



Identification of Different Sources of Wastewater from Semiconductor Industry Using Rare Earth Elements and Lead Isotopes

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Semiconductor industry is highly developed in Taiwan. Hsinchu Science Park (HSP), the first foundry, was established in 1980. The wastewater from multiple sources is being discharged into Keya Creek watershed. This study intends to use geochemical methods, rare earth elements (REEs) and lead isotopes, to characterize the water from different sources. The water samples were collected along the Keya Creek and its tributaries. The geochemical components were determined using ICP-MS and IC. The results demonstrate that several heavy metals (Cu, Zn, Ni and W) increases from upstream to downstream. The principal component analysis can categorize three end components, including the uncontaminated upstream water and two different kinds of effluents from HSP. After normalized by REEs of north American shale composite (NASC), all water samples show heavy REE enriched pattern, which indicate a strong adsorption process during the transportation in the watershed. However, the effluent water from HSP is characterized with a predominant Ce positive anomaly while the others, on the contrary, show a slight Ce negative anomaly. In addition, Gd positive anomaly can be observed in some effluent water samples. In addition, the lead isotopes ($^{207}\text{Pb}/^{206}\text{Pb}$ vs. $^{208}\text{Pb}/^{206}\text{Pb}$) of effluent water present a distinct mixing trend, which has an opposite slope to that of upstream water. These confirm that REEs and lead isotopes can be excellent indicators for wastewater from semiconductor industry.