



Seasonal variation of polycyclic aromatic hydrocarbons (PAHs) in the Thai/Laos Mekong River, 2003-2004

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Abstract

The great change in the water level of the Mekong River in each season creates the variation in many environmental factors including polycyclic aromatic hydrocarbons (PAHs). Seasonal monitoring of PAHs in water samples from 10 sampling stations along Thai/Laos Mekong River in April 2003-January 2004 from Golden Triangle to Kongchiam were analyzed. Quantitative analysis of the 16 priority PAHs namely, naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, benzo[g,h,i]perylene and indeno[1,2,3,cd]pyrene were performed. Each PAH was extracted from water sample using SPE C18-column and eluted by hexane. The amount of each PAH was determined by EPA 8310 using HPLC-UV. The results show that there are variations of type of PAHs in each station at various seasons. The total PAHs in dry season (April 2003) was in the range of 0.0090-6.1084 ppm, in raining season (August 2003) was in the range of 0.0376-1.2554 ppm and cold season (January 2004) was in the range of 0.0431-1.5193 ppm. Although the PAHs concentration in water is low but it does not taken into account the bioaccumulation factors which range from 69-29,000 for the PAHs analyzed.

Introduction

PAHs are ubiquitous pollutants in environment, consisting of two or more fused benzene rings in linear, angular or cluster arrangement. PAHs in the atmosphere can be polluted in many kinds of environmental sample such as soil, rain, river etc., which many are known to be carcinogenic agents. The toxicity of the PAHs in environment depends on the types and quantity of each PAHs. The aim of this report is to examine the distribution and seasonal variation of the PAHs in water the Mekong River, Thailand from 2003-2004.

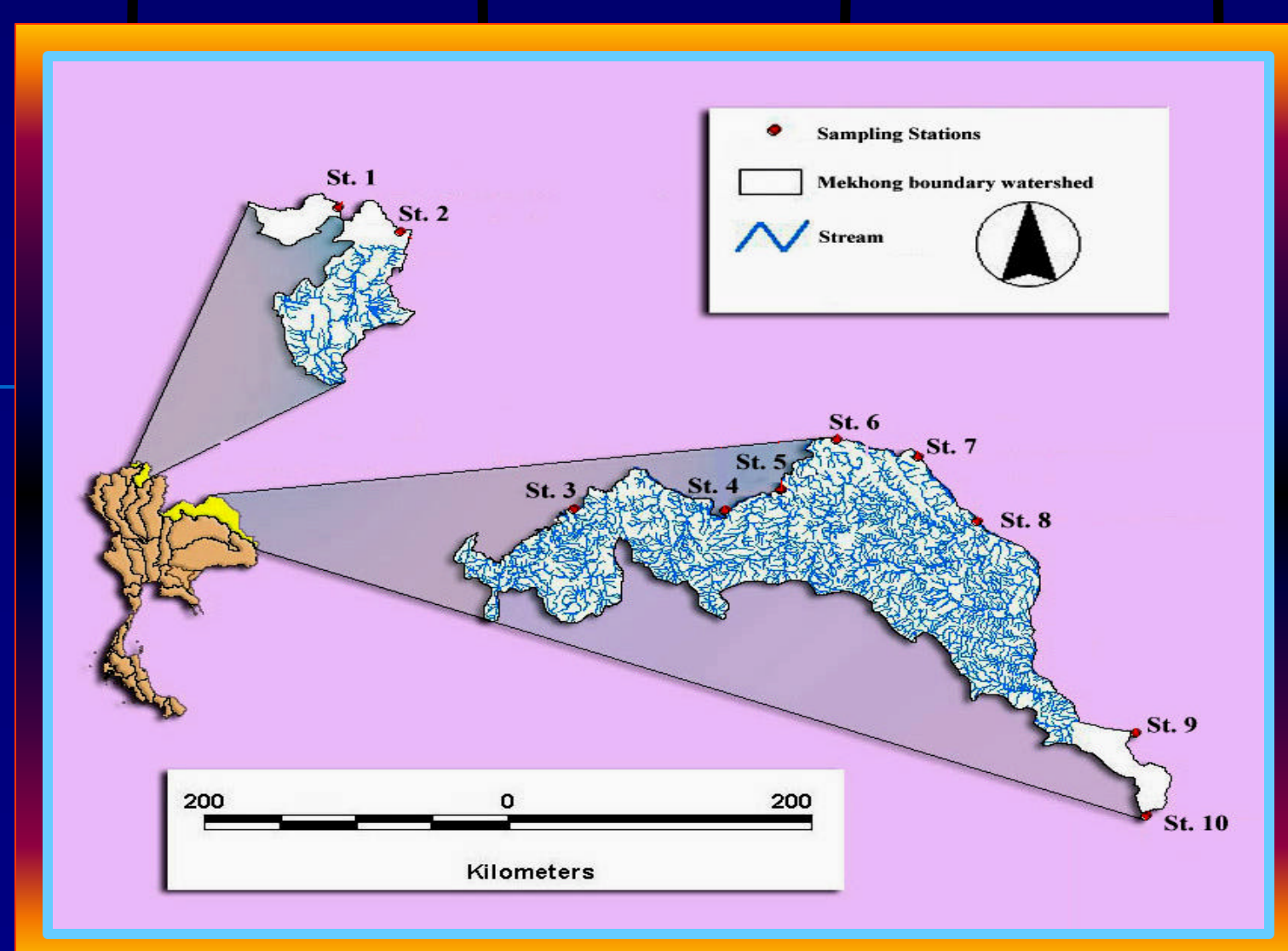


Figure 1 Map shows the locations of the sampling stations along the Mekong River.

Materials and Methods

Analysis of PAHs by HPLC

500 ml of water from the Mekong River was passed successively through activated SPE-C18 column with a flow rate of 2 ml/min. The column was then eluted with hexane with a flow of 1 ml/min. The extract was evaporated to dryness in a rotary evaporator at 20-30 °C and the residue was transferred quantitatively into a volumetric flask using acetonitrile. Analysis of 16 PAHs in the extracts were performed by HPLC-DAD (EPA 8310) using the standard addition method.

Results and Discussion

Figure 2 shows standard chromatogram of 16 PAHs from the separation using EPA 8310 method. The total PAHs observed in surface water in dry season (April, 2003) was in the range of 9.0-61.1 ppb, in raining season (August, 2003) was in the range of 37.6-125.5 ppb and cold season (January, 2004) was in the range of 43.1-151.9 ppb. It shows that Mekong water is quite dirty compared surface water in Antarctica, 0.15-4.65 µg (Weber and Bicego, 1987). By comparing the results with the previous year, it is found that the Mekong water is increasing in the concentration of PAHs (Bangkedphol et al., 2003)

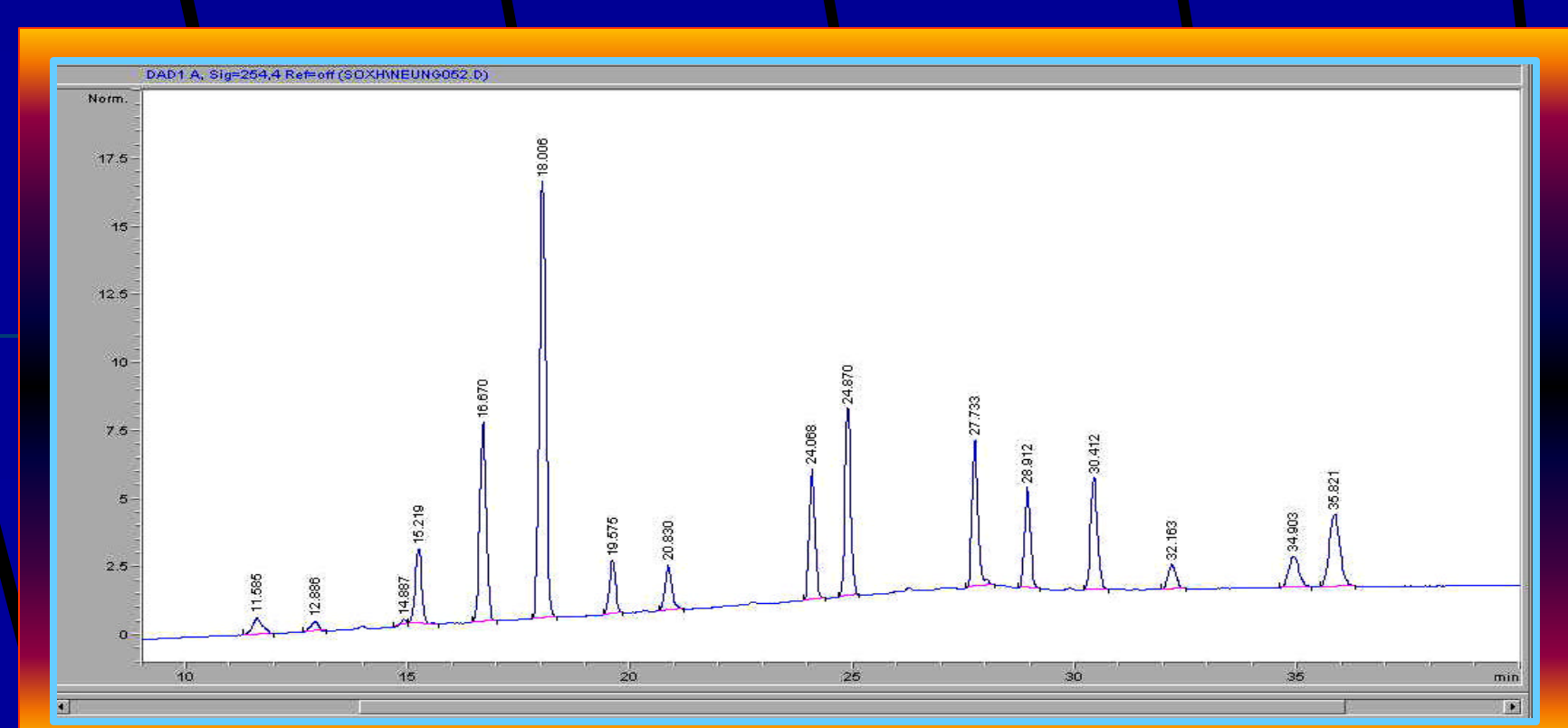


Figure 2 Standard chromatogram of 16 PAHs

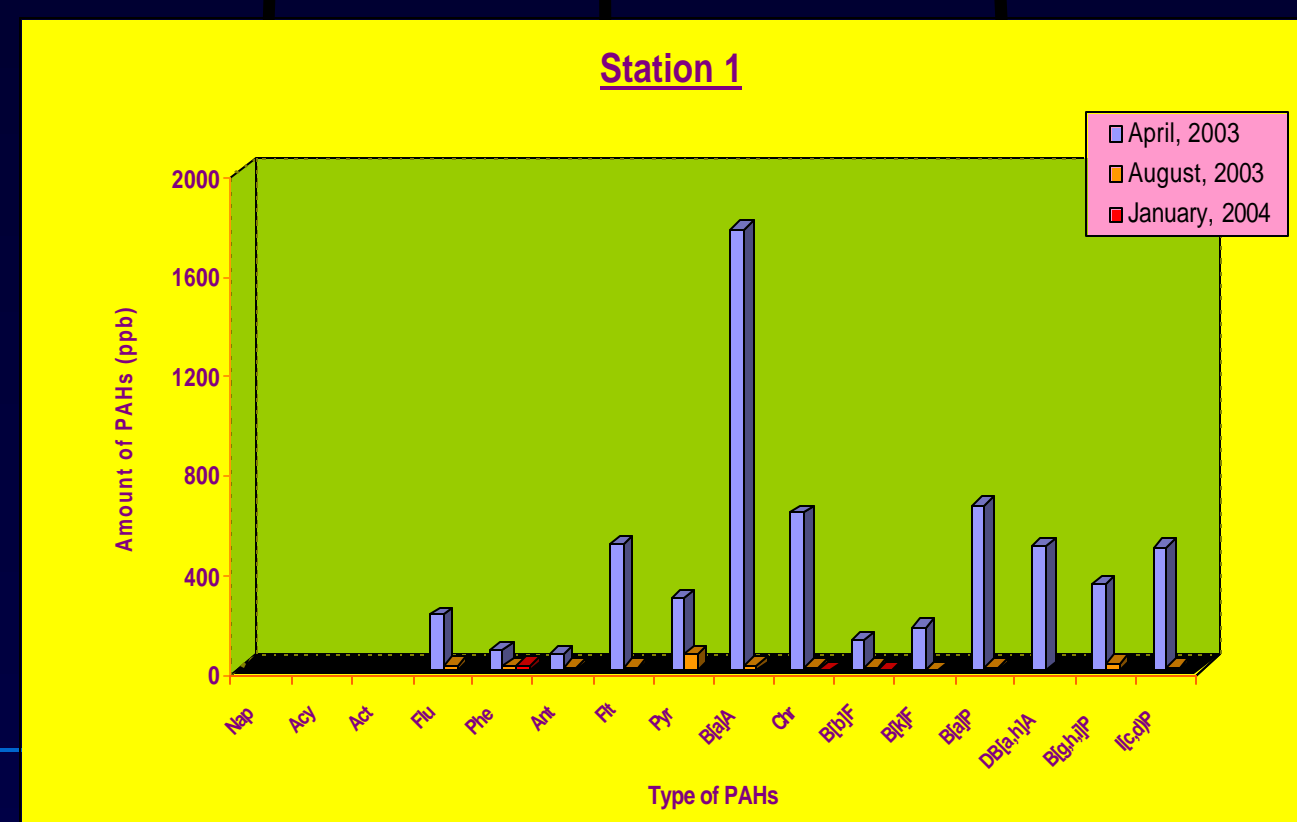


Figure 3 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 1 : GOLDEN TRIANGLE

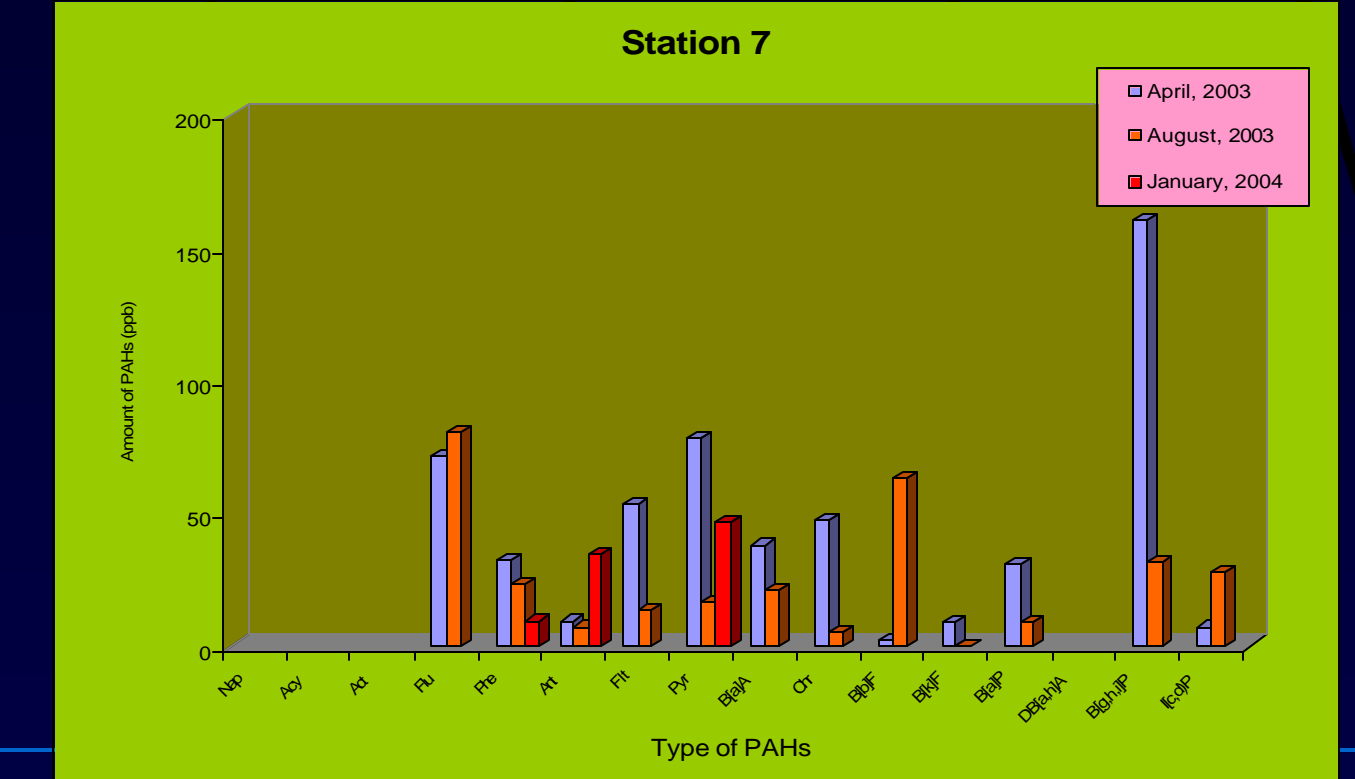


Figure 9 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 7 : SRI SONGKHRAM RIVER

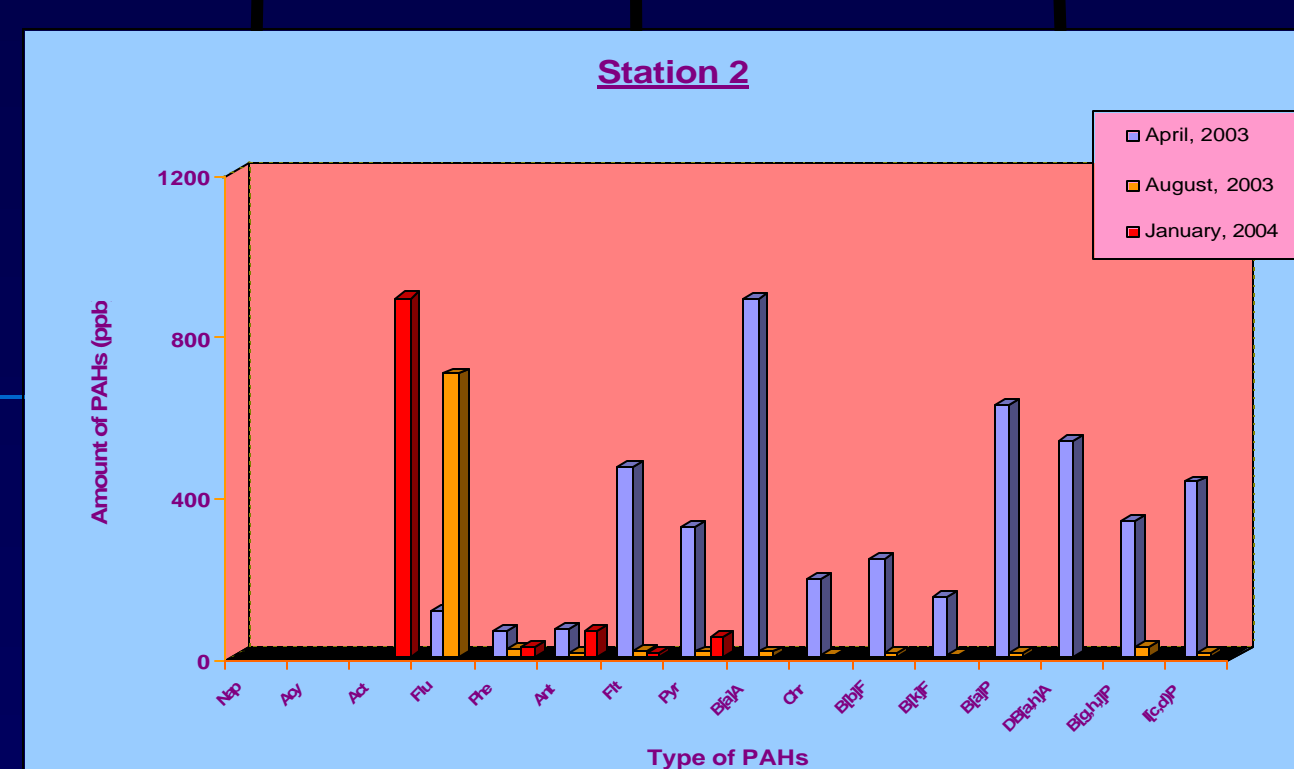


Figure 4 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 2 : BAN CHEAM PONG

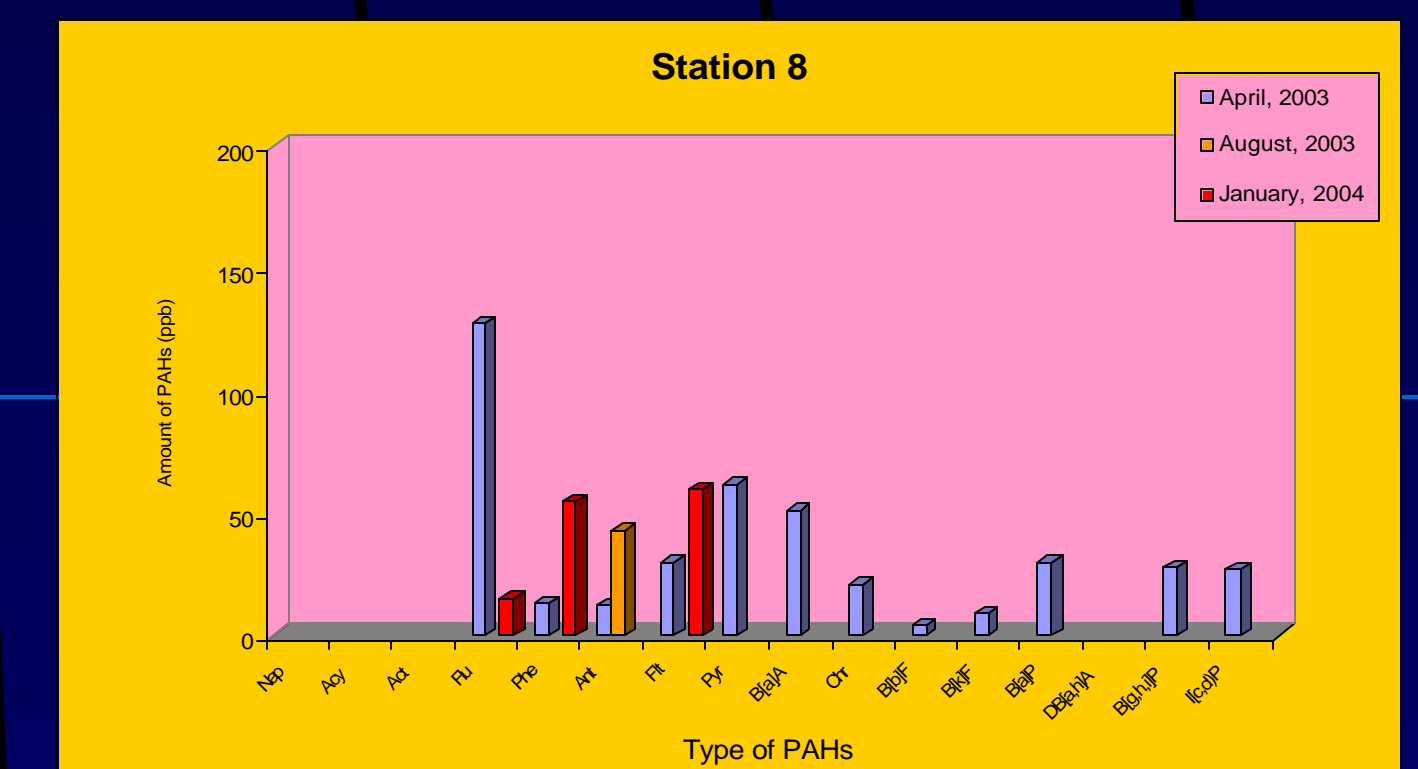


Figure 10 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 8 : AMPHOE THAT PHRA NOM

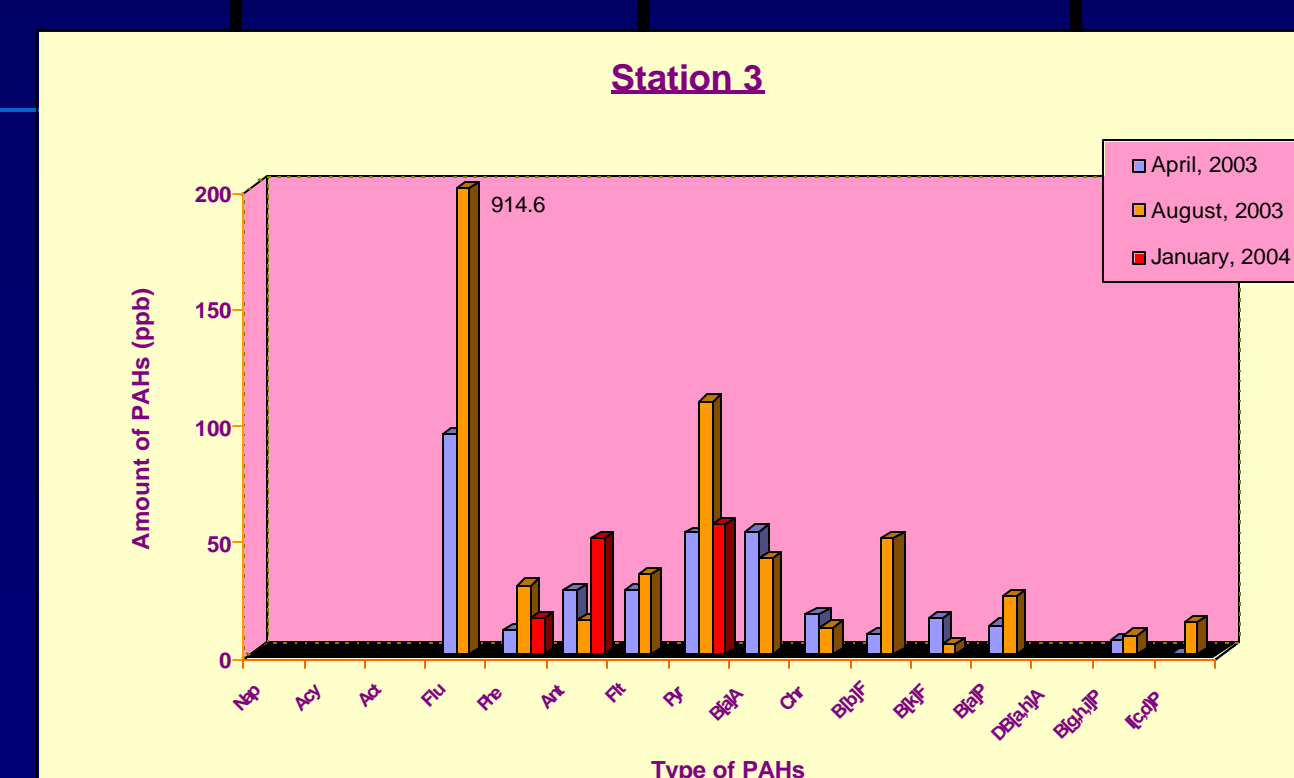


Figure 5 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 3 : A COMMUNITY CENTRE

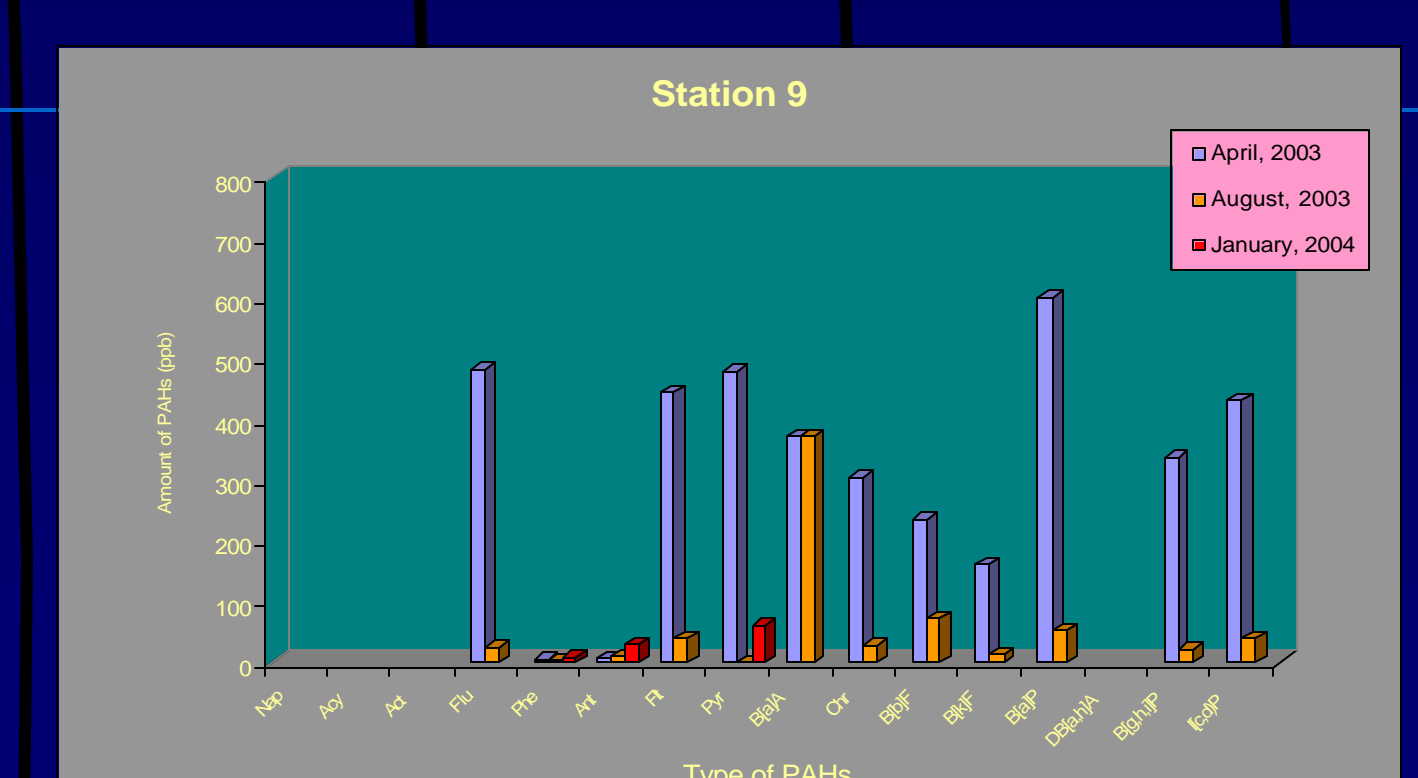


Figure 11 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 9 : WAT KHONG CHIAM BURAWAS

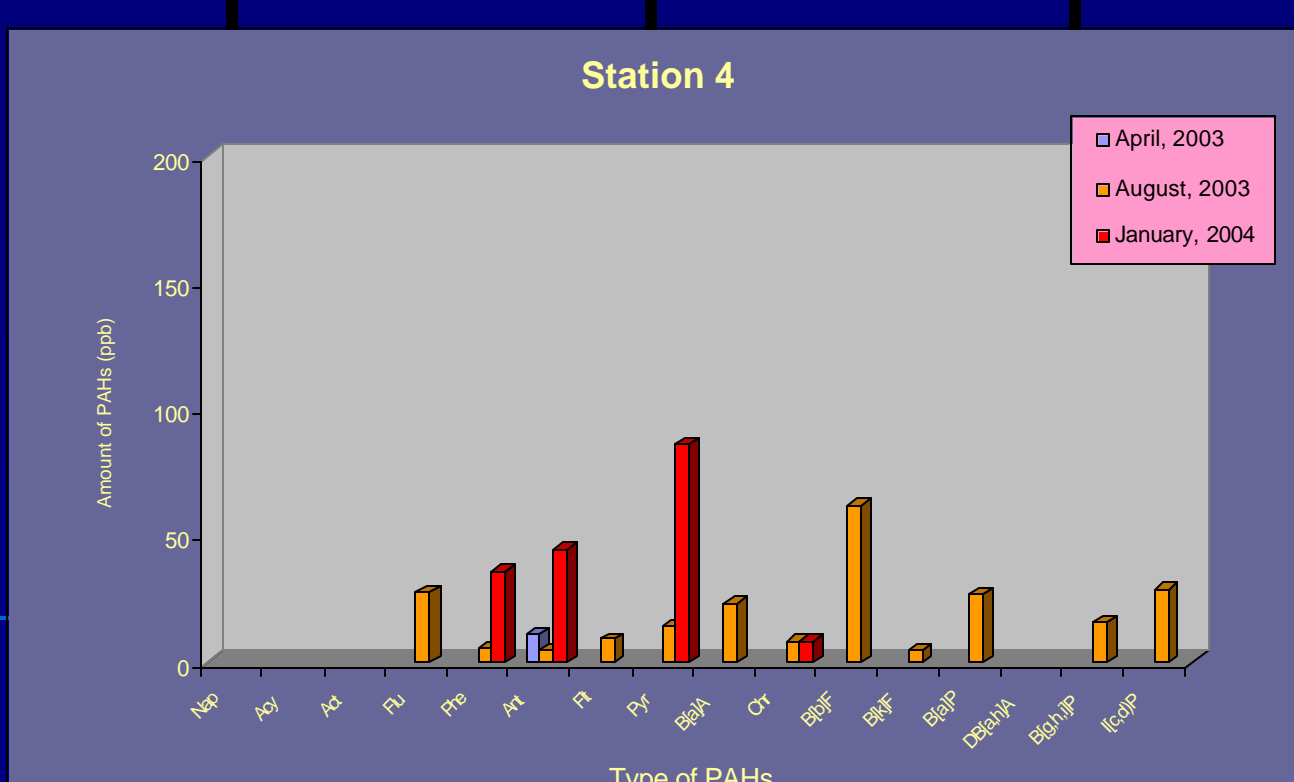


Figure 6 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 4 : LAOS FRIENDSHIP BRIDGE

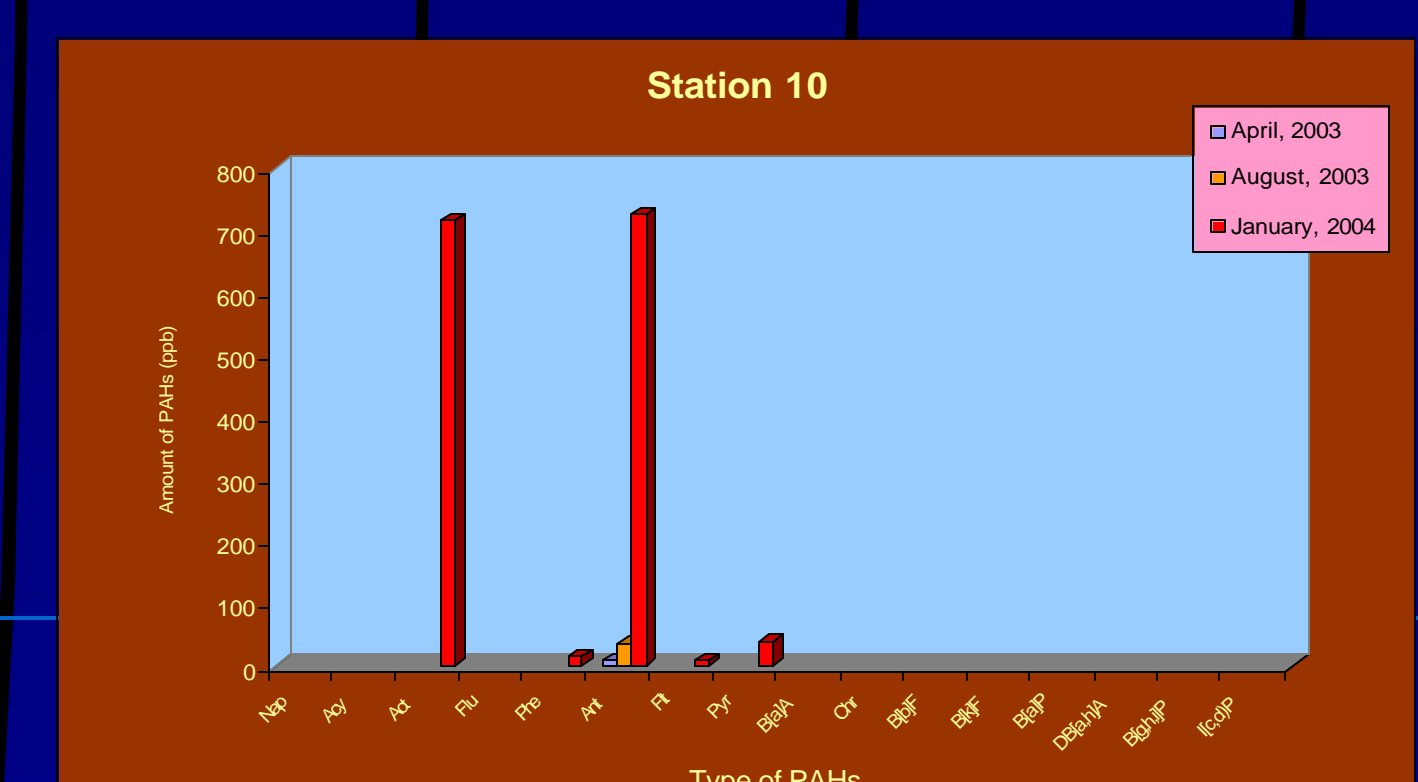


Figure 12 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 10 : AMPHOE KHONG CHIAM

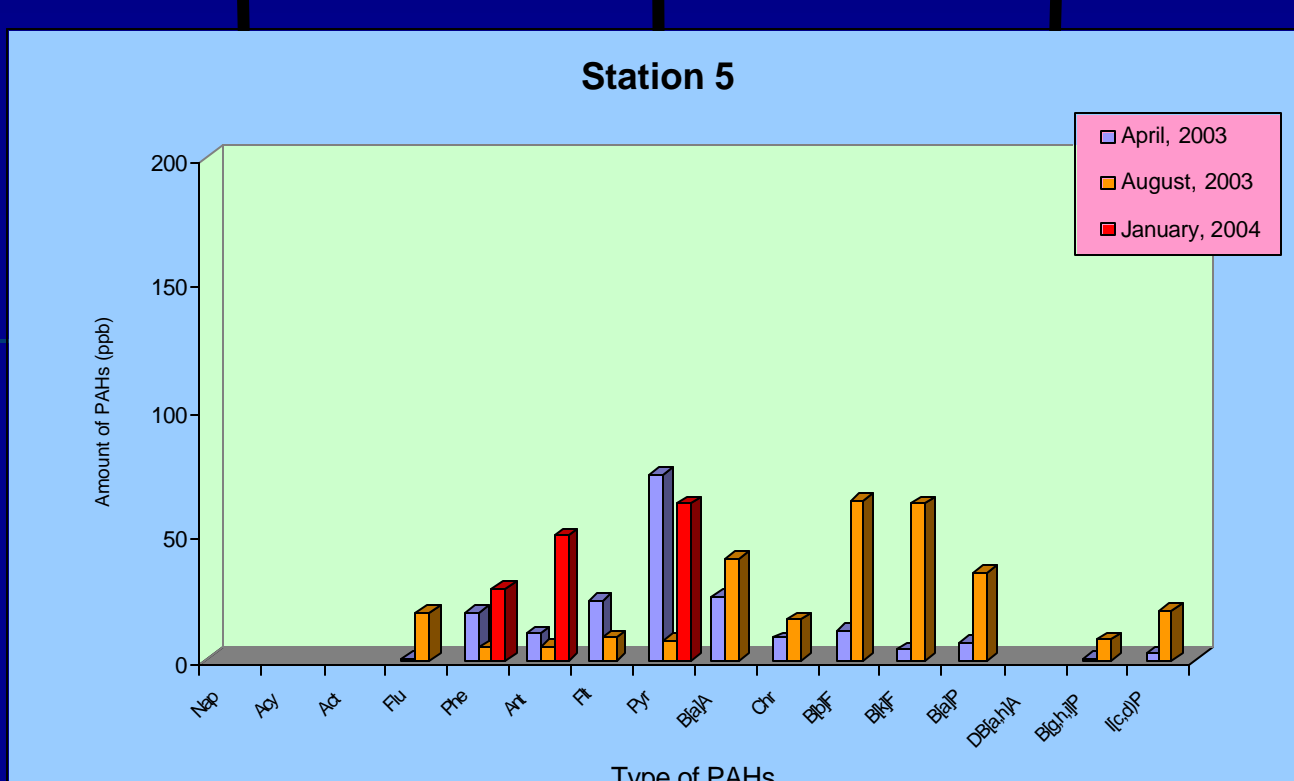


Figure 7 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 5 : HUAILUANG

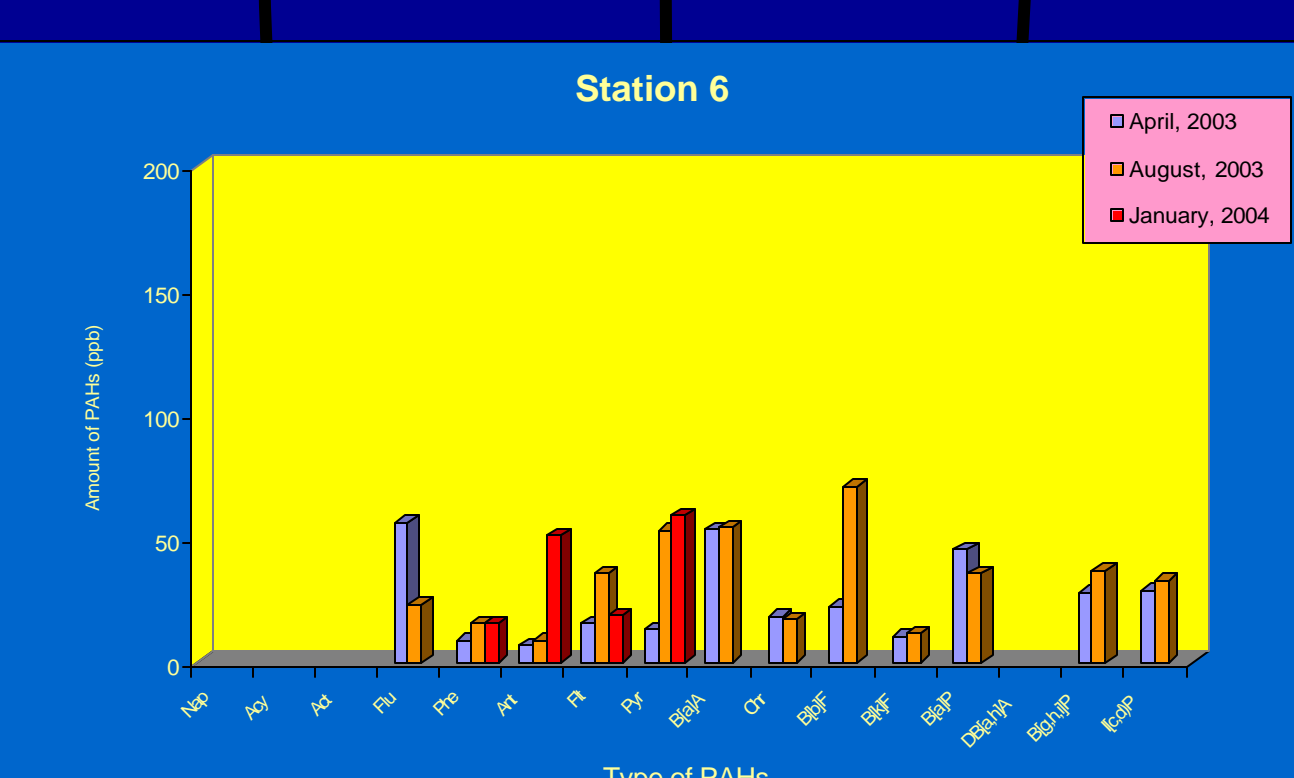


Figure 8 Seasonal variation of each PAHs in the Thai/Laos Mekong River at station 6 : WAT AR HONG

From the results, the distribution of various PAHs was effect by the changing in season. In summer (April, 2003), the concentration of PAHs in almost station was higher than other seasons.

The concentration of PAHs in station 1, 2 and 9 were quite high compare to other stations. The presences of carcinogenic PAHs (5-6) rings i.e. benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, benzo[g,h,i]perylene and indeno[1,2,3,cd]pyrene were observed in almost station. This may effect the health problem to the life along the Mekong river.

Conclusion

This work shows the distribution of PAHs in the Mekong river at various locations and seasons. It seems that there is a seasonal variation associated with rain and temperature.

References

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