-radioactive-elements.png]

- “Periodic Table”. Royal Society of Chemistry. [www.rsc.org/periodic-table]

- “Power Generation”. Radiation Answers. [www.radiationanswers.org/radiation-sources-uses/industrial-uses/power-generation.html]

• "Radiation and Airport Security – Are You at Risk?". Radiation Safety Institute of Canada. [www.radiationsafety.ca/resources/factsheets/radiation-and-airport-security-are-you-at-risk]

• "Radiation Basics". United States Nuclear Regulatory Commission – Protecting People and the environment. [www.nrc.gov/about-nrc/radiation/health-effects/radiation-basics.html]

• "Radiation Therapy". National Cancer Institute. [www.cancer.gov/about-cancer/treatment/types/radiation-therapy]

• "Radioactive Decay". ePA. December 21, 2017. [www.epa.gov/radiation/radioactive-decay]

• "Radioactive Decay". Teach Nuclear. [www.teachnuclear.ca/all-things-nuclear/radiation/radioactive-decay]

• Rasmussen, John O., and ellis P. Steinberg. "Applications of Radioactivity". encyclopedia Britannica.

• "Radioactivity". Physical Science for Dummies. [calebcroomphysci4dummies.weebly.com/radioactivity.html]

• "Roentgen's Discovery of the x-ray". The British Library. May 19, 2006. [www.bl.uk/learning/cult/bodies/xray/roentgen.html]

• Smith, Sandy. "Obninsk Nuclear Power Plant". Stanford University. March 9, 2017. [www.large.stanford.edu/courses/2017/ph241/smith-s1]

• "Sievert". encyclopædia Britannica. March 23, 2011. [www.britannica.com/technology/sievert]

• Steinberg, ellis P., and John O. Rasmussen. "Radioactivity". encyclopædia Britannica. July 19, 2018. [www.britannica.com/science/radioactivity]

• Steinberg, ellis P. "Nuclear Fission". encyclopædia Britannica. December 21, 2018. [www.britannica.com/science/nuclear-fission]

• "The Discovery of Radioactivity". Nuclear Wall Chart. November 18, 2004. [www2.lbl.gov/abc/wallchart/chapters/03/4.html]

• "Understanding Radiation Risk from Imaging Tests". American Cancer Society. [www.cancer.org/treatment/understanding-your-diagnosis/tests/understanding-radiation-risk-from-imaging-tests.html]

• "Uranium: Its Uses and Hazards". Institute for energy and environmental Research. May 2012. [wwww.ieer.org/resource/factsheets/uranium-its-uses-and-hazards]

• verkindt, Didier. "Radioactivity is 100 Years Old". Radioactivity History for Radioactivity Century and 20 Years of LAPP. August 28, 2000. [www.lappweb.in2p3.fr/neutrinos/centenaire/rada.html]

• "What Is Uranium? How Does it Work?". World Nuclear Association. January 2017. [www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/what-is-uranium-how-does-it-work.aspx]

• "Wilhelm Conrad Röntgen". Nobel Prize. [www.nobelprize.org/prizes/physics/1901/rontgen/biographical]

• "WW2 People's War". BBC. October 15, 2014. [www.bbc.co.uk/history/ww2peopleswar/timeline/factfiles/nonflash/a6652262.html]

05

• "Fukushima: Impact on Agriculture and Fisheries". Friends of the earth.

• "Fukushima". Japan Guide. [www.japan-guide.com/e/e7725.html]

• "Fukushima". Regions & Cities. [web-japan.org/region/pref/fukushima.html]

• "Fukushima". Statistics Japan: Prefecture Comparisons. [www.stats-japan.com/t/tdfk/fukushima]

• "Fukushima Sake Brewery Map". Fukushima Sake Story. September 30, 2018. [www.fukushima-sake.com]

• Hays, Jeffrey. "Rice Farming in Japan: History, Paddies, Planting, Harvesting and Mechanization". Facts and Details. [www.factsanddetails.com/japan/cat24/sub159/item939.html]

• "Japan: Fukushima". City Population. November 11, 2018. [www.citypopulation.de/Japan-Fukushima.html]

• Koarashi, Jun, Mariko Atarashi-Andoh, erina Takeuchi, and Syusaku Nishimura. "Topograpic Heterogeneity effect on the Accumulation of Fukushima-derived Radiocesium on Forest Floor Driven by Biologically Mediated Processes". October 31, 2014. [www.ncbi.nlm.nih.gov/pmc/articles/PMC4215300]

• Sekizawa, Ryo, Kazuhito Ichii, and Masayuki Kondo. "Satellite-Based Detection of evacuation-Induced Land Cover Changes Following the Fukushima Daiichi Nuclear Disaster". Remote Sensing Letters 6(11) (September 2015), 824-33. [www.researchgate.net/publication/281568822_Satellite-based_detection_of_evacuation-induced_land_cover_changes_following_the_Fukushima_Daiichi_nuclear_disaster]

• "Transition of evacuation Designated Zones". Fukushima Revitalisation Station. March 4, 2019. [www.pref.fukushima.lg.jp/site/portal-english/en03-08.html]

• Yamada, Takahiro, Puangkaew Lurhathaiopath, and Toshiyuki Monma. "Characteristics of the Agricultural and Forestry Industries in the Soma Area and Damage Sustained as a Result of the Great east Japan earthquake". In Agriculture and Forestry Reconstruction after the Great east Japan earthquake, 43-59.

• Yokokawa, Hanae, and Masaru Mizoguchi. "Collaboration Structure for the Resurrection of Iitate village, Fukushima: A Case Study of a Nonprofitable Organization". In Agricultural Implications of the Fukushima Nuclear Accident, 205-15.

06

• "After 3 Years of Taint-free Rice, Fukushima Mulls Review of Checks: The Asahi Shimbun". The Asahi Shimbun. February 16, 2018. [www.asahi.com/ajw/articles/AJ201802160053.html]

• “Akiu Taue Odori (Rice Planting Dance)”. Cultural Property in Miyagi. [www.thm.pref.miyagi.jp/culturalproperty/en/cultural/akiu_taueodori.html]

• Basho, Matsuo. “Rice Planting Song”.

• Cartwright, Mark. “Inari”. Ancient History encyclopedia. May 23, 2017. [www.ancient.eu/Inari]

• ebikeme, Charles. “Water World”. Nature News. July 5, 2013. [www.nature.com/scitable/blog/eyes-on-environment/water_world]

• “Farmers in Fukushima Count the Cost”. Financial Times. January 4, 2012. [www.ft.com/content/7dff5d8e-220f-11e1-a19f-00144feabdc0]

• Hays, Jeffrey. “Rice Farming in Japan: History, Paddies, Planting, Harvesting and Mechanization”. Facts and Details. [www.factsanddetails.com/japan/cat24/sub159/item939.html]

• “Fukushima Sake Brewery Map”. Fukushima Sake Story. September 30, 2018. [www.fukushima-sake.com]

• “Japan: Fukushima”. Rice is Life. 2004. [www.fao.org/rice2004/en/p8.htm]

• Kanno, Numeo. Interview.

• “Number of Shrines in Japan, 2013”. How Much is it in Tokyo? March 13, 2015. [www.nbakki.hatenablog.com/entry/Shrine_numbers_in_Japan]

• Obe, Mitsuru. “TPP Deal expected to Shake up Japan's Agriculture Sector”. The Wall Street Journal. October 06, 2015. [www.blogs.wsj.com/japanrealtime/2015/10/06/tpp-deal-expected-to-shake-up-japans-agriculture-sector]

• “The JA Group”. Zen-Noh. [www.zennoh.or.jp/english/cooperatives/jagroup.html]

• Yamada, Takahiro, Puangkaew Lurhathaiopath, and Toshiyuki Monma. “Characteristics of the Agricultural and Forestry Industries in the Soma Area and Damage Sustained as a Result of the Great east Japan earthquake”. In Agriculture and Forestry Reconstruction After the Great east Japan earthquake, 43-59.

07

• Anzai, Kazunori, Nobuhiko Ban, Toshihiko Ozawa, and Shinji Tokonami. “Fukushima Daiichi Nuclear Power Plant Accident: Facts, environmental Contamination, Possible Biological effects, and Countermeasures”. Journal of Clinical Biochemistry and Nutrition, December 29, 2011, 2-8. January 2012. [www.ncbi.nlm.nih.gov/pmc/articles/PMC3246178]

• “Distance from Tokyo to Fukushima”. Distance Between Cities. [www.distancefromto.net/distance-from-tokyo-to-fukushima]

• “Fukushima”. Regions & Cities. [www.web-japan.org/region/pref/fukushima.html]

• “Fukushima Daiichi Accident”. World Nuclear Association. October 2018. [www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx]

• “Fukushima Nuclear Accident Update Log”. IAeA. April 04, 2011. [www.iaea.org/newscenter/news/fukushima-nuclear-accident-update-log-5]

• “Fukushima Nuclear Crisis Time-line”. Amsterdam: Greenpeace. February 2012.

• “Fukushima Nuclear Power Plant”. Chernobyl Place. March 22, 2018. [www.chernobylplace.com/fukushima-nuclear-plant]

• Fukushima Radioactivity Spread Map. Digital image. Pinimig. [www.i.pinimg.com/originals/1d/a6/d5/1da6d5a93518f0a0cf331a7f7f061d89.png]

• “Japanese Nuclear Workers enter Fukushima Reactor”. The Guardian. May 05, 2011. [www.theguardian.com/world/2011/may/05/fukushima-nuclear-workers-enter-reactor]

• Jolly, David. “Fukushima’s Contamination Produces Some Surprises at Sea”. The New York Times. September 28, 2011. [www.green.blogs.nytimes.com/2011/09/28/fukushimas-contamination-produces-some-surprises-at-sea]

• Kanno, Keichi. Interview.

• Kanno, Numeo. Interview.

• Kazama, Motoki, and Toshihiro Noda. “Damage Statistics (Summary of the 2011 off the Pacific Coast of Tohoku earthquake Damage)”. Soils and Foundations 52, no. 5: 780-92. [www.sciencedirect.com/science/article/pii/S0038080612000947]

• Mizoguchi, Masaru. Interview.

• Okubo, Kenichi, Masaru Mizoguchi, and Colin Campbell. The Rebirth of Fukushima. March 11, 2015. [www.youtube.com/watch?v=nwOrNdU_cmI]

• “Plutonium”. World Nuclear Association. December 2018. [www.world-nuclear.org/information-library/nuclear-fuel-cycle/fuel-recycling/plutonium.aspx]

• “Radioactive Cesium-137 Released from Fukushima 1.5 Times Tepco estimate: Study”. The Japan Times. May 10, 2014. [www.japantimes.co.jp/news/2014/05/10/national/radioactive-cesium-137-released-from-fukushima-1-5-times-tepco-estimate-study/#.xL8Ddi-B3Oq]

• Sanderson, D.C.W., A.J. Cresswell, B. Seitz, K. Yamaguchi, and M. Sasaki. “Results of Airborne Monitoring by MexT and DOe (Readings of Air Dose Monitoring Inside 80 Km Zone of Fukushima Daiichi NPP)”. Digital image. Research Gate. 2011. [www.researchgate.net/figure/Dose-rates-for-the-area-within-80km-of-the-Fukushima-Daiichi-NPP-generated-from_fig2_259310727]

• Sangiorgi, Marco. “Short Overview of 11 March 2011 Accidents and Considerations”. Bologna: eNeA, April 11, 2011.

• Schneider, Stephanie, Clemens Walther, Stefan Bister, viktoria Schauer, Marcus Christl, Hans-Arno Synal, Katsumi Shozugawa, and Georg Steinhauser. “Plutonium Release from Fukushima Daiichi Fosters the Need for More Detailed Investigations”. Nature. Nature. October 18, 2013. [www.nature.com/articles/srep02988]

• Tabuchi, Hiroko, and Ken Belson. “Japan Releases Low-Level Radioactive Water Into Ocean”. The New York Times.

April 04, 2011. [www.nytimes.com/2011/04/05/world/asia/05japan.html]

• "Timeline: A Nuclear Crisis Unfolds in Japan". NPR. March 31, 2011. [www.npr.org/2011/04/04/134798724/timeline-a-nuclear-crisis-unfolds-in-japan?t=1556982265823]

• "Timeline of the Fukushima I Nuclear Accidents". [www.miraikan.jst.go.jp/sp/case311e/docs/Timeline_Fukushima_e.pdf]

• Wooden, Geoff. "Radioactivity of Some Natural and Other Materials". Digital image. NoBS News Tokyo. March 23, 2011. [www.nobsnewstokyo.wordpress.com/2011/03/]

• Yokokawa, Hanae, and Masaru Mizoguchi. "Collaboration Structure for the Resurrection of Iitate village, Fukushima: A Case Study of a Nonprofitable Organization". In Agricultural Implications of the Fukushima Nuclear Accident, 205-15.

08

• Bernie, Shaun, and Kazue Suzuki. "On the Frontline of the Fukushima Nuclear Accident: Workers and Children". Germany and Japan: Greenpeace, March 2019.

• "Boeing 767-300F Designed to Deliver". Seattle: Boeing Airplane Programs Communication.

• "Compensation Awarded over 102-year-old's Suicide amid Fukushima Crisis". The Japan Times. February 20, 2018. [www.japantimes.co.jp/news/2018/02/20/national/crime-legal/compensation-awarded-102-year-olds-suicide-amid-fukushima-crisis/#.xM2u2pMzZqJ]

• Denyer, Simon. "eight Years After Fukushima's Meltdown, the Land is Recovering, but Public Trust is not". The Washington Post. February 20, 2019. [www.washingtonpost.com/world/asia_pacific/eight-years- after-fukushimas-meltdown-the- land-is-recovering-but-public-trust-has-not/2019/02/19/0bb29756-255d-11e9-b5b4-1d18dfb7b084_story.html?utm_term=.27cded956bd8]

• "Fukushima Daiichi Accident". World Nuclear Association. October 2018. [www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx]

• "Fukushima operator told to compensate for suicide of 102-year-old ordered to evacuate". The Straits Times. February 20, 2018. [www.straitstimes.com/asia/east-asia/fukushima-operator-told-to-compensate-for-suicide-of-102-year-old-ordered-to-evacuate]

• Gibney, elizabeth. "Fukushima Data Show Rise and Fall in Food Radioactivity". Nature News. February 27, 2015.[www.nature.com/news/fukushima-data-show-rise-and-fall-in-food-radioactivity-1.17016]

• Hamilton, Bevan. "Fukushima 5 Years Later: 2011 Disaster by the Numbers". CBCnews. March 10, 2016. [www.cbc.ca/news/world/5-years-after-fukushima-by-the-numbers-1.3480914]

• Hirabayashi, Daisuke. "As Fears Linger, Fukushima Rice Rebounds Under Anonymity: The Asahi Shimbun". The Asahi Shimbun. March 20, 2019. [www.asahi.com/ajw/articles/photo/AS20190319001407.html]

• Kanno, Numeo. Interview.

• Kaufman, Noah. "7 Years After its Devastating Nuclear Disaster Fukushima is Making Japan's Best Sake". Supercall. July 20, 2018. [www.supercall.com/culture/fukushima-sake]

• Little, Jane Braxton. "Fukushima Residents Return Despite Radiation". Scientific American. January 16, 2019. [www.scientificamerican.com/article/fukushima-residents-return-despite-radiation]

• Livni, ephrat. "Radioactive Wild Boars in Sweden are eating Nuclear Mushrooms". quartz. October 11, 2017. [www.qz.com/1099248/radioactive-wild-boars-in-sweden-are-eating-nuclear-mushrooms]

• Merz, Stefan, Katsumi Shozugawa, and Georg Steinhauser. "Analysis of Japanese Radionuclide Monitoring Data of Food Before and After the Fukushima Nuclear Accident". environmental Science and Technology, January 26, 2015, 2875-885.

• Miura, Shoichi. Interview.

• Mizoguchi, Masaru. "Challenges of Agricultural Land Remediation and Renewal of Agriculture in Iitate village by a Collaboration Between Scholar and NPO".

• Obayashi, Yuka, and Kentaro Hamada. "Japan Nearly Doubles Fukushima Disaster-related Cost to $188 Billion". Reuters. December 09, 2016. [www.reuters.com/article/us-tepco-fukushima-costs/japan-nearly-doubles-fukushima-disaster-related-cost-to-188-billion-idUSKBN13Y047]

• O'Sullivan, Tom, and Mathyos Japan. "Will Japan Regain Leading Role in Global Nuclear energy Development?". Japan Forward. May 31, 2017. [www.japan-forward.com/will-japan-regain-leading-role-in-global-nuclear-energy-development]

• Mizoguchi, Masaru. Interview.

• Nakanishi, Tomoko M. "Agricultural Implications of the Fukushima Nuclear Accident". Journal of Radiation Research 57. August 16, 2016. [doi:10.1093/jrr/rrw042]

• "Over 70,000 Live in evacuation 7 Years After Fukushima Disaster". xinhua. March 11, 2018. [www.xinhuanet.com/english/2018-03/11/c_137032155.htm]

• "Radiation Levels in the Prefecture". Fukushima Revitalisation Station. [www.pref.fukushima.lg.jp/site/portal-english/en02-01.html]

• "Ship Sizes". Maritime Connector. [www.maritime-connector.com/wiki/ship-sizes]

• Silverstein, Ken. "Japan Circling Back to Nuclear Power After Fukushima Disaster". Forbes. September 08, 2017. [www.forbes.com/sites/kensilverstein/2017/09/08/japan-may-be-coming-full-circle-after-its-fukushima-nuclear-energy-disaster/#51ccb1e230e8]

• Taira, Wataru, Chiyo Nohara, Atsuki Hiyama, and Joji M. Otaki. "Fukushima's Biological Impacts: The Case of the Pale Grass Blue Butterfly". Journal of Heredity

105, no. 5 (September/October 2014): 710-22. August 13, 2014. [www.academic.oup.com/jhered/article/105/5/710/2961788]

• "Taiwan votes to Keep Ban on Foods from Fukushima Disaster Areas for 2 More Years". The Mainichi. November 26, 2018. [www.mainichi.jp/english/articles/20181126/p2a/00m/0na/023000c]

• Uesako, Daisuke. "The Current Situation of Off-Site Cleanup in Japan". The Society of Remediation of Radioactive Contamination in environment. July 20, 2017.

• "Update 2-Japan's 2013 LNG Imports Hit Record High on Nuclear Woes". Reuters. January 27, 2014. [www.reuters.com/article/energy-japan-mof/update-2-japans-2013-lng-imports-hit-record-high-on-nuclear-woes-idUSL3N0L103N20140127]

• Wada, Toshihiro, Tsuneo Fujita, Yoshiharu Nemoto, Shinya Shimamura, Takuji Mizuno, Tadahiro Sohtome, Kyoichi Kamiyama, Kaoru Narita, Masato Watanabe, Noboyuki Hatta, Yasuo Ogata, Takami Morita, and Satoshi Igarashi. "effects of the Nuclear Disaster on Marine Products in Fukushima: An Update After Five Years". Science Direct, November 2016, 312-24. November 2016. [www.sciencedirect.com/science/article/pii/S0265931x16302302]

• Worland, Justin. "This May be the Biggest Health Threat From Fukushima- and it's Still Ongoing". Time. March 11, 2016. [www.time.com/4256088/fukushima-mental-health]

• Yamada, Takahiro, Puangkaew Lurhathaiopath, and Toshiyuki Monma. "Characteristics of the Agricultural and Forestry Industries in the Soma Area and Damage Sustained as a Result of the Great east Japan earthquake". In Agriculture and Forestry Reconstruction After the Great east Japan earthquake, 43-59.

• Yamaguchi, Noriko, Ichiro Taniyama, Takeshi Kimura, Kunio Yoshioka, and Masanori Saito. "Contamination of Agricultural Products and Soils with Radiocesium Derived from the Accident at TePCO Fukushima Daiichi Nuclear Power Station: Monitoring, Case Studies, and Countermeasures". Soil Science and Plant Nutrition 62, no. 3 (2016): 303-14. June 28, 1016. [www.tandfonline.com/doi/full/10.1080/00380768.2016.1196119]

09

• "Fukushima Farmers Struggle". NHK WORLD. June 8, 2017. [www3.nhk.or.jp/nhkworld/en/news/editors/3/fukushimafarmersstruggle/index.html]

• "Iitate Fukushima". City Population. November 11, 2018. [www.citypopulation.de/php/japan-fukushima.php?cityid=07564]

• "Iitate village in Fukushima Divided Into 3 Zones". Japan Today. July 17, 2012. [www.japantoday.com/category/nationalIitate-village-in-fukushima-divided-into-3-zones]

• Kanno, Numeo. Interview.

• "Lower Price of Fukushima Rice Shifts Demand to Commercial Sector". Nippon. October 1, 2018. [www.nippon.com/en/features/h00290]

• McNeill, David, and Chie Matsumoto. "In Fukushima, a Land Where few Return". The Japan Times. May 13, 2017. [www.japantimes.co.jp/news/2017/05/13/national/social-issues/fukushima-land-return/#.xM22SZMzZqJ]

• Nakanishi, Tomoko M. "Agricultural Implications of the Fukushima Nuclear Accident". Journal of Radiation Research 57. August 16, 2016. [doi:10.1093/jrr/rrw042]

• Okubo, Kenichi, Masaru Mizoguchi, and Colin Campbell. The Rebirth of Fukushima. March 11, 2015. [www.youtube.com/watch?v=nwOrNdU_cml]

• Osnos, evan. "The Fallout". The New Yorker. July 10, 2017. [www.newyorker.com/magazine/2011/10/17/the-fallout]

• "Provisional Report regarding Radioactive Contamination in Iitate village and Recommended Countermeasures". Friends of earth Japan, April 4, 2011.

• Reiher, Cornelia. "Food Safety and Consumer Trust in Post-Fukushima Japan". Japan Forum 29, no. 1, 53-76. October 28, 2016. [www.tandfonline.com/doi/abs/10.1080/09555803.2016.1227351]

• "Rural Population". World Bank Group. 2018. [www.data.worldbank.org/indicator/SP.RUR.TOTL.ZS]

• "Transition of evacuation Designated Zones". Fukushima Revitalisation Station. March 4, 2019. [www.pref.fukushima.lg.jp/site/portal-english/en03-08.html]

• Yokokawa, Hanae, and Masaru Mizoguchi. "Collaboration Structure for the Resurrection of Iitate village, Fukushima: A Case Study of a Nonprofitable Organization". In Agricultural Implications of the Fukushima Nuclear Accident, 205-215.

10

• "Cornell Controlled environment Agriculture". Cornell College of Agriculture and Life Sciences. [www.cea.cals.cornell.edu]

• "exports of Fukushima-Brand Alcohol Hit Record in Fiscal 2017". Japan Times. November 18, 2018. [www.japantimes.co.jp/news/2018/11/18/national/exports-fukushima-brand-alcohol-hit-record-fiscal-2017/#.xM2kz5MzZqJ]

• "Fukushima Farmers Struggle". NHK WORLD. June 8, 2017. [www3.nhk.or.jp/nhkworld/en/news/editors/3/fukushimafarmersstruggle/index.html]

• Gibney, elizabeth. "Fukushima Data Show Rise and Fall in Food Radioactivity". Nature News. February 27, 2015. [www.nature.com/news/fukushima-data-show-rise-and-fall-in-food-radioactivity-1.17016]

• Hidaka, Masahiro, and Yuko Takeo. "Fukushima Looks to Top-Tier Sake to Beat Stigma, Lift economy". Bloomberg. December 28, 2017. [www.bloomberg.com/news/articles/2017-12-28/fukushima-looks-to-top-tier-sake-to-beat-stigma-lift-economy]

• Hurst, Daniel. "Town Where Nobody's Home: Fukushima Communities Struggling to Survive". The Guardian. March 09, 2018. [www.theguardian.com/environment/2018/mar/09/fukushima-communities-struggling].

- Kanno, Keichi. Interview.

- “Lower Price of Fukushima Rice Shifts Demand to Commercial Sector”. Nippon. October 1, 2018. [www.nippon.com/en/features/h00290]

- “Mid-and-Long-Term Roadmap Towards the Decommissioning of TePCO's Fukushima Daiichi Nuclear Power Station Units 1-4”. MeTI. September 12, 2018. [www.meti.go.jp/english/earthquake/nuclear/decommissioning/index.html]

- Miura, Shoichi. Interview.

- Mizoguchi, Masaru. “Challenges of Agricultural Land Remediation and Renewal of Agriculture in Iitate village by a Collaboration Between Scholar and NPO”.

- Mizoguchi, Masaru. “Collaboration is Important”. 2013.

- Mizoguchi, Masaru. Interview.

- Nakanishi, Tomoko M., and Keitaro Tanoi. Agricultural Implications of the Fukushima Nuclear Accident. [www.link.springer.com/book/10.1007/978-4-431-55828-6]

- Paulo, Derrick A. “New Cracks Seven Years on, as Fukushima Residents Urged to Return Home”. CNA. March 06, 2018. [www.channelnewsasia.com/news/cnainsider/fukushima-daiichi-nuclear-radiation-residents-return-safety-9888552]

- “Resurrection of Fukushima”. Fukushima Saisei. [www.fukushima-saisei.jp/archives/index_en.html]

- Yokokawa, Hanae, and Masaru Mizoguchi. “Collaboration Structure for the Resurrection of Iitate village, Fukushima: A Case Study of a Nonprofitable Organization”. In “Agricultural Implications of the Fukushima Nuclear Accident”. Pages 205-215.

00

01

02

03

04

05

06

07

08

09

10

11

12

13

00

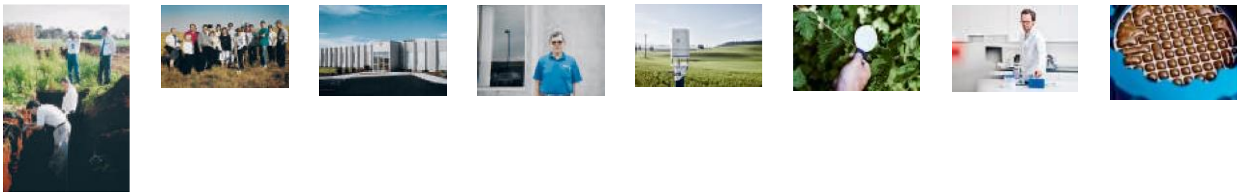
P 8–13

01

P 14–19

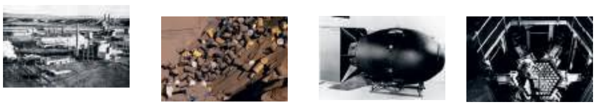
02

P 20–27



03

P 28–33

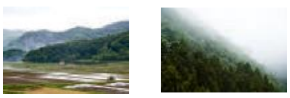


04

P 34–51

05

P 52–59



06

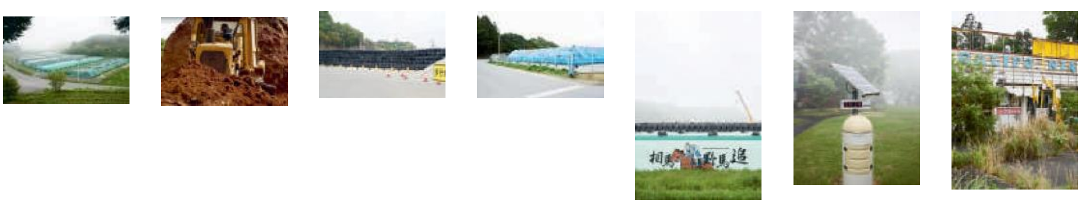
P 60–77

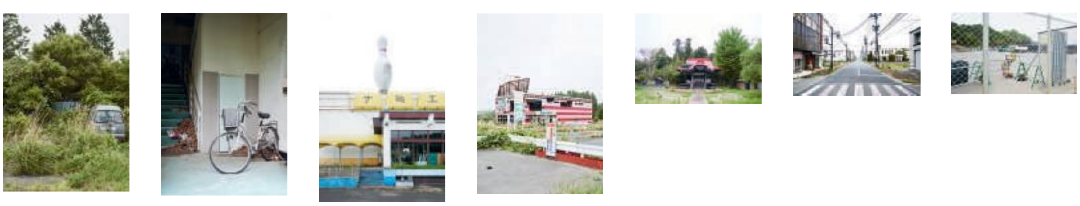
07

P 78–101

08

P 102–137

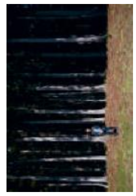




09

P 138–153




10

P 154–201



























11

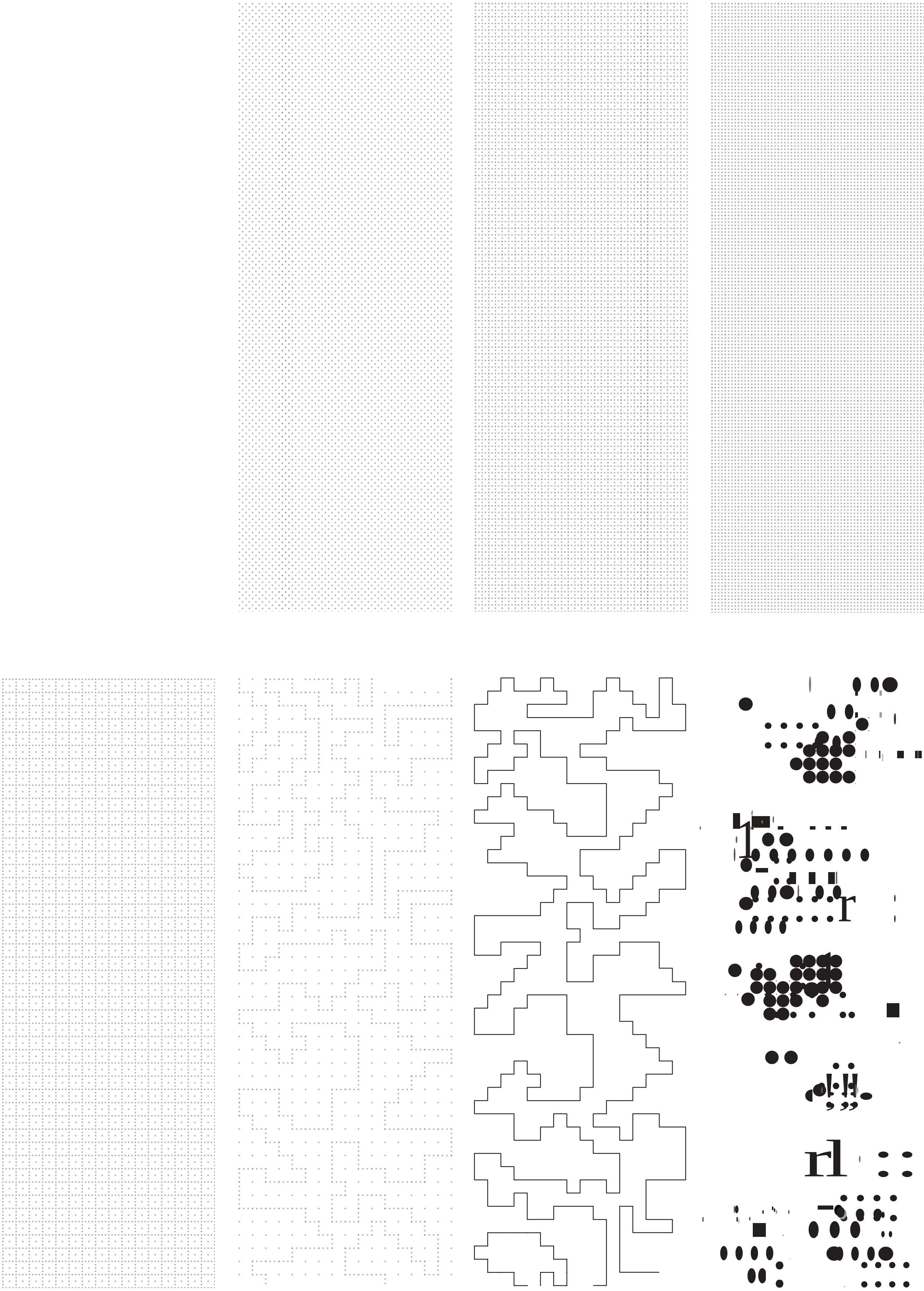
P 202–203

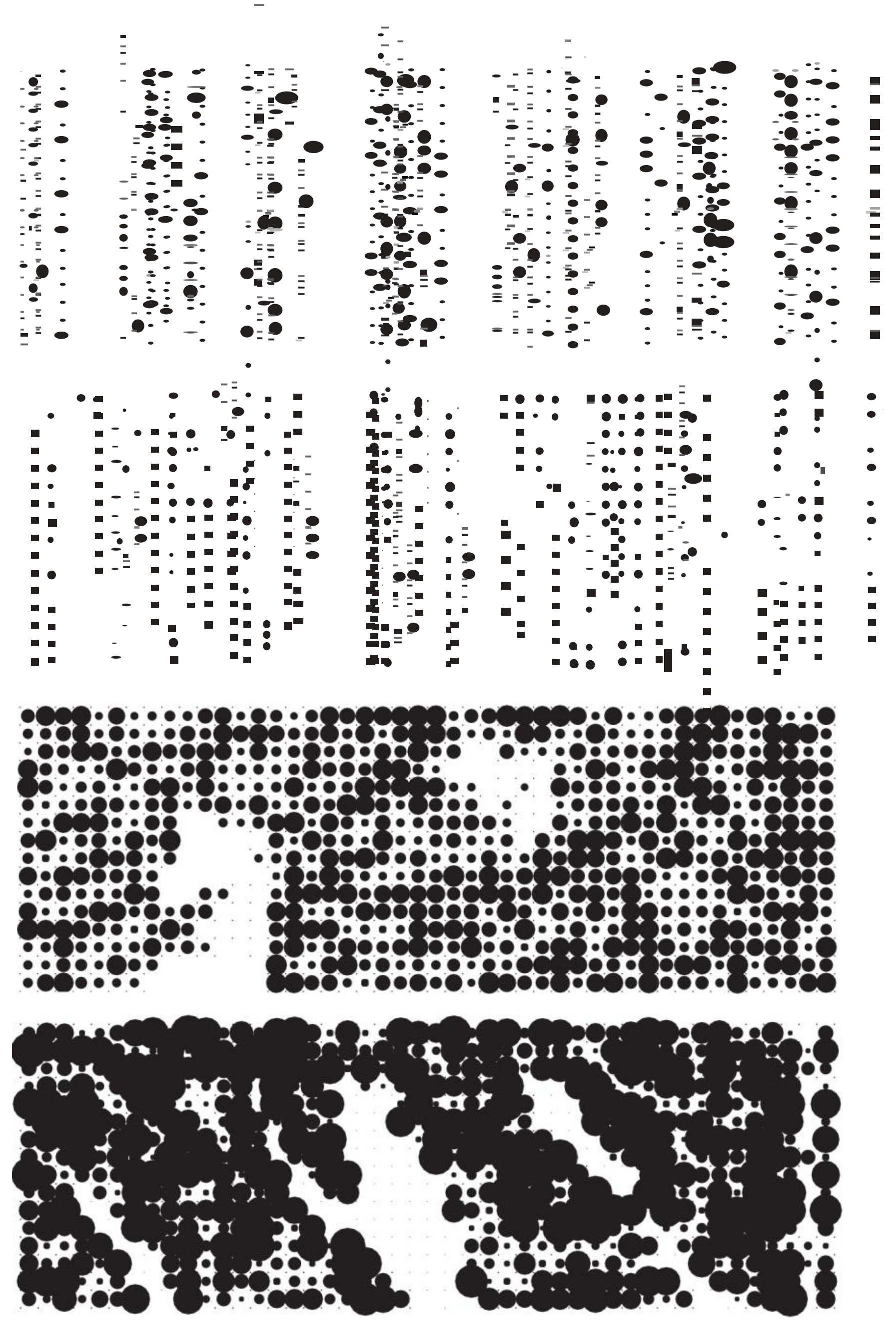
12

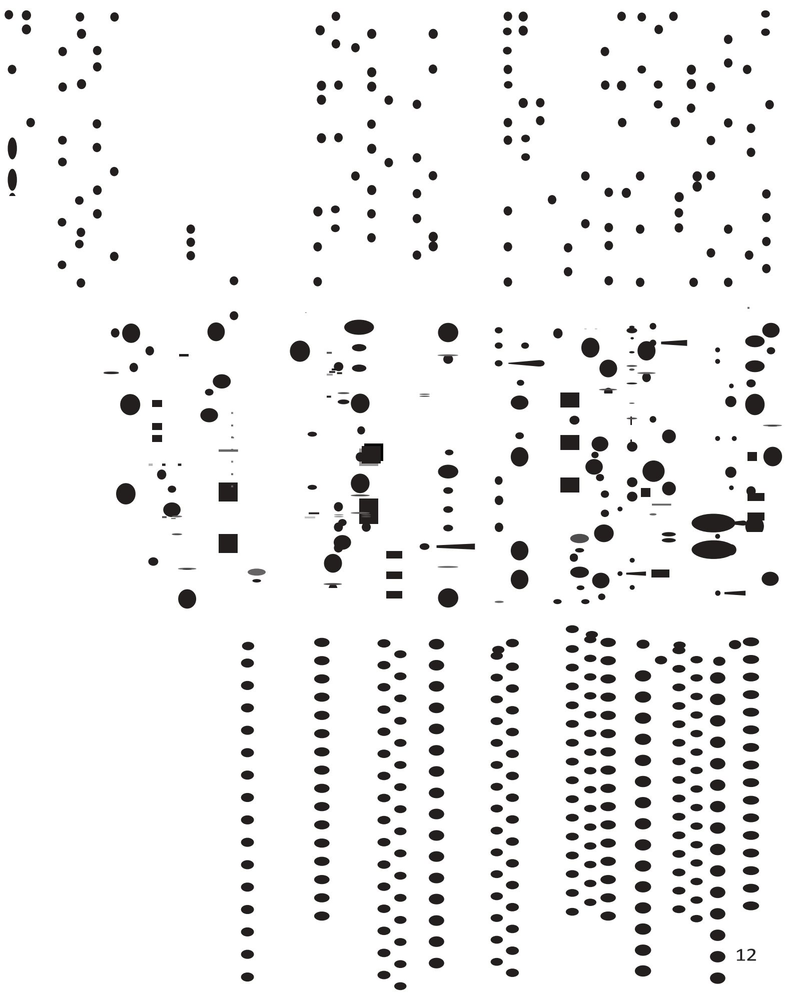
P 204–227

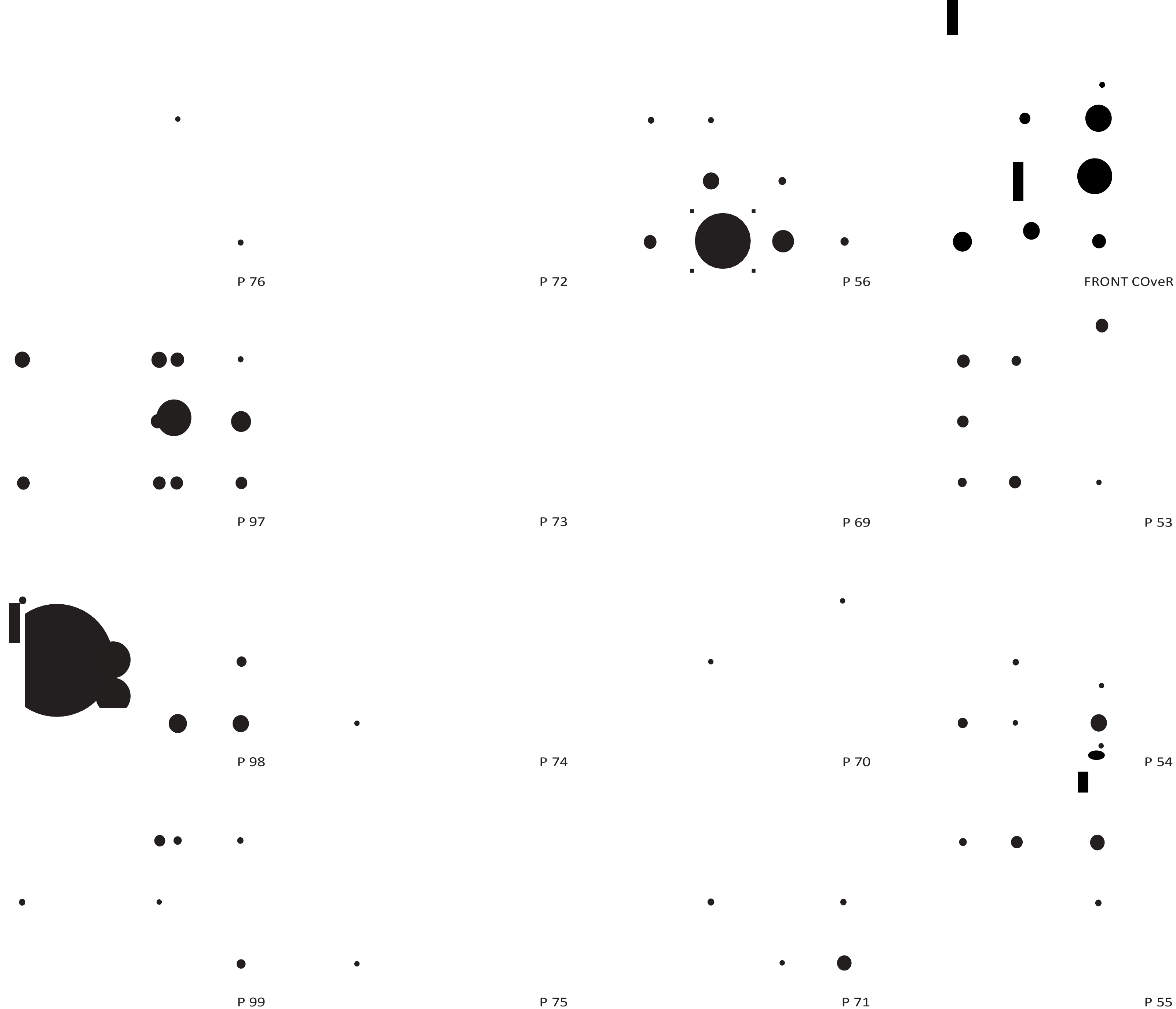
13

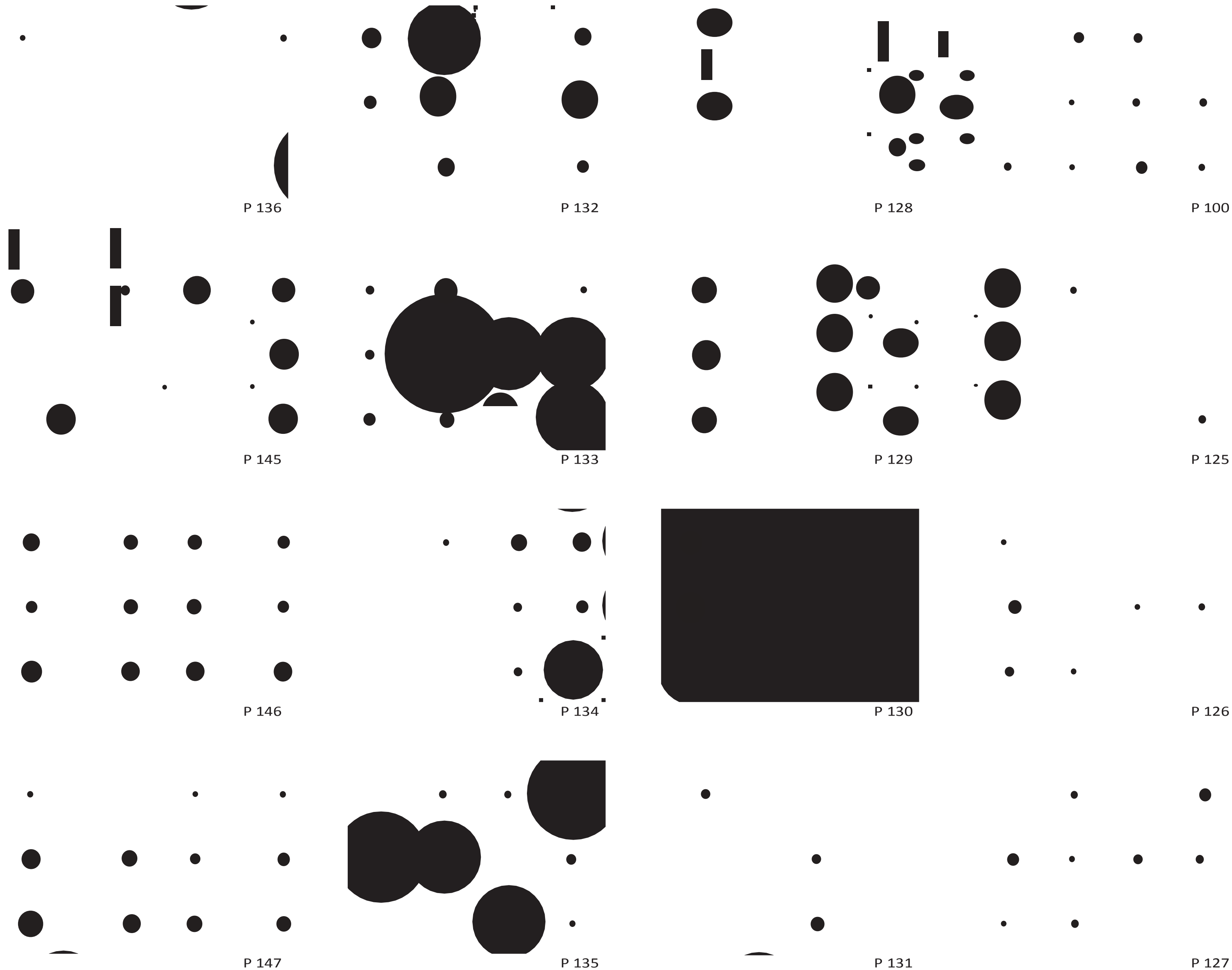
P 228–229

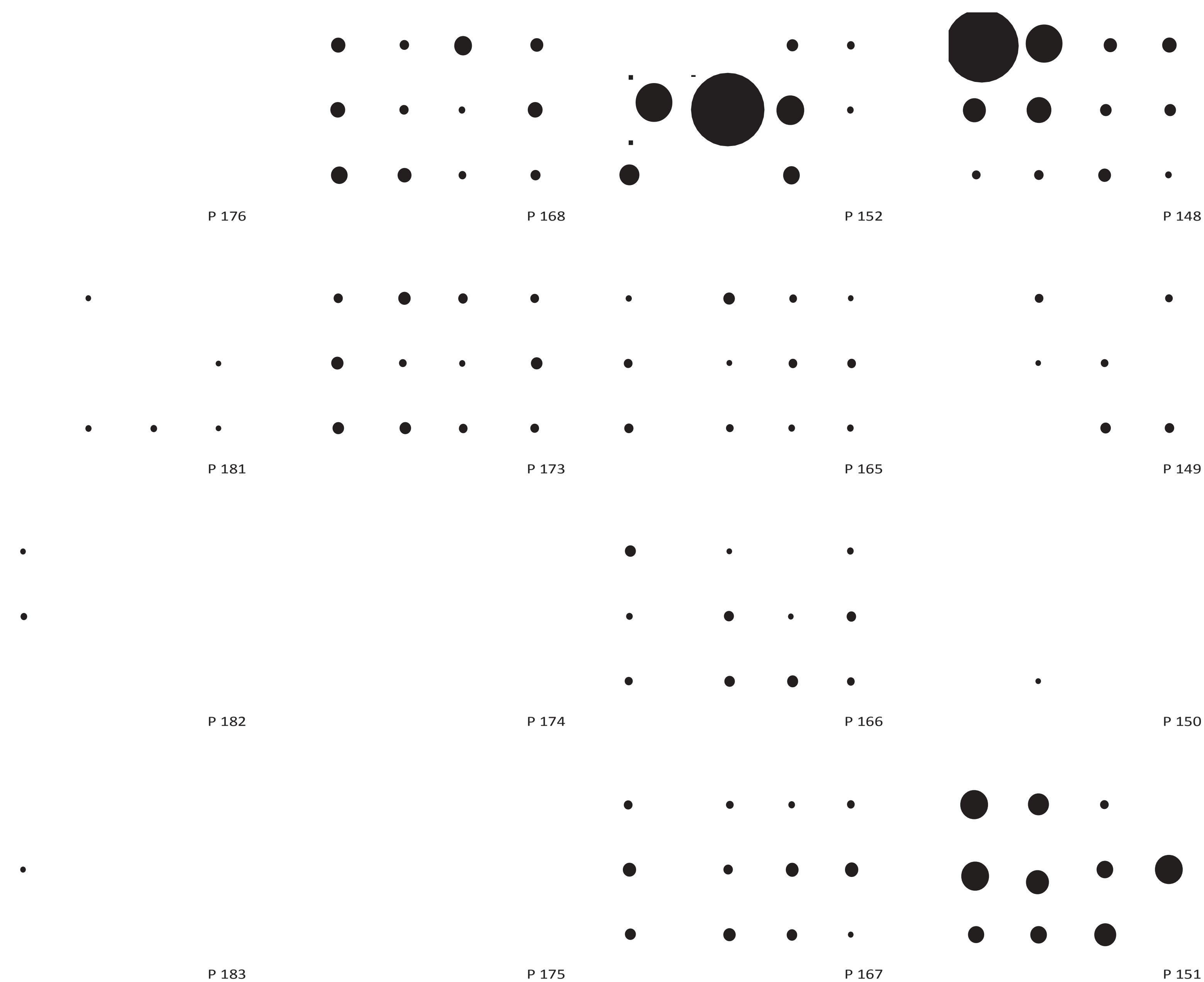


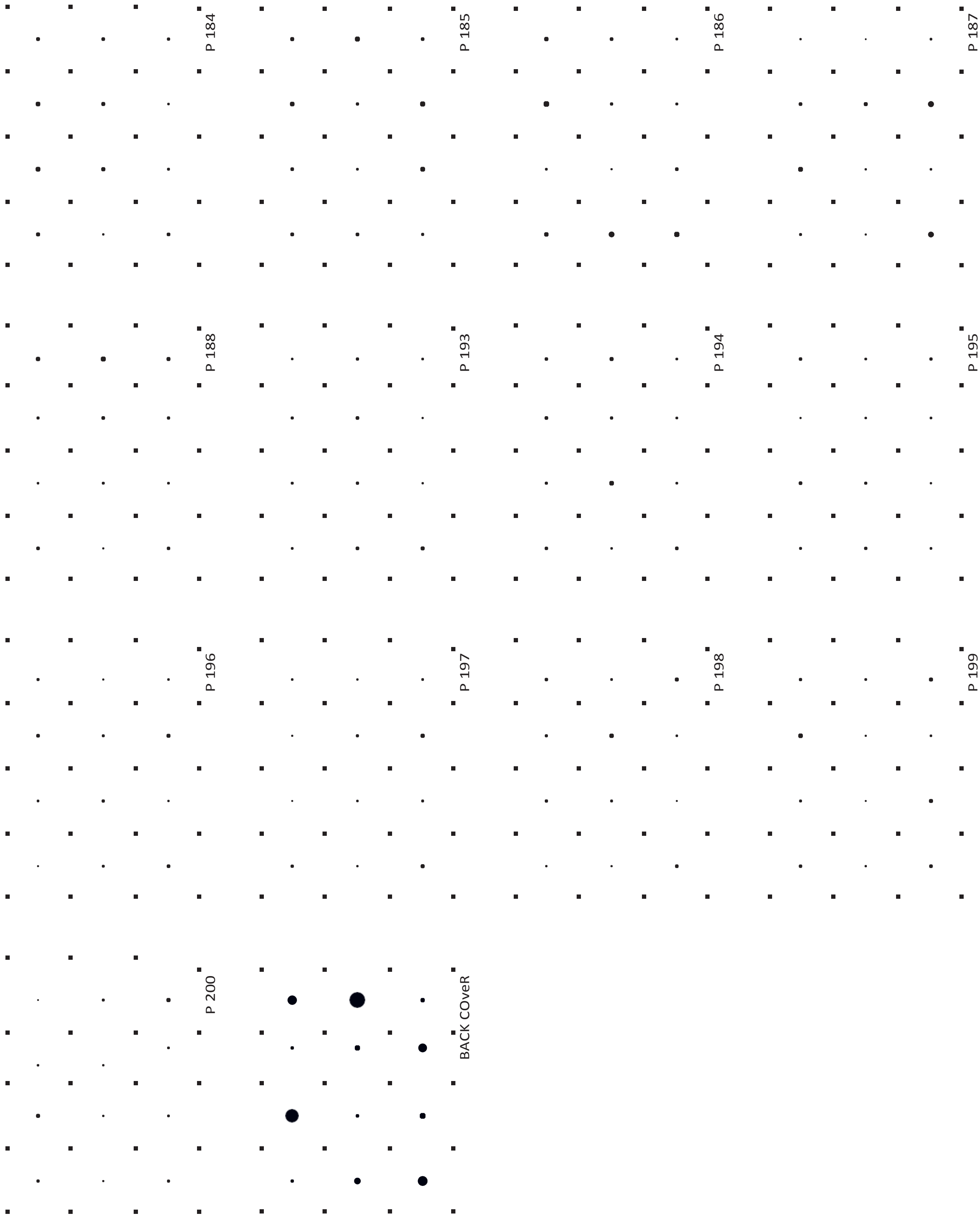





FRONT COVeR
P 53
P 54
P 55
P 56
P 69
P 70
P 71
P 72
P 73
P 74
P 75
P 76
P 97
P 98
P 99


P 136
P 132
P 128
P 100
P 145
P 133
P 129
P 125
P 146
P 134
P 130
P 126
P 147
P 135
P 131
P 127


P 148
P 149
P 150
P 151
P 152
P 165
P 166
P 167
P 168
P 173
P 174
P 175
P 176
P 181
P 182
P 183



The data visualized on the inside pages represent the radiation levels in the areas where the pictures were taken.

Date	Latitude [DD]	Longitude [DD]	Radiation [µSv/h]	Date	Latitude [DD]	Longitude [DD]	Radiation [µSv/h]
05.17.2018	37.780980	140.724186	0.37	05.17.2018	37.892881	140.570545	0.24
05.17.2018	37.643557	140.754442	0.29	05.17.2018	37.909678	140.577505	0.27
05.17.2018	37.914124	140.593903	0.24	05.17.2018	37.902929	140.570590	0.19
05.17.2018	37.769509	140.626253	0.27	05.17.2018	37.896891	140.565048	0.21
05.17.2018	37.625859	140.652740	0.59	05.17.2018	37.906033	140.583462	0.17
05.17.2018	37.694256	140.614015	0.29	05.17.2018	37.905754	140.582856	0.21
05.17.2018	37.797196	140.607958	0.32	05.17.2018	37.905488	140.582249	0.19
05.17.2018	37.914124	140.593903	0.24	05.17.2018	37.906394	140.583271	0.20
05.17.2018	37.694153	140.690607	0.86	05.17.2018	37.906091	140.582583	0.17
05.17.2018	37.796001	140.680136	0.37	05.17.2018	37.905820	140.581959	0.28
05.17.2018	37.909373	140.670430	0.12	05.17.2018	37.906833	140.583028	0.24
05.17.2018	37.684320	140.679033	0.29	05.17.2018	37.906538	140.582273	0.29
05.17.2018	37.598687	140.686345	0.75	05.17.2018	37.906202	140.581602	0.24
05.17.2018	37.845864	140.611524	0.25	05.17.2018	37.907400	140.582637	0.27
05.17.2018	37.845058	140.613656	0.15	05.17.2018	37.907089	140.581754	0.24
05.17.2018	37.844285	140.615801	0.19	05.17.2018	37.906779	140.581073	0.31
05.17.2018	37.844682	140.610842	0.25	05.17.2018	37.907964	140.583775	0.20
05.17.2018	37.843788	140.612976	0.21	05.17.2018	37.907554	140.583818	0.24
05.17.2018	37.843001	140.615055	0.20	05.17.2018	37.907210	140.583911	0.19
05.17.2018	37.843321	140.610037	0.14	05.17.2018	37.907918	140.583395	0.26
05.17.2018	37.842521	140.612229	0.23	05.17.2018	37.907472	140.583437	0.18
05.17.2018	37.841659	140.614317	0.22	05.17.2018	37.907043	140.583511	0.29
05.17.2018	37.841937	140.609301	0.24	05.17.2018	37.907889	140.582917	0.18
05.17.2018	37.841187	140.611429	0.16	05.17.2018	37.907381	140.582999	0.21
05.17.2018	37.840467	140.613620	0.28	05.17.2018	37.906833	140.583028	0.24
05.17.2018	37.685577	140.563558	0.30	05.17.2018	37.907833	140.582288	0.20
05.17.2018	37.685601	140.565112	0.17	05.17.2018	37.907274	140.582343	0.25
05.17.2018	37.685659	140.566762	0.27	05.17.2018	37.906774	140.582465	0.30
05.17.2018	37.684697	140.563647	0.20	05.17.2018	37.907855	140.583634	0.24
05.17.2018	37.684684	140.565163	0.10	05.17.2018	37.907738	140.583470	0.19
05.17.2018	37.684779	140.566831	0.23	05.17.2018	37.907606	140.583317	0.34
05.17.2018	37.683840	140.563668	0.16	05.17.2018	37.907954	140.583493	0.31
05.17.2018	37.683864	140.565166	0.32	05.17.2018	37.907842	140.583334	0.20
05.17.2018	37.683856	140.566816	0.28	05.17.2018	37.907711	140.583179	0.22
05.17.2018	37.682925	140.563835	0.21	05.17.2018	37.908139	140.583278	0.18
05.17.2018	37.682958	140.565298	0.25	05.17.2018	37.908015	140.583088	0.21
05.17.2018	37.682976	140.566777	0.27	05.17.2018	37.907889	140.582917	0.18
05.17.2018	37.905286	140.741269	0.14	05.17.2018	37.908334	140.583073	0.12
05.17.2018	37.784086	140.729272	0.37	05.17.2018	37.908188	140.582822	0.19
05.17.2018	37.682907	140.723143	0.82	05.17.2018	37.908055	140.582629	0.25
05.17.2018	37.910767	140.665565	0.16	05.17.2018	37.357430	141.009587	0.85
05.17.2018	37.790185	140.652847	0.21	05.17.2018	37.507925	141.010324	0.21
05.17.2018	37.687355	140.641486	0.33	05.17.2018	37.433394	141.015693	2.80
05.17.2018	37.912611	140.589417	0.25	05.17.2018	37.359370	141.026640	1.07
05.17.2018	37.792207	140.580357	0.40	05.17.2018	37.504860	140.997102	0.15
05.17.2018	37.684684	140.565163	0.10	05.17.2018	37.498179	140.995159	0.30
05.17.2018	37.913030	140.498866	0.17	05.17.2018	37.504860	140.997102	0.15
05.17.2018	37.791579	140.486495	0.24	05.17.2018	37.491518	141.001286	0.18
05.17.2018	37.689815	140.478755	0.21	05.17.2018	37.496718	141.003341	0.38
05.17.2018	37.904524	140.558960	0.21	05.17.2018	37.720894	140.615340	0.41
05.17.2018	37.912055	140.568787	0.24	05.17.2018	37.632309	140.809641	0.33
05.17.2018	37.919645	140.577348	0.28	05.17.2018	37.560832	140.968835	0.43
05.17.2018	37.900138	140.563136	0.19	05.17.2018	37.672122	140.590937	0.27
05.17.2018	37.908622	140.572888	0.27	05.17.2018	37.593040	140.784432	0.67
05.17.2018	37.916297	140.582954	0.23	05.17.2018	37.521820	140.944465	0.31
05.17.2018	37.892881	140.570545	0.24	05.17.2018	37.401576	140.687340	0.21
05.17.2018	37.903861	140.579125	0.21	05.17.2018	37.555204	140.645083	0.27
05.17.2018	37.912611	140.589417	0.25	05.17.2018	37.720894	140.615340	0.41
05.17.2018	37.888930	140.575344	0.14	05.17.2018	37.421483	140.801114	0.39
05.17.2018	37.898371	140.586368	0.23	05.17.2018	37.576828	140.763917	3.12
05.17.2018	37.907065	140.595898	0.18	05.17.2018	37.728899	140.733250	1.06
05.17.2018	37.899694	140.593947	0.21	05.17.2018	37.440870	140.898867	1.74
05.17.2018	37.893042	140.588611	0.14	05.17.2018	37.504472	140.997111	0.17
05.17.2018	37.886189	140.582422	0.26	05.17.2018	37.500196	140.991904	0.22
05.17.2018	37.902820	140.588582	0.22	05.17.2018	37.496196	140.987580	0.26
05.17.2018	37.896374	140.582650	0.17	05.17.2018	37.508028	140.991610	0.54
05.17.2018	37.889289	140.576612	0.13	05.17.2018	37.503568	140.986059	0.27
05.17.2018	37.906202	140.581602	0.24	05.17.2018	37.499792	140.981065	0.25
05.17.2018	37.899880	140.576956	0.17	05.17.2018	37.359405	140.983974	0.95

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]	Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.17.2018	37.438667	140.982164	2.34	05.17.2018	37.849703	140.601970	0.13
05.17.2018	37.504199	140.977531	0.67	05.17.2018	37.850801	140.599334	0.14
05.17.2018	37.359802	140.998849	2.99	05.17.2018	37.849628	140.605285	0.19
05.17.2018	37.438496	141.000594	1.36	05.17.2018	37.851010	140.602808	0.16
05.17.2018	37.504472	140.997111	0.17	05.17.2018	37.852088	140.600363	0.12
05.17.2018	37.913127	140.595491	0.14	05.17.2018	37.850985	140.605749	0.15
05.17.2018	37.913158	140.595452	0.17	05.17.2018	37.852186	140.603533	0.17
05.17.2018	37.913124	140.595559	0.20	05.17.2018	37.853379	140.601243	0.14
05.17.2018	37.913149	140.595516	0.25	05.17.2018	37.849364	140.606785	0.16
05.17.2018	37.913179	140.595474	0.15	05.17.2018	37.850127	140.605272	0.11
05.17.2018	37.913105	140.595422	0.19	05.17.2018	37.850907	140.603755	0.13
05.17.2018	37.913169	140.595492	0.24	05.17.2018	37.850372	140.607241	0.19
05.17.2018	37.913237	140.595557	0.14	05.17.2018	37.850985	140.605749	0.15
05.17.2018	37.913061	140.595490	0.25	05.17.2018	37.851751	140.604451	0.21
05.17.2018	37.913124	140.595559	0.20	05.17.2018	37.851270	140.607744	0.14
05.17.2018	37.913197	140.595619	0.17	05.17.2018	37.851828	140.606244	0.17
05.17.2018	37.913020	140.595554	0.13	05.17.2018	37.852489	140.604946	0.12
05.17.2018	37.913085	140.595620	0.20	05.17.2018	37.852040	140.608131	0.10
05.17.2018	37.913158	140.595680	0.12	05.17.2018	37.852576	140.606661	0.15
05.17.2018	37.912986	140.595613	0.15	05.17.2018	37.853213	140.605333	0.19
05.17.2018	37.913049	140.595676	0.13	05.17.2018	37.851061	140.605800	0.13
05.17.2018	37.913124	140.595734	0.17	05.17.2018	37.850982	140.605883	0.12
05.17.2018	37.765710	140.739568	0.12	05.17.2018	37.850928	140.605842	0.14
05.17.2018	37.847566	140.654468	0.25	05.17.2018	37.851073	140.605847	0.11
05.17.2018	37.807404	140.662379	0.12	05.17.2018	37.851011	140.605805	0.16
05.17.2018	37.754934	140.668747	0.13	05.17.2018	37.850960	140.605789	0.22
05.17.2018	37.851089	140.605702	0.15	05.17.2018	37.851109	140.605786	0.10
05.17.2018	37.807464	140.609827	0.11	05.17.2018	37.851043	140.605748	0.13
05.17.2018	37.746963	140.620307	0.31	05.17.2018	37.850985	140.605749	0.15
05.17.2018	37.849277	140.604521	0.23	05.17.2018	37.851143	140.605708	0.17
05.17.2018	37.850873	140.604638	0.26	05.17.2018	37.851082	140.605674	0.12
05.17.2018	37.852350	140.604526	0.21	05.17.2018	37.851026	140.605642	0.21
05.17.2018	37.849494	140.605733	0.16	05.17.2018	37.851055	140.605486	0.18
05.17.2018	37.850992	140.605730	0.19	05.17.2018	37.851137	140.605603	0.14
05.17.2018	37.852309	140.605620	0.17	05.17.2018	37.851203	140.605751	0.21
05.17.2018	37.849708	140.606821	0.13	05.17.2018	37.850901	140.605654	0.16
05.17.2018	37.851089	140.605702	0.15	05.17.2018	37.850979	140.605767	0.23
05.17.2018	37.852299	140.606496	0.14	05.17.2018	37.851049	140.605925	0.13
05.17.2018	37.849891	140.607805	0.19	05.17.2018	37.850784	140.605791	0.17
05.17.2018	37.851112	140.607757	0.11	05.17.2018	37.850860	140.605899	0.10
05.17.2018	37.852254	140.607695	0.18	05.17.2018	37.851061	140.605800	0.15
05.17.2018	37.850408	140.605224	0.13	05.17.2018	37.850673	140.605916	0.12
05.17.2018	37.850989	140.605343	0.17	05.17.2018	37.850743	140.606029	0.11
05.17.2018	37.851602	140.605400	0.14	05.17.2018	37.850813	140.606147	0.19
05.17.2018	37.850392	140.605621	0.16	05.17.2018	37.852315	140.603729	0.17
05.17.2018	37.850992	140.605730	0.19	05.17.2018	37.852186	140.605697	0.14
05.17.2018	37.851531	140.605817	0.11	05.17.2018	37.852140	140.607726	0.21
05.17.2018	37.850426	140.606052	0.15	05.17.2018	37.851025	140.603805	0.24
05.17.2018	37.851001	140.606130	0.17	05.17.2018	37.850941	140.605726	0.11
05.17.2018	37.851500	140.606214	0.12	05.17.2018	37.850855	140.607547	0.13
05.17.2018	37.850444	140.606417	0.14	05.17.2018	37.849899	140.603968	0.15
05.17.2018	37.851009	140.606483	0.19	05.17.2018	37.849835	140.605675	0.10
05.17.2018	37.851476	140.606545	0.21	05.17.2018	37.849811	140.607425	0.21
05.17.2018	37.848386	140.597221	0.18	05.17.2018	37.848889	140.604182	0.18
05.17.2018	37.849331	140.597599	0.21	05.17.2018	37.848895	140.605727	0.12
05.17.2018	37.850137	140.597859	0.14	05.17.2018	37.848824	140.607297	0.19
05.17.2018	37.848300	140.597904	0.19	05.17.2018	37.848456	140.608596	0.09
05.17.2018	37.849194	140.598213	0.17	05.17.2018	37.848456	140.608594	0.15
05.17.2018	37.850050	140.598459	0.14	05.17.2018	37.849224	140.602493	0.22
05.17.2018	37.848196	140.598481	0.16	05.17.2018	37.850666	140.609063	0.17
05.17.2018	37.849112	140.598748	0.24	05.17.2018	37.850898	140.605653	0.12
05.17.2018	37.849961	140.599039	0.14	05.17.2018	37.851184	140.603153	0.14
05.17.2018	37.848121	140.598984	0.18	05.17.2018	37.852548	140.609302	0.12
05.17.2018	37.849016	140.599253	0.13	05.17.2018	37.853072	140.606176	0.21
05.17.2018	37.849876	140.599514	0.19	05.17.2018	37.853253	140.603899	0.14
05.17.2018	37.846909	140.604364	0.18	05.17.2018	37.854434	140.609720	0.13
05.17.2018	37.848143	140.601034	0.14	05.17.2018	37.855023	140.606703	0.11
05.17.2018	37.849194	140.598213	0.17	05.17.2018	37.855219	140.604368	0.16
05.17.2018	37.848422	140.604928	0.11	05.18.2018	37.692336	140.763549	0.70

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.18.2018	37.796675	140.756869	0.14
05.18.2018	37.908175	140.750820	0.13
05.18.2018	37.690250	140.834056	0.45
05.18.2018	37.794605	140.830786	0.11
05.18.2018	37.908290	140.821046	0.17
05.18.2018	37.788206	140.918547	0.14
05.18.2018	37.693261	140.922253	0.24
05.18.2018	37.604386	140.925055	0.48
05.18.2018	37.779759	140.826057	0.14
05.18.2018	37.690250	140.834056	0.45
05.18.2018	37.603065	140.836814	1.26
05.18.2018	37.774686	140.749771	0.33
05.18.2018	37.687945	140.755475	0.97
05.18.2018	37.600062	140.766509	3.12
05.18.2018	37.772115	140.670380	0.37
05.18.2018	37.357425	141.010186	1.16
05.18.2018	37.357393	141.010863	0.69
05.18.2018	37.356945	141.009637	0.81
05.18.2018	37.357038	141.010215	2.48
05.18.2018	37.357020	141.010803	0.72
05.18.2018	37.356495	141.009676	0.88
05.18.2018	37.356522	141.010262	0.81
05.18.2018	37.356532	141.010840	0.72
05.18.2018	37.356072	141.009710	0.91
05.18.2018	37.356080	141.010304	0.19
05.18.2018	37.356122	141.010846	0.75
05.18.2018	37.511676	141.026432	0.17
05.18.2018	37.437070	141.031179	0.57
05.18.2018	37.362019	141.036632	0.97
05.18.2018	37.430219	140.998326	2.29
05.18.2018	37.357038	141.010215	2.48
05.18.2018	37.503492	140.972767	0.43
05.18.2018	37.428588	140.976682	15.61
05.18.2018	37.354494	140.990583	1.77
05.18.2018	37.494933	140.979056	0.38
05.18.2018	37.500063	140.981032	0.24
05.18.2018	37.506330	140.982674	0.51
05.18.2018	37.493688	140.986126	0.46
05.18.2018	37.499260	140.987665	0.27
05.18.2018	37.505704	140.989607	0.24
05.18.2018	37.492730	140.994217	0.64
05.18.2018	37.502610	141.006118	0.21
05.18.2018	37.492812	140.994254	0.27
05.18.2018	37.492778	140.994256	0.44
05.18.2018	37.492735	140.994265	0.36
05.18.2018	37.492810	140.994209	0.51
05.18.2018	37.492774	140.994212	0.44
05.18.2018	37.492730	140.994217	0.64
05.18.2018	37.492806	140.994167	0.60
05.18.2018	37.492770	140.994170	0.31
05.18.2018	37.492732	140.994162	0.29
05.18.2018	37.492807	140.994110	0.19
05.18.2018	37.492766	140.994113	0.20
05.18.2018	37.492721	140.994115	0.30
05.18.2018	37.332174	141.023797	0.21
05.18.2018	37.332207	141.025154	0.10
05.18.2018	37.332172	141.026279	0.42
05.18.2018	37.331360	141.023859	0.13
05.18.2018	37.331410	141.025154	0.22
05.18.2018	37.331393	141.026238	0.25
05.18.2018	37.330483	141.023802	0.37
05.18.2018	37.330497	141.025050	0.19
05.18.2018	37.330497	141.026240	0.17
05.18.2018	37.329675	141.023782	0.24
05.18.2018	37.329650	141.025070	0.20
05.18.2018	37.329732	141.026136	0.23
05.18.2018	37.600469	141.021160	0.17
05.18.2018	37.462957	141.030853	0.35
05.18.2018	37.330769	141.026823	0.21

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.18.2018	37.600078	141.011727	0.15
05.18.2018	37.461227	141.015909	0.31
05.18.2018	37.330644	141.024508	0.22
05.18.2018	37.599556	141.003944	0.12
05.18.2018	37.460519	141.002399	0.26
05.18.2018	37.332524	141.010034	0.30
05.18.2018	37.597341	140.978333	0.33
05.18.2018	37.461944	140.982148	0.75
05.18.2018	37.333855	140.989885	0.51
05.18.2018	37.798104	140.667349	0.66
05.18.2018	37.714911	140.862903	0.46
05.18.2018	37.646000	141.023708	0.11
05.18.2018	37.759222	140.641039	0.24
05.18.2018	37.676463	140.839085	0.52
05.18.2018	37.599556	141.003944	0.12
05.18.2018	37.359892	141.010251	4.38
05.18.2018	37.438320	141.017674	2.87
05.18.2018	37.504486	141.014544	0.97
05.18.2018	37.359290	141.032328	1.07
05.18.2018	37.437918	141.033305	0.72
05.18.2018	37.505141	141.028301	0.17
05.18.2018	37.485420	141.023999	0.37
05.18.2018	37.422076	141.015644	6.16
05.18.2018	37.359892	141.010251	4.38
05.18.2018	37.488708	141.009123	3.19
05.18.2018	37.424318	141.000993	5.23
05.18.2018	37.363188	140.995469	2.86
05.18.2018	37.492455	140.993278	1.30
05.18.2018	37.426355	140.986020	15.42
05.18.2018	37.366009	140.982430	0.82
05.18.2018	37.496000	140.978639	0.47
05.18.2018	37.428842	140.968688	0.54
05.18.2018	37.367767	140.967327	0.69
05.18.2018	37.486884	140.989688	1.06
05.18.2018	37.488947	140.982880	0.69
05.18.2018	37.490896	140.975913	3.16
05.18.2018	37.491147	140.991695	0.89
05.18.2018	37.493645	140.985060	0.49
05.18.2018	37.496000	140.978639	0.47
05.18.2018	37.494888	140.994056	0.34
05.18.2018	37.498271	140.987126	0.27
05.18.2018	37.500428	140.980969	0.23
05.18.2018	37.500374	140.996582	0.21
05.18.2018	37.503402	140.989101	0.24
05.18.2018	37.505566	140.983070	0.27
05.18.2018	37.330814	140.991740	0.56
05.18.2018	37.413822	140.991746	9.18
05.18.2018	37.494888	140.994056	0.34
05.18.2018	37.330675	141.003172	0.40
05.18.2018	37.413590	141.007714	5.55
05.18.2018	37.493941	141.008153	0.21
05.18.2018	37.330796	141.014371	0.43
05.18.2018	37.412881	141.020814	4.43
05.18.2018	37.493715	141.022195	0.11
05.18.2018	37.330684	141.025128	0.21
05.18.2018	37.412414	141.032449	9.01
05.18.2018	37.494733	141.035574	0.14
05.18.2018	37.332729	141.026262	0.36
05.18.2018	37.330588	141.026087	0.23
05.18.2018	37.328358	141.025922	0.13
05.18.2018	37.332696	141.025325	0.19
05.18.2018	37.330684	141.025128	0.21
05.18.2018	37.328412	141.025074	0.24
05.18.2018	37.332666	141.024288	0.27
05.18.2018	37.330674	141.024217	0.21
05.18.2018	37.328469	141.024338	0.15
05.18.2018	37.332658	141.023352	0.30
05.18.2018	37.330637	141.023388	0.27
05.18.2018	37.328565	141.023379	0.22

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]	Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.18.2018	37.706726	140.745399	1.29	05.19.2018	37.727453	140.755617	0.41
05.18.2018	37.708346	140.748182	1.65	05.19.2018	37.673973	140.722449	0.24
05.18.2018	37.709834	140.750314	1.61	05.19.2018	37.621417	140.690972	0.53
05.18.2018	37.705698	140.746764	1.52	05.19.2018	37.730654	140.746435	0.29
05.18.2018	37.707444	140.749140	1.89	05.19.2018	37.676664	140.714833	0.44
05.18.2018	37.708843	140.751462	1.71	05.19.2018	37.624007	140.683644	0.59
05.18.2018	37.704610	140.748053	0.51	05.19.2018	37.734980	140.737231	0.48
05.18.2018	37.706212	140.750512	1.81	05.19.2018	37.674500	140.773916	1.10
05.18.2018	37.707752	140.752727	1.77	05.19.2018	37.734772	140.690934	0.32
05.18.2018	37.703711	140.749481	1.29	05.19.2018	37.734761	140.691589	0.47
05.18.2018	37.705143	140.751759	1.74	05.19.2018	37.734778	140.692389	0.38
05.18.2018	37.706480	140.753897	1.65	05.19.2018	37.734519	140.690909	0.43
05.18.2018	37.692561	140.829892	0.70	05.19.2018	37.734487	140.691624	0.48
05.18.2018	37.692549	140.834189	0.64	05.19.2018	37.734480	140.692403	0.37
05.18.2018	37.692518	140.837616	1.06	05.19.2018	37.734187	140.690864	0.63
05.18.2018	37.690653	140.830189	0.78	05.19.2018	37.734180	140.691617	0.29
05.18.2018	37.690639	140.834306	0.82	05.19.2018	37.734206	140.692461	0.41
05.18.2018	37.690671	140.837942	1.04	05.19.2018	37.733880	140.690858	0.33
05.18.2018	37.689017	140.830154	0.77	05.19.2018	37.733896	140.691599	0.49
05.18.2018	37.688861	140.834285	0.81	05.19.2018	37.733905	140.692512	0.50
05.18.2018	37.688726	140.838351	1.07	05.19.2018	37.733507	140.691838	0.39
05.18.2018	37.687142	140.829887	0.97	05.19.2018	37.733523	140.690840	0.54
05.18.2018	37.686920	140.834452	0.64	05.19.2018	37.733547	140.690002	0.43
05.18.2018	37.686943	140.838582	1.17	05.19.2018	37.733854	140.691828	0.27
05.18.2018	37.780836	140.803741	0.36	05.19.2018	37.733880	140.690858	0.33
05.18.2018	37.738579	140.818604	0.70	05.19.2018	37.733939	140.690070	0.61
05.18.2018	37.690639	140.834306	0.82	05.19.2018	37.734272	140.691835	0.29
05.18.2018	37.772300	140.768284	0.31	05.19.2018	37.734272	140.690902	0.55
05.18.2018	37.730015	140.779585	0.59	05.19.2018	37.734335	140.690131	0.58
05.18.2018	37.683124	140.792089	0.88	05.19.2018	37.734653	140.691804	0.61
05.18.2018	37.591971	140.868745	2.96	05.19.2018	37.734668	140.690932	0.37
05.18.2018	37.745233	140.838102	1.31	05.19.2018	37.734696	140.690183	0.45
05.18.2018	37.449861	141.009194	2.54	05.19.2018	37.699936	140.687104	0.44
05.18.2018	37.600372	140.979771	1.40	05.19.2018	37.715923	140.689129	0.76
05.18.2018	37.766433	140.952423	1.71	05.19.2018	37.733880	140.690858	0.33
05.18.2018	37.449676	141.009061	2.36	05.19.2018	37.697518	140.698738	0.38
05.18.2018	37.449761	141.009070	2.41	05.19.2018	37.715537	140.701078	0.71
05.18.2018	37.449867	141.009098	2.48	05.19.2018	37.734579	140.703124	0.60
05.18.2018	37.449672	141.009139	1.39	05.19.2018	37.694144	140.711359	0.41
05.18.2018	37.449752	141.009161	1.66	05.19.2018	37.714605	140.714401	0.54
05.18.2018	37.449861	141.009194	2.54	05.19.2018	37.735383	140.716746	0.69
05.18.2018	37.449667	141.009222	2.76	05.19.2018	37.690539	140.727098	0.48
05.18.2018	37.449749	141.009254	1.55	05.19.2018	37.713874	140.731127	0.73
05.18.2018	37.449839	141.009293	2.48	05.19.2018	37.736731	140.735166	0.62
05.18.2018	37.449651	141.009346	1.39	05.19.2018	37.691016	140.725981	0.72
05.18.2018	37.449737	141.009368	1.57	05.19.2018	37.622019	140.689813	0.48
05.18.2018	37.449832	141.009388	1.41	05.19.2018	37.622080	140.691163	0.64
05.18.2018	37.491462	141.028915	0.52	05.19.2018	37.622189	140.692551	0.49
05.18.2018	37.471452	141.028790	0.34	05.19.2018	37.621549	140.689909	0.53
05.18.2018	37.451143	141.028399	0.43	05.19.2018	37.621602	140.691234	0.34
05.18.2018	37.492349	141.011334	0.41	05.19.2018	37.621700	140.692575	0.47
05.18.2018	37.470429	141.009597	0.80	05.19.2018	37.621016	140.690015	0.68
05.18.2018	37.449667	141.009222	2.76	05.19.2018	37.621024	140.691274	0.44
05.18.2018	37.493389	140.993000	0.76	05.19.2018	37.621117	140.692615	0.63
05.18.2018	37.470595	140.989113	0.91	05.19.2018	37.620384	140.690074	0.51
05.18.2018	37.449318	140.989183	1.10	05.19.2018	37.620377	140.691329	0.70
05.18.2018	37.495094	140.970829	1.23	05.19.2018	37.620424	140.692665	0.62
05.18.2018	37.471285	140.969617	1.65	05.19.2018	37.913481	140.595279	0.24
05.18.2018	37.448436	140.967820	6.32	05.19.2018	37.913307	140.595626	0.17
05.18.2018	37.498530	141.005747	0.17	05.19.2018	37.913106	140.595946	0.13
05.18.2018	37.494268	141.001266	0.20	05.19.2018	37.913283	140.595111	0.18
05.18.2018	37.490721	140.997040	0.18	05.19.2018	37.913111	140.595415	0.22
05.18.2018	37.501716	141.001356	0.21	05.19.2018	37.912915	140.595737	0.15
05.18.2018	37.496834	140.997126	0.53	05.19.2018	37.913120	140.594964	0.19
05.18.2018	37.493389	140.993000	0.76	05.19.2018	37.912949	140.595270	0.16
05.19.2018	37.746352	140.722055	0.53	05.19.2018	37.912765	140.595575	0.12
05.19.2018	37.621417	140.690972	6.40	05.19.2018	37.912983	140.594828	0.19
05.19.2018	37.683219	140.717853	1.29	05.19.2018	37.912803	140.595137	0.14
05.19.2018	37.741519	140.738423	0.48	05.19.2018	37.912627	140.595421	0.18

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]	Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.19.2018	37.913059	140.595479	0.14	05.19.2018	37.765687	140.739982	0.29
05.19.2018	37.913084	140.595448	0.18	05.19.2018	37.765685	140.739969	0.17
05.19.2018	37.913111	140.595415	0.22	05.19.2018	37.765685	140.739955	0.26
05.19.2018	37.913078	140.595501	0.15	05.19.2018	37.765721	140.739984	0.14
05.19.2018	37.913105	140.595468	0.11	05.19.2018	37.765716	140.739971	0.11
05.19.2018	37.913135	140.595432	0.21	05.19.2018	37.765714	140.739956	0.19
05.19.2018	37.913098	140.595525	0.13	05.19.2018	37.765750	140.739991	0.23
05.19.2018	37.765882	140.739754	0.30	05.19.2018	37.765748	140.739973	0.31
05.19.2018	37.766054	140.739895	0.33	05.19.2018	37.765749	140.739957	0.27
05.19.2018	37.765633	140.739809	0.27	05.19.2018	37.840938	140.735058	0.12
05.19.2018	37.765772	140.739967	0.25	05.19.2018	37.808027	140.737095	0.09
05.19.2018	37.765941	140.740066	0.36	05.19.2018	37.765721	140.739984	0.14
05.19.2018	37.765557	140.739970	0.30	05.19.2018	37.843018	140.707496	0.19
05.19.2018	37.765707	140.740089	0.23	05.19.2018	37.806531	140.707601	0.21
05.19.2018	37.765837	140.740210	0.34	05.19.2018	37.760882	140.708380	0.32
05.19.2018	37.765494	140.740115	0.26	05.20.2018	37.662578	140.898391	0.20
05.19.2018	37.765643	140.740214	0.29	05.20.2018	37.662572	140.898477	0.22
05.19.2018	37.765758	140.740316	0.22	05.20.2018	37.662575	140.898574	0.75
05.19.2018	37.765879	140.739705	0.25	05.20.2018	37.662501	140.898392	0.19
05.19.2018	37.765887	140.739919	0.19	05.20.2018	37.662500	140.898472	0.26
05.19.2018	37.765918	140.740134	0.26	05.20.2018	37.662502	140.898567	0.29
05.19.2018	37.765746	140.739746	0.21	05.20.2018	37.662417	140.898393	0.56
05.19.2018	37.765758	140.739935	0.16	05.20.2018	37.662421	140.898477	0.21
05.19.2018	37.765769	140.740116	0.27	05.20.2018	37.662418	140.898560	0.72
05.19.2018	37.765625	140.739784	0.22	05.20.2018	37.662343	140.898393	0.74
05.19.2018	37.765649	140.739944	0.18	05.20.2018	37.662348	140.898480	0.68
05.19.2018	37.765663	140.740110	0.24	05.20.2018	37.662344	140.898559	0.53
05.19.2018	37.765534	140.739811	0.33	05.20.2018	37.917699	140.855592	0.15
05.19.2018	37.765547	140.739962	0.36	05.20.2018	37.794267	140.885431	0.13
05.19.2018	37.765551	140.740121	0.22	05.20.2018	37.662500	140.898472	0.26
05.19.2018	37.765765	140.739945	0.15	05.20.2018	37.915861	140.774901	0.11
05.19.2018	37.765768	140.739953	0.24	05.20.2018	37.787058	140.811163	0.24
05.19.2018	37.765770	140.739963	0.26	05.20.2018	37.657941	140.839661	0.97
05.19.2018	37.765750	140.739949	0.18	05.20.2018	37.914564	140.684994	0.17
05.19.2018	37.765753	140.739959	0.11	05.20.2018	37.764272	140.733191	0.27
05.19.2018	37.765758	140.739969	0.19	05.20.2018	37.723466	140.742970	0.94
05.19.2018	37.765734	140.739953	0.15	05.20.2018	37.677850	140.758344	1.01
05.19.2018	37.765738	140.739964	0.17	05.20.2018	37.755306	140.693673	0.36
05.19.2018	37.765742	140.739975	0.18	05.20.2018	37.716193	140.707657	1.07
05.19.2018	37.765716	140.739955	0.23	05.20.2018	37.671572	140.722053	1.42
05.19.2018	37.765722	140.739968	0.33	05.20.2018	37.633499	140.641535	0.78
05.19.2018	37.765725	140.739984	0.19	05.20.2018	37.696636	140.666881	0.64
05.19.2018	37.765749	140.739903	0.20	05.20.2018	37.755306	140.693673	0.36
05.19.2018	37.765754	140.739913	0.19	05.20.2018	37.630137	140.656150	0.75
05.19.2018	37.765759	140.739923	0.17	05.20.2018	37.692830	140.682614	0.65
05.19.2018	37.765733	140.739921	0.24	05.20.2018	37.750373	140.706442	0.72
05.19.2018	37.765738	140.739931	0.21	05.20.2018	37.626580	140.673345	2.22
05.19.2018	37.765745	140.739939	0.13	05.20.2018	37.687903	140.700621	1.36
05.19.2018	37.765722	140.739933	0.25	05.20.2018	37.680130	140.705168	0.31
05.19.2018	37.765728	140.739942	0.22	05.20.2018	37.627230	140.675511	0.27
05.19.2018	37.765734	140.739953	0.15	05.20.2018	37.737528	140.728194	0.14
05.19.2018	37.765711	140.739942	0.21	05.20.2018	37.683355	140.696621	0.17
05.19.2018	37.765717	140.739953	0.12	05.20.2018	37.630511	140.667356	0.24
05.19.2018	37.765723	140.739968	0.19	05.20.2018	37.737140	140.726841	0.15
05.19.2018	37.765684	140.739932	0.21	05.20.2018	37.737427	140.727418	0.14
05.19.2018	37.765694	140.739924	0.26	05.20.2018	37.737670	140.727997	0.17
05.19.2018	37.765701	140.739913	0.19	05.20.2018	37.737084	140.726863	0.16
05.19.2018	37.765704	140.739947	0.24	05.20.2018	37.737364	140.727464	0.24
05.19.2018	37.765702	140.739932	0.17	05.20.2018	37.737636	140.728053	0.17
05.19.2018	37.765707	140.739922	0.27	05.20.2018	37.737015	140.726900	0.15
05.19.2018	37.765714	140.739956	0.19	05.20.2018	37.737298	140.727523	0.27
05.19.2018	37.765717	140.739944	0.14	05.20.2018	37.737587	140.728119	0.33
05.19.2018	37.765722	140.739933	0.25	05.20.2018	37.736933	140.726939	0.15
05.19.2018	37.765730	140.739973	0.20	05.20.2018	37.737228	140.727578	0.21
05.19.2018	37.765734	140.739959	0.19	05.20.2018	37.737528	140.728194	0.14
05.19.2018	37.765741	140.739950	0.16	05.20.2018	37.683521	140.633411	0.27
05.19.2018	37.765660	140.739980	0.23	05.20.2018	37.708684	140.674272	1.55
05.19.2018	37.765661	140.739967	0.19	05.20.2018	37.737140	140.726841	0.15
05.19.2018	37.765662	140.739952	0.14	05.20.2018	37.664410	140.650702	0.46

Date	Latitude [DD]	Longitude [DD]	Radiation [μSv/h]
05.20.2018	37.691457	140.693901	0.94
05.20.2018	37.718277	140.746572	0.36
05.20.2018	37.642861	140.671188	1.17
05.20.2018	37.671338	140.717155	1.29
05.20.2018	37.701219	140.768728	0.28
05.20.2018	37.619722	140.693722	1.57
05.20.2018	37.649885	140.741672	1.52
05.20.2018	37.682057	140.792659	0.32
05.20.2018	37.539843	140.640433	0.43
05.20.2018	37.612505	140.635186	0.37
05.20.2018	37.676436	140.624989	0.21
05.20.2018	37.554429	140.704759	0.64
05.20.2018	37.619722	140.693722	1.57
05.20.2018	37.677481	140.688997	0.94
05.20.2018	37.565962	140.749473	2.06
05.20.2018	37.624100	140.742566	3.26
05.20.2018	37.675758	140.736326	0.25
05.20.2018	37.573846	140.786544	2.00
05.20.2018	37.628249	140.779334	2.89
05.20.2018	37.691072	140.726961	0.85
05.20.2018	37.691103	140.727861	0.55
05.20.2018	37.690450	140.726092	0.97
05.20.2018	37.690474	140.727034	0.37
05.20.2018	37.690509	140.727842	0.42
05.20.2018	37.689979	140.726274	0.54
05.20.2018	37.690051	140.727070	0.51
05.20.2018	37.690095	140.727833	0.76
05.20.2018	37.689504	140.726418	0.81
05.20.2018	37.689570	140.727166	0.85
05.20.2018	37.689606	140.727833	0.91

13 Colophon

Contributors

Made in Fukushima
2019

Dedicated to
Dr. Masaru Mizoguchi
The farmers of Iitate

Photography
Nick Frank

Design
Moby Digg

Text
Dr. Colin Campbell
Quentin Lichtblau

Publisher
METER Group, Inc. USA
2365 NE Hopkins Ct
Pullman, WA 99163,
USA

METER