To improve heat recovery and electrical power generation at municipal solid waste incinerators, a new flue gas treatment system, which includes a ceramic filter for dust removal at 300°C and a selective catalytic reduction (SCR) process for nitrogen oxide (NOx) decomposition, has been proposed. In this study, we added urea to this system as an inhibitor of polychlorinated dibenzo-p-dioxin/dibenzofuran (PCDD/Fs) and polychlorinated biphenyl (PCB) formation, as well as a NOx reducing agent, and examined the resulting PCDD/Fs, PCB, and NOx concentrations. First, we confirmed that PCB concentrations decreased by 87% in the presence of 1% urea and 5% oxygen (compared with no urea and 10% oxygen) in a lab-scale test. Bench-scale tests were then performed. In the presence of 1% urea, the rates of PCB and PCDD/Fs inhibition ranged from 11% to 36%. Considering the residence time of fly ash on the ceramic filter, the overall inhibitory efficiency in the bench-scale test concurred with the result of the lab-scale test. Nitrogen monoxide (NO) was simultaneously reduced at almost ideal stoichiometric proportions between NO and urea. The toxic equivalency (TEQ) concentration in flue gas at the outlet of the SCR met the regulation value (0.1 ng-TEQ/Nm^3).