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Master Thesis

Risk Assessment for Solar Photovoltaic (PV)

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Abstract

In this study, a comparative risk assessment for solar photovoltaic (PV) technologies is presented to evaluate the potential impact on human health of accidents occurring along the manufacturing chain and during installation. The analysis identified monocrystalline silicon (mono-Si), multicrystalline silicon (multi-Si), cadmium telluride (CdTe), copper-indium-gallium-diselenide (CIGS), and tandem perovskite silicon to be the most important commercial and future PV technologies. Designated severe hazardous chemicals involved in these PV manufacturing chains were selected from life cycle inventories to characterize the risk of PV production processes. The assessment quantitively estimated the accident risk of hazardous chemicals with risk indicators including fatality rate, injury rate, and maximum consequences using global incident data collected from multiple industrial accident databases. The chemical risk indicators were allocated to the PV technologies to estimate manufacturing accident risk and relative contributions of the hazardous chemicals to PV indicators were compared. The estimated PV risk indicators were comparatively assessed with other energy chains in OECD countries. The installation risk of PV panels was also evaluated using fatality rate estimates from the construction industry to characterize installation activities. The risk assessment for PV technologies determined that solar PV has a better accident risk performance than all other energy technologies in OECD countries comparing fatality rates.