PNCT N841 84-63

THE STUDY ON THE CORROSION OF POOL COMPONENTS BY THE EVALUATION OF MICRO-ELEMENTS VARIATION IN FUEL STORAGE WATER, 1984

October 1984

TOKAI WORKS
POWER REACTOR AND NUCLEAR FUEL DEVELOPMENT CORPORATION

PNCT N841 84-63
October 1984

THE STUDY ON THE CORROSION OF POOL COMPONENTS BY THE EVALUATION OF MICRO-ELEMENTS VARIATION IN FUEL STORAGE WATER, 1984

Korehiro Takeda
Hiromitsu Kaneko
Kazuyoshi Watanabe
Kazuya Ochiai

Abstract

This study was started in 1982 as the part of BEFAST programme. In this year (1984), periodical measurements of the concentrations of micro-element (Fe, Ni, Cr) in the pool water continuously performed and the results were statistically compared with the results of 1983. It seems that no significant changes in concentration of each micro-elements caused between the two years.

1. Introduction

This study has been carried out as a part of the BEFAST Programme, utilizing the fuel storage pool of PNC Tokai Reprocessing Plant. In this study, as the concentration of micro elements of corrosion products (Fe, Cr, Ni) in pool water is concidered to be a factor which relates directly to corrosion of fuel components, then the measurements have been periodically performed, and the evaluation of corrosion has been made from the results of analysis. This study was started in 1982 and the first results of measurement and evaluation were reported in the previous paper. To obtain the information on the corrosion of pool components by the estimation of micro elements variation in lapse of time, the monthly measurements were continued and the measured data were analyzed statistically in the present paper.

2. Operational situation

Since the first reception of JPDR fuel in 1977, Tokai Reprocessing Plant has received 255 tU of spent fuel assemblies, and already reprocessed about 172 tU. The plant stopped for installation of new dissolver since October 1983 through October 1984, thus no spent fuels have been received during the period of the study.

3. Measurements

The samples of fuel storage water were taken from the fuel storage pool. The samples were concentrated 100 times and the micro elements were measured by the flameless atomic absorption spectro-photometer. Dissolved oxygen, chlorine concentration and temperature distribution of the pool water were measured to know the environmental factors relating

b) Cr

(μg/ℓ)

	1983	1984
measured value	0.3, 0.1, 0.5, 0.5	0.3, 0.3, 0.3, 0.1, 0.1
mean	$x_1 = 0.39$	$x_2 = 0.22$
sum of squares	$S_1 = 0.099$	$S_2 = 0.048$
number of degrees of freedom	$\phi_1 = 3$	$\phi_2 = 4$

$$t_0 = (x_1 - x_2) \,/\, V(1/n_1 + 1/n_2) = 1.73$$

where $V = (S_1 + S_2) \,/\, (\phi_1 + \phi_2)$

$t\ (7,\ 0.05) = 2.365$

$t > t_0$

c) Ni

(μg/ℓ)

	1983	1984
measured value	0.3, 0.1, 0.2, 0.4	0.3, 0.4, 0.5, 0.2, 0.1
mean	$x_1 = 0.25$	$x_2 = 0.30$
sum of squares	$S_1 = 0.05$	$S_2 = 0.10$
number of degrees of freedom	$\phi_1 = 3$	$\varphi_1 = 4$

$$t_0 = (x_2 - x_1) \,/\, V(1/n_1 + 1/n_2) = 0.5$$

where $V = (S_1 + S_2) \,/\, (\phi_1 + \phi_2)$

$t\ (7,\ 0.05) = 2.365$

$t > t_0$

to the corrosion.

4. Results and conclusions

Table 1 shows the results of measurements on concentration of micro elements for last year and this year. To evaluate the difference of concentrations of two years, T-test was done.

a) Fe

(μg/ℓ)

	1983	1984
measured value	3.2, 1.8, 3.0, 2.5	1.6, 5.0, 5.0, 2.0, 3.0
mean	$x_1 = 2.63$	$x_2 = 3.32$
sum of squares	$S_1 = 1.17$	$S_2 = 10.44$
number of degrees of freedom	$\phi_1 = 3$	$\phi_2 = 4$

$$t_0 = (x_2 - x_1) / V(1/n_1 + 1/n_2) = 0.79$$

where $V = (S_1 + S_2) / (\phi_1 + \phi_2)$

$t\ (7, 0.05) = 2.365$

$t < t_0$

It seems, from the calculation, that no significant changes in concentration of each micro elements caused between the two years. Thus the apparent value on the corrosion of pool components were not found this time.

Dissolved oxygen and chlorine was 8 ppm below 0.1 ppm, respectively. Several conditions of storage pool water for last year and this year are summerized in Fig.1 and Fig.2, respectively. As the result of measurements, there is no difference of the temperature in pool water depending on the place of the pool. All of the measured value were ranged within 2 °C. This equality on the temperature of pool water indicates that the circuration of pool water works well. According to this result, it can be said that there may be nodifference in micro elements concentration depending on the sampling points.

5. Future plan

We continue periodical measurements of the concentrations of the micro elements to accumulate much data. Significant changes are not expected as seen in this study, so that the measurement frequency will be examined to get the lower detection limit.

6. Acknowledgment

We would like to thank MM.S. Irinouchi and H. Hirayama (Analysis Section) for the cooperation of measurement and fruitful discussions.

Table 1 The results of measurements of micro elements concentration (μg/ℓ)

(1983)	May	June	July	August
Fe	3.2	1.8	3.0	2.5
Cr	0.3	0.1	0.5	0.5
Ni	0.3	0.1	0.2	0.4

(1984)	April	May	June	July	August
Fe	1.6	5.0	5.0	2.0	3.0
Cr	0.3	0.3	0.3	0.1	0.1
Ni	0.3	0.4	0.5	0.2	0.1

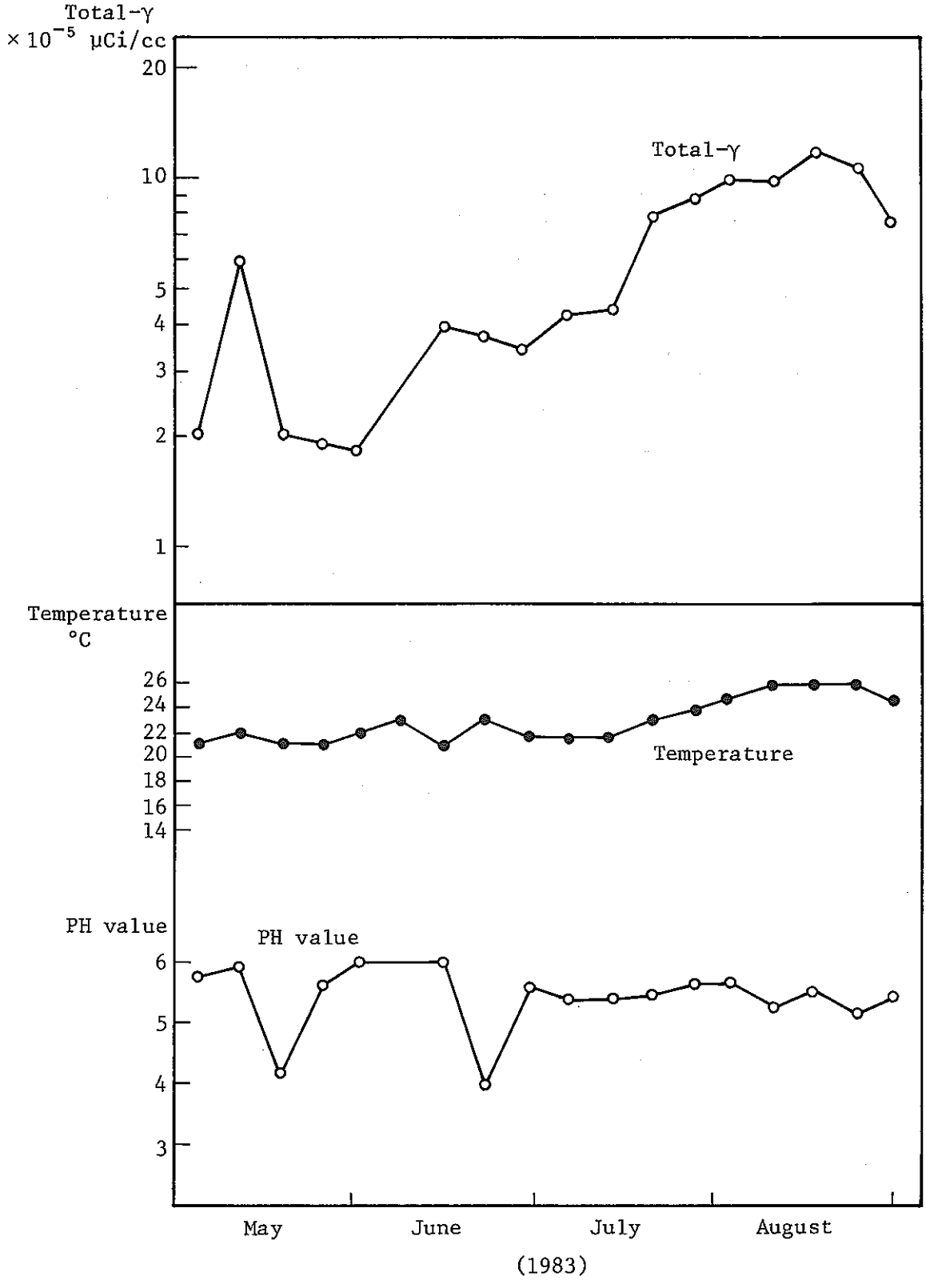

Fig.1 The results of measurements of water condition

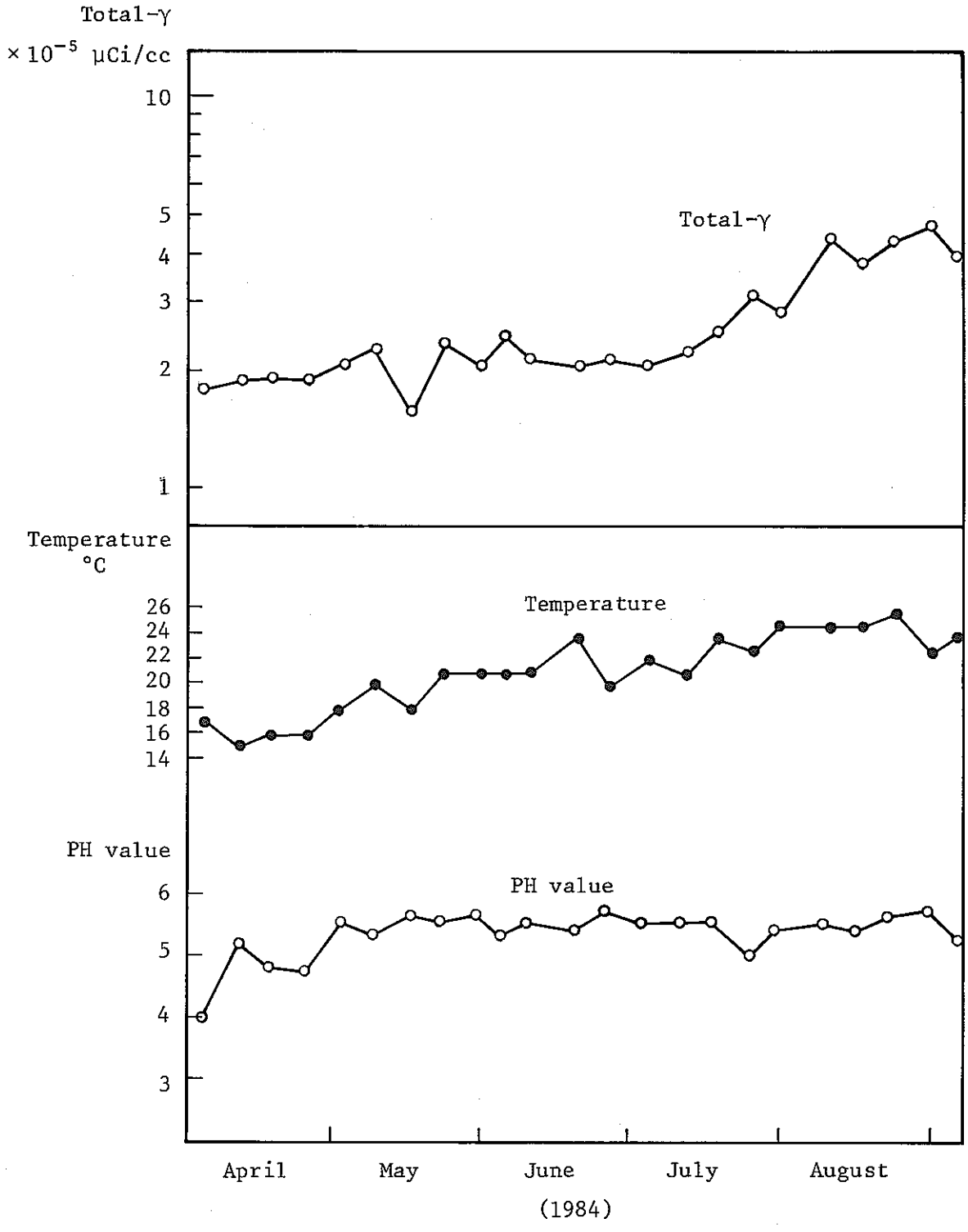

Fig.2 The results of measurement of water condition