

The relation between size of plant and risk: traditional processing versus intensive continuous processing

Parastoo Khoshabi

Parastoo.khoshabi@postgrad.manchester.ac.uk

Paul. N. Sharratt

paul.sharratt@manchester.ac.uk

Abstract

There have been always problems regarding scale up of a process to move from laboratory to a commercial scale plant. In general, this is considered in terms of process performance, while safety and environmental issues are considered based on the full scale design. The relation between Safety and Environmental Risk and the Size of plant is an important consideration in design but one that is often considered only indirectly. The magnitude of hazards change with scale in ways that depend on their nature, as well as the response time of equipment, inventories in process, changes in the ability to control etc.

The IMPULSE project¹ aims to deploy innovative process equipment such as microreactors, thin-film devices and other structured components to attain step-change performance enhancement for whole processes, including intensification, thereby contributing to significant improvements in supply-chain sustainability. One theme pursued is the numbering up (rather than scale-up) of processing devices, so that in IMPULSE the size of commercial devices is the same size of the size of equipment in the lab. By this means it is expected to have less problems regarding performance change on scale up. Also, it has been widely claimed that process intensification leads to safer manufacture. However, for intensive plant there may be many small devices, so while the hazardous consequences of failures might be low, the frequency of occurrence of hazardous events might be higher. This paper analyses the issues that could arise. For example, by having smaller plant, several parallel streams might be needed to product the same amount of production. In this circumstance, the total leakage (for example) might more for the IMPULSE plant than a conventional one. In addition the (small) equipment will be very closely spaced, raising questions as to the risk profile of such a plant?

¹ This research is a part of the EU FP6 IMPULSE (Integrated Multi-scale Process Units with Locally Structured Elements) project. <http://www.impulse-project.net/>