



## Integrated evaluation of chemical reactions

In order to produce an integrated evaluation of an experiment, the results of the procedures described above are condensed into a short evaluation text. The evaluation text takes into account yield and purity of the product as well as substance efficiency and energy efficiency.

Further, the health hazards associated with the required and/or produced substances are summarized. In this section, data availability and the results of theoretical estimation methods are considered. In the section about ecotoxicological impacts, fate and ecotoxicity of the required and produced substances are discussed.

This evaluation leads to the rating of the experiment with a green, a yellow or a red light.



The green light is given for experiments that are especially favorable regarding their substance and energy efficiency, as well as their treatment/avoidance of hazardous substances.



The yellow light is attributed to experiments that do bear risks for men and/or environment, and that should be carried out with considerable caution.



The red light means that there is a problem with this experiment, which is further described in the evaluation text. For these experiments, special precautions are necessary, and there is a clear need for improvement of the experiment.



If a question mark is shown for an experiment, this means that

- the experiment has been chosen to fulfill the criteria to be part of the NOP,
- that the risk for men and environment (ecological compliance and workplace safety as elements of sustainability) have been analysed in the following way,
  - the availability of data of substance properties and effects is known.
  - the effect factors according to the German TRGS 600 have been defined according to the R phrases.
  - the German MAK list was consulted for workplace exposure limits for the substances.



- the Wassergefährdungsklasse (water pollution class) of the substance according to the German Federal Environmental Agency (UBA) is given, where available.
- for substances that are not being used in the first nine experiments of the NOP (teaching module), no detailed data are in the database for the properties and effects of the chemicals are in the database - they should be researched by the students.

A central aim of the experiments with the traffic light with the question mark is to give an incentive to learn and practice to find out about the hazard potential of a chemical substance! They should acquire the ability to judge the risk of a substance for man and environment in dependency of the exposure and to take informed decisions on measures for the protection of workplace health and the environment.

This requires that the students start with looking up detailed data on

- physicochemical,
- chemical,
- toxicological and
- ecotoxicological

properties of the substances from literature, from the internet, from corporate publications and other sources in a comprehensive way. The following requirements for an independent estimation of hazards and risks are developed in this way:

- proficiency in researching properties and effects of a chemical substance,
- a feeling for the amount of available data on properties and effects,
- understanding of regulatory limit values and classifications,
- Thinking in terms of Structure-Activity Relationships (T-SAR)

*update 23. August 2012*