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MAKING THE CASE FOR GREEN VERSUS TOXIC PROPELLANT SELECTIONS: THE ROLE OF ENVIRONMENTAL LIFE CYCLE COSTS

Abstract

Current launch systems used by the US and other countries in the public domain use ammonium perchlorate (AP) as the propellant of choice for their solid propulsion systems. For many years, this propellant has been known to provide outstanding performance and reliability for launch propulsion systems. Unfortunately, this remarkable performance comes with a significant trade-off in risk as it relates to hazards to humans and the environment in the handling, transport, storage, and disposal of these toxic materials.

In the past, large uncertainties of both performance and expense have inhibited serious consideration of less-toxic alternatives to ammonium perchlorate (AP). The term “life cycle” refers to the major activities in the course of the product’s life-span from its manufacture, including the raw material acquisition, use, maintenance, and its final disposal. This paper discusses methodological issues related to how environmental costs should be considered in life cycle cost comparisons for fuel selection decisions.

While performance characteristics of ADN have shown increasing promise, the business case for transitioning to ADN is still quite problematic, largely due to the difficulty of comparing life cycle costs. On the one hand, future avoidance of clean-up and remediation costs for fuel-related perchlorate contamination to water and soil may be significant. On the other hand, the switchover costs for ADN production, operation, storage and other life stages may be substantial.

We discuss life cycle cost analysis in this context, including a summary of recent site visits and discussions with stakeholders within NASA. Site visits will be conducted at key facilities responsible for operations with the current fuels and potential replacement fuels. Sites being considered for visits include the orbiter processing facilities at Kennedy Space Flight Center in Florida; the Indian Head Naval Surface Warfare Center (Energetics Manufacturing Technology Center) of the Naval Sea Systems Command in Maryland; and FOI (the Swedish Defense Research Agency) and/or Eurenko (ADN manufacturer) in Sweden. This analysis can provide a more accurate representation of the true human health and environmental impacts associated with these products, and will better inform decision-makers of the cost trade-offs in product and process selection. This paper will address lessons learned that can improve the quality of life cycle cost estimation which will in turn support decisions regarding time, cost, risk management and safety.