November 22, 2018
Environmental Preservation Division
Department of Environment Affairs
Okinawa Prefectural Government

Survey of Perfluorinated Compounds in the Environmental Water in Okinawa (Result of Summer Survey in Fiscal Year 2018)

Results of Survey

The Okinawa Prefectural Government (OPG) has been conducting a survey of perfluorinated compounds in the environmental water of the prefecture since August 2016 in order to assess perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) levels in groundwater. The results of the most recent analysis of 16 samples from various sites (See Appendix 1) are listed in Appendix 2. The detected values of perfluorinated compounds in these samples were almost the same as the results of a previous survey, although there was some fluctuation. There are no standards set for perfluorinated compounds in water in Japan, however the total concentration levels of PFOS and PFOA at 6 out of 16 samples in groundwater around Marine Corps Air Station (MCAS) Futenma were found to have exceeded lifetime health advisory levels for drinking water in the United States (hereinafter referred to as "recommended levels").

Furthermore, in this survey, 6:2FTS and 8:2FTS which were reported to be decomposed and generated from fire extinguishing foam were also measured. As a result, it was confirmed that in some of the points where PFOS and PFOA concentration exceeded the recommended value; it was detected at higher concentrations than at other points. This suggested the influence of fire extinguishing foam extinguishing agent on groundwater. From this fact, it is considered that at some points, the probability that PFOS and PFOA detected beyond the recommended value is more likely to be fire extinguishing foam used in airports, etc.

The levels detected are not considered to be a problem as long as residents do not drink the groundwater directly. In this summer survey, OPG conducted sampling and analysis of surface water around MCAS Futenma; it was confirmed that the concentration of PFOS and PFOA in surface water flowing into the air station is low. OPG will continue to monitor relatively high concentration points to assess the situation.

> The lifetime health advisory levels for drinking water is calculated assuming that 2 liters of drinking water per day is drunk for 70 years and exposed to chemical substances. PFOS, PFOA combined to a concentration of 70 ng / L, it is considered that there is no health impact even if you continue drinking for the lifetime (70 years).

Reference Material

The standards of PFOS and PFOA

○Japan(There are no standards.)

Ministry of Health, Labor and Welfare： Items should be examined in regards to tap water (2009)

Desired amount has not been set both on PFOS or PFOA

Ministry of Environment : Items which require research for programs on conservation of aquatic environment（March, 2014）

Although PFOS and PFOA are marked to be researched, neither standards nor advisories among others are set.

○The United States

Lifetime Health Advisories in drinking water

2016：Total amount of PFOS and PFOA 70 ng/L

○Germany

Lifetime Health Advisories in drinking water

2006：Total amount of PFOS and PFOA 300 ng/L

About PFOS and PFOA

○ PFOS stands for Per Fluoro Octane Sulfonate while PFOA stands for Per Flouro Octanoic Acid. Both of them are one of organofluorine compounds. Because PFOS and PFOA possess hydrophobicity nature (a feature to repel water) and oleophobicity nature (a feature to repel oil), they had been widely used for fire extinguishing foam, water repellents and antifouling agents, etc.

○ PFOS is mainly used for fire extinguishing foam, plating solution, aircraft hydraulic oil, water repellent and floor wax, etc. However, the authorized use of PFOS is currently limited to production of etching solutions, semiconductor resist, and business purpose photographic films as the essential use which cannot be replaced with substitutes. The use of PFOS for any other purposes than those mentioned above are prohibited. However, the use of PFOS in all products is prohibited in Japan from April 2018. PFOA is used for producing fluoroplastics. It has not been a target of regulation at the present moment, however it is expected to be regulated in the same way as PFOS in the future. Please note that fire extinguishing foam is not subject to essential use of PFOS, however the use of PFOS for fire extinguishing foam is permitted on the condition that its producers must set the technical standards in handling PFOS and make them public in order to prevent the environment of pollution. However, it is recommended to replace it with substitutes.

○ PFOS and PFOA hardly decompose in the environment. Therefore, its persistence in the environment as well as its accumulation in living organisms are considered to be problematic and have been object to regulation as new environmental pollutants. Following that Lifetime Health Advisories in regard to

drinking water in the U.S. is now based on the total of PFOS and PFOA, research should be conducted on these two substances.

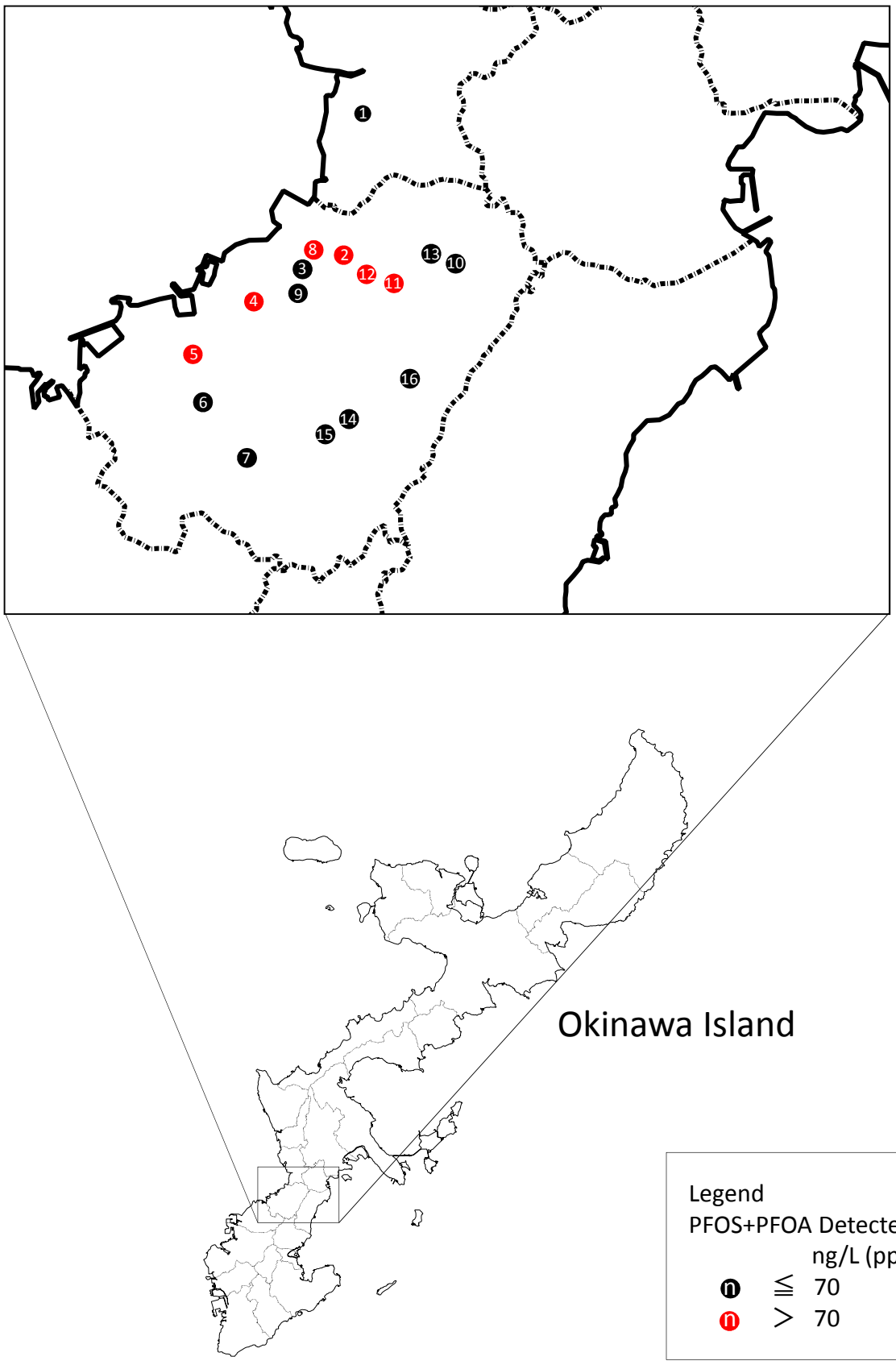
About 6:2FTS and 8:2FTS

○ 6:2FTS stands for 1H, 1H, 2H, 2H-perfluoro octane sulfonate while 8:2FTS stands for 1H, 1H, 2H, 2H-perfluoro decane sulfonate. These substances were reported to be decomposed and generated from fire extinguishing foam in the presence of oxidizing agent*1. Based on this fact, if 6:2FTS and 8:2FTS are detected in groundwater surrounding the air station, it is suggested that the groundwater may be affected by fire extinguishing foam.(Fire extinguishing foam is held at the base to cope with aircraft fires.)

*1 Cheng F, Mallavarapu M, Ravendra N, CHEMICAL OXIDIZATION OF SOME AFFFS LEADS TO THE FORMATION OF 6:2FTS AND 8:2FTS, Environmental Toxicology and Chemistry, 34(2015), 2625-2628

Sampling Points

Appendix 1



Appendix **2**

Result of Winter Survey in Fiscal Year 2017

Analysis Items	Perfluorooctane sulfonate (PFOS)
	Perfluorooctanoic Acid (PFOA)
	1H,1H,2H,2H-Perfluorooctane sulfonate (6:2FTS)
	1H,1H,2H,2H-Perfluorooctanoic Acid (8:2FTS)
Subject	Water quality

(ng/L)

Result List

			Summer Survey(JFY2016)			Winter Survey(JFY2016)			Summer Survey(JFY2017)			Winter Survey(JFY2017)			Summer Survey(JFY2018)				
	Municipality	Location	PFOS	PFOA	Total Value	PFOS	PFOA	Total Value	PFOS	PFOA	Total Value	PFOS	PFOA	Total Value	PFOS	PFOA	Total Value	6:2FTS	8:2FTS
①	Chatan Town	Surrounding area of Camp Zukeran, Western Drainage	30	11	41	57	7.5	64	29	9.1	38	30	8.0	38	27	8.3	35	5.4	1.4
②	Ginowan City	Surrounding area of Futenma Air Station, Chunnaga (spring)	1200	190	1300	730	150	880	740	140	880	900	130	1000	1800	200	2000	390	40
③	Ginowan City	Surrounding area of Futenma Air Station, Hunshinga (spring)	38	21	59	39	22	61	37	25	62	39	22	61	39	23	62	4.4	0.4
④	Ginowan City	Surrounding area of Futenma Air Station, Hiyakaga (spring)	180	31	210	94	26	120	120	33	150	160	36	190	150	29	170	75	6.9
⑤	Ginowan City	Surrounding area of Futenma Air Station, Mendakarihiga (spring)	680	35	710	670	42	710	590	43	630	640	42	680	600	50	650	150	31
⑥	Ginowan City	Surrounding area of Futenma Air Station, Morinokawa (spring)	30	9.4	39	40	5.4	45	39	11	50	71	25	96	46	6.4	52	2.0	<0.1
⑦	Ginowan City	Surrounding area of Futenma Air Station, Samashita Ubuga (spring)	24	9.0	33	30	11	41	18	8.8	26	13	7.2	20	25	9.9	34	<0.1	<0.1
⑧	Ginowan City	Surrounding area of Futenma Air Station, Isaufuga (spring)				130	62	190	120	35	150	250	42	290	220	60	280	17	14
⑨	Ginowan City	Surrounding area of Futenma Air Station, Furuchinga (spring)				96	22	110	66	17	83	49	14	63	30	11	41	21	0.8
⑩	Ginowan City	Surrounding area of Futenma Air Station, Aragusuku A (groundwater)							15	4.4	19	17	4.8	21	15	4.3	19	<0.1	<0.1
⑪	Ginowan City	Surrounding are Futenma Air Station, Kyuna A (groundwater)							260	26	280	320	29	340	280	24	300	<0.1	<0.1
⑫	Ginowan City	Surrounding area Futenma Air Station, Kyuna B (groundwater)							40	31	71	34	23	57	76	72	140	0.1	<0.1
⑬	Ginowan City	Surrounding area Futenma Air Station, Aragusuku B (groundwater)							40	15	55	35	12	47	42	13	55	<0.1	<0.1
⑭	Ginowan City	Surrounding area of Futenma Air Station, In Civic Park (Upstream Surface-Water)				6.6	3.8	10	11	4.6	15	6.9	3.9	10	6.8	4.1	10	0.2	<0.1
⑮	Ginowan City	Surrounding area of Futenma Air Station, Ginowan Kumaiabu Ritual Site (spring)	7.2	3.9	11	6.7	3.0	9.7	11	5.5	16	6.2	3.5	9.0	9.4	3.4	12	<0.1	<0.1
⑯	Ginowan City	Surrounding area of Futenma Air Station, Akamichi (Upstream Surface-Water)				12	4.1	16	11	5.1	16	7.8	4.7	12	13	4.9	17	0.2	<0.1

(Note) The results of measurement are shown in two effective digits (disregarding the third digit) in accordance with "Designation of Water Type in Environmental Standards Based on the Environmental Basic Law and Processing Standards Including Continuous Monitoring Based on the Water Pollution Prevention Act (Ref. 1303271 of March 27,2013)." When the total value was below the lowest detectable limit, the detectable value, 0.04ng/L is used to calcurate the value.
(Note) Regarding past measurement results, only the survey measurement points in FY2018 are shown.