**Developing Resource Exploration Strategies for Lunar Polar Volatiles**

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## Abstract:

Driven by a need to find low cost energy solutions to meet the anticipated demands arising from increasing robotic and human cis-lunar activities, the extraction and utilization of naturally occurring volatiles found on the lunar surface is an area of growing interest. The production of hydrogen and oxygen derived from water, in particular that from water ice, is the primary focus of near-term investigations, due to the lower energy requirements to extract it from the surface and separate it from the host rock. Using data collected by orbital spacecraft, numerous studies have identified indicators of enhanced hydrogen within in the permanently shadowed regions (PSRs) of the northern and southern poles of the Moon. Several lines of evidence strongly suggest that these signatures relate to the presence of water ice in the near surface. This study examines the current understanding of the geological environment which hosts these prospective deposits and the proposed development strategies for extracting them. We provide recommendations for undertaking resource exploration and evaluation activities with a focus on identifying the key parameters and processes to develop an in-place resource estimate. This workflow serves as a basis for early lunar volatile deposit development, which can also be adapted to the exploration and evaluation of surface and subsurface water ice resource deposits on Mars. Although a formal code or standard for resource estimation and classification practices for space resources does not yet exist it is hope that this study will provide some guidance for developing such standards when evaluating ice deposits on the Moon and Mars.

***Keywords:***

*Space Resources, Lunar Exploration, Off-Earth Mining, Off-Earth Field Production, Lunar Volatile Resources*