Applying a Simplified Life Cycle Assessment Approach for Cleaner Production Purposes – a Brief Overview of a Case Study in the South African Automotive Sector

Introduction

Life Cycle Assessment (LCA) is documented as a quantitative procedure to assess the environmental burdens associated with the life cycle of an activity (product, process, or service) (1). A complete life cycle (of a product) includes raw material extraction (including water), processing, transportation, manufacturing, distribution, use, re-use, maintenance, recycling, and final waste disposal (2). The life cycle stages of unit processes within the product life cycle have been described as process implementation, resource provision, primary and complimentary process operations, and refurbishment, recycling and disposal (3). A framework for executing a LCA study is well documented in the ISO publications (4). In general, a complete LCA study of a product system must consist of four phases (5):

- Goal and scope definition; describes the application or specific interest, and indicates the target group. A detailed description of the system to be studied is included, providing a clear delimitation of scope, periods and system boundaries.
- Life Cycle Inventory (LCI) analysis; quantifies the environmentally relevant inputs and outputs of the studied system, which is essentially a mass and energy balance of each unit, or smaller, process within the larger system. ISO has provided a general framework for the inventory analysis (ISO 14041) (6).
- Life Cycle Impact Assessment (LCIA); quantifies the environmental impact potential of the inventory data.
- Interpretation and improvement analysis, whereby options are identified and evaluated to reduce the environmental impacts of the studied system.

For cleaner production purposes the LCA procedure is typically simplified (7):

- Only the primary and complimentary process operations are focused on, i.e. a gate-to-gate analysis of the operations under the control of a single entity, e.g. a company.
- Only singular process parameters are considered, e.g. water and energy usage, and waste produced.
- No formal impact assessment is conducted.

Case study in an automotive Original Equipment Manufacturer

The application of a simplified LCA approach has been demonstrated in a South African OEM. A cleaner production study in the form of a screening LCA was undertaken of the stamping plant of the OEM, and specifically the degreasing facility of the plant (see Figure 1). Mass and energy balances were conducted to identify improvement possibilities. In terms of water usage it was found that approximately 95% of the water was used by the rinsing baths in the degreasing facility.

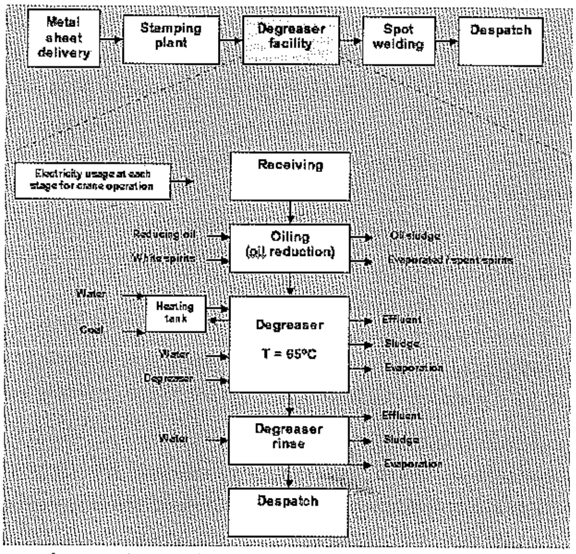

Figure 1. Simplified low diagram for the degreaser process of the stamping plant

Recommendations for water use improvement

The water was used to remove sludge by overflowing the rinse baths. It was subsequently recommended that the sludge be removed with skimming equipment, with pumps or with reusable absorbing material.

Apart from reducing the water usage significantly, the regular flooding of the oil water separator would be eliminated. Also, these interventions would also reduce the labour intensity of the process.

Water only needs to be added to the rinsing baths when the pH of a bath is not in specification. It was deduced that more regular and accurate measurement of the pH levels would reduce water usage further.

The real return on investment for these interventions is currently being determined.

References

1. International Institute for Sustainable Development, 1996. Global green standards – ISO 14000 and sustainable development. IISD, Winnipeg, Canada.
2. Consoli FJ, Allen DT, Boustead I, Fava JA, Franklin W, Jensen AA, de Oude N, Parrish R, Perriman R, Postlethwaite D, Quay B, Séguin J, Vigon B (eds), 1993. Guidelines for life-cycle assessment: A code of practice. Society of Environmental Toxicology and Chemistry (SETAC), SETAC Press, Brussels, Belgium.
3. Graedel, TE, 1998. Streamlined Life-Cycle Assessment. Prentice-Hall.
4. South African Bureau of Standards, 1998. Code of Practice: Environmental management – Life cycle assessment – Principles and framework. SABS ISO 14040: 1997, Pretoria, South Africa.
5. Neitzel H, 1996. Principles of product-related life cycle assessment – Conceptual framework/Memorandum of understanding. The International Journal of Life Cycle Assessment, 1 (1), 49-54.
6. International Organization for Standardization, 2003. ISO 14000. http://www.iso.org/iso/en/iso9000-14000/iso14000/iso14000index.html, Geneva, Switzerland.
7. Brent AC, Visser JK, 2005. An Environmental Performance Resource Impact Indicator for Life Cycle Management in the manufacturing industry. Journal of Cleaner Production, 13 (6), 557-565.

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