QSAR TOOLBOX

The OECD QSAR Toolbox for Grouping Chemicals into Categories

OECD QSAR Toolbox v.3.0

Step-by-step example of how to build a user-defined profiling scheme

QSAR TOOLBOX

Outlook

- **Background**
- Objectives
- Profiling
- The exercise

QSAR TOOLBOX

Background

- This is a step-by-step presentation designed to provide guidance to users of the Toolbox on how to create their own profiling scheme.

QSAR TOOLBOX

Outlook

- Background
- **Objectives**
- Profiling
- The exercise

QSAR TOOLBOX

Objectives

- **This presentation demonstrates how to build a new profiling scheme including the:**
  - naming of the new scheme
  - building a category by defining its boundaries
  - saving the new profiler

QSAR TOOLBOX

Outlook

- Background
- Objectives
- **Profiling**
- The exercise

QSAR TOOLBOX

Profiling
Overview

- As you are aware "Profiling" refers to the electronic process of retrieving relevant information on a compound which is stored in the Toolbox, other than fate and toxicity data.
- The Toolbox has many predefined profilers but it also allows the user to development new profilers.

QSAR TOOLBOX

Outlook

- Background
- Objectives
- Profiling
- **The exercise**

QSAR TOOLBOX

The Exercise

In this example we build a profiler that identifies chemicals:

- that are aldehydes (rule 1)
- that can react with proteins by "Schiff base formation" (rule 2), but
- that do not react with proteins by "Michael-type nucleophilic addition" (rule 3)
- which also have the fragment C(=O)(O)c1ccccc1 in their structure (rule 4), and
- that have a value of Log KOW between 1 and 7 (rule 5).

QSAR TOOLBOX

The Exercise
Start building a new profiler

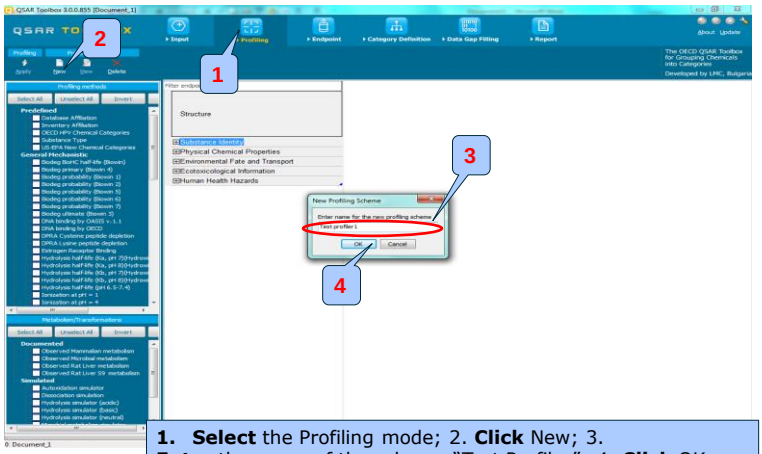
We are going to create a new profiling scheme:

- Open the Toolbox.
- Move to the Profiling module

(see next screen shot).

QSAR TOOLBOX

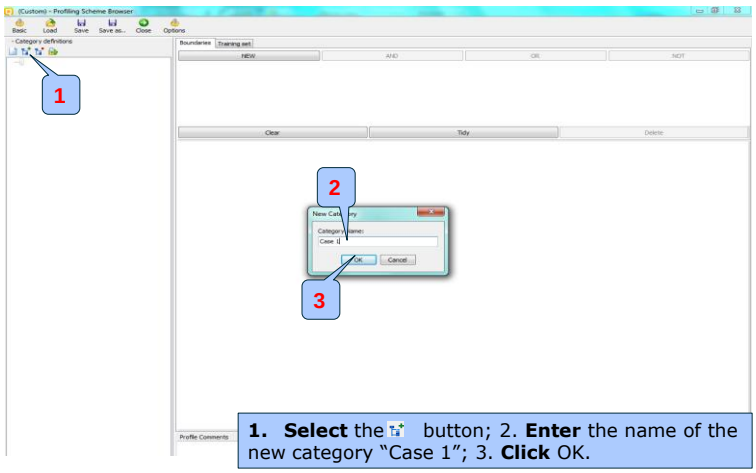
Building of a new profiler
Define the name of the new profiler



1. Select the Profiling mode; 2. **Click** New; 3. **Enter** the name of the scheme "Test Profiler"; 4. **Click** OK.

QSAR TOOLBOX

Building of a new profiler
Add a new category within the profiler



1. Select the button; 2. **Enter** the name of the new category "Case 1"; 3. **Click** OK.

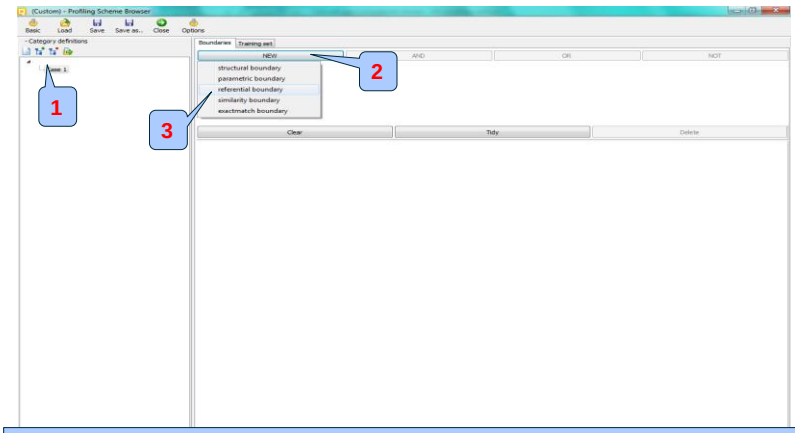
QSAR TOOLBOX

Building of a new profiler
Building the category definition – rule 1

To specify aldehydes, include a referential boundary making use of the predefined category definition "Aldehydes" within the Organic functional groups profiler.

QSAR TOOLBOX

Building of a new profiler
Building the category definition – rule 1

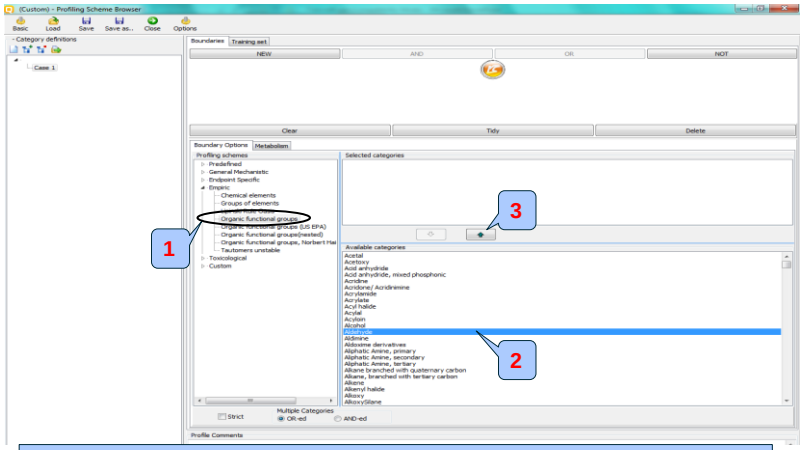


1. **Click** on the newly defined category 2. **Press** NEW; 3. **Select** Referential boundary.

QSAR TOOLBOX

Building of a new profiler

Building the category definition – rule 1

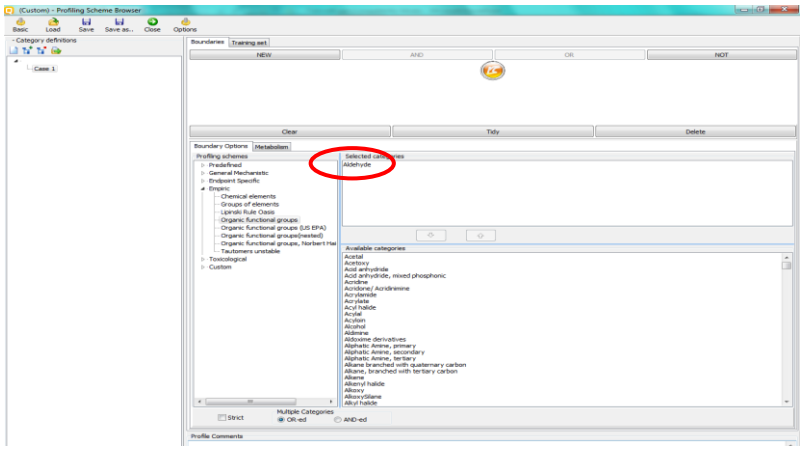


1. From Empiric profilers **highlight** Organic functional groups; 2. **Select** Aldehydes from the available categories; 3. **Press** up arrow button

QSAR TOOLBOX

Building of a new profiler

Building the category definition – rule 1



QSAR TOOLBOX

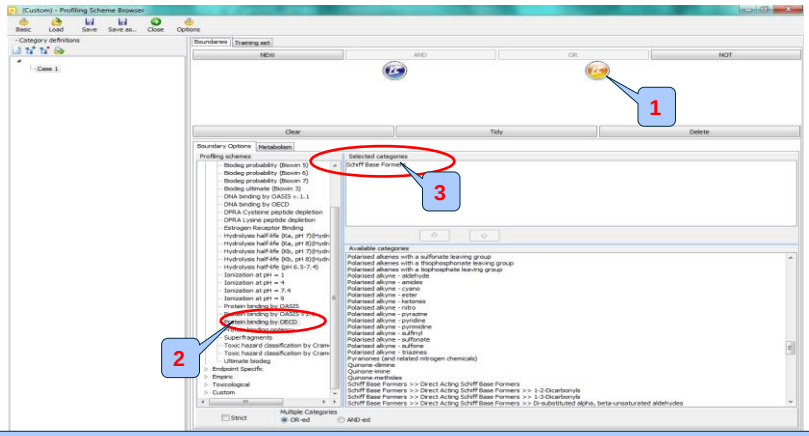
Building of a new profiler
Restriction of the category definition

To restrict the category definition by mechanism, add two additional referential boundaries:

- the first one specifies chemicals that can react with proteins by forming a Schiff base (rule 2) according to Protein binding by OECD.
- the other one specifies chemicals that do NOT react with proteins by Michael-type nucleophilic addition (rule 3) according to Protein binding by OECD.

QSAR TOOLBOX

Building of a new profiler
Building the category definition – rule 2

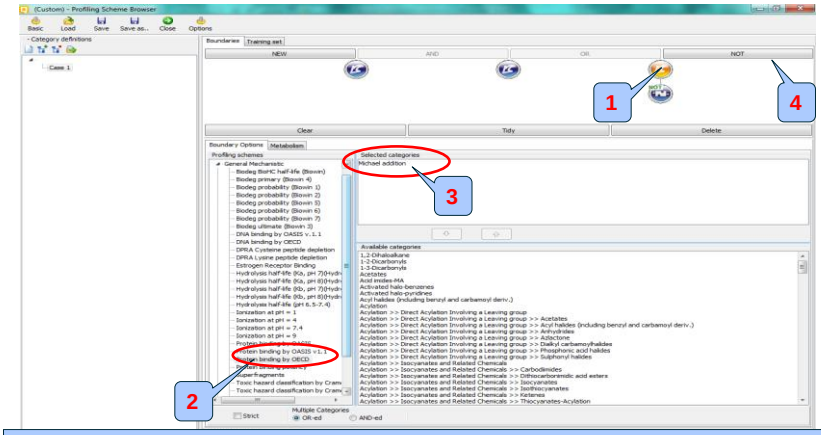


1. **Create** new referential boundary; 2. From the General mechanistic profilers **select** Protein binding by OECD; 3. **Select** Schiff base formers category.

QSAR TOOLBOX

Building of a new profiler

Building the category definition – rule 3

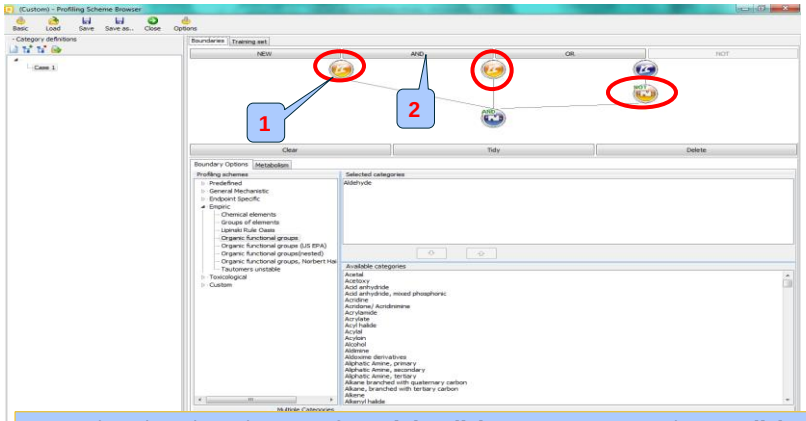


1. Create new referential boundary; 2. **Select** Protein binding by OECD; 3. **Select** Michael addition category; 4. to negate the boundary **click** NOT.

QSAR TOOLBOX

Building of a new profiler

Grouping the referential boundaries.



1. To select the 3 boundaries perform **right-clicks** to get orange circles; 2. **Click** AND.

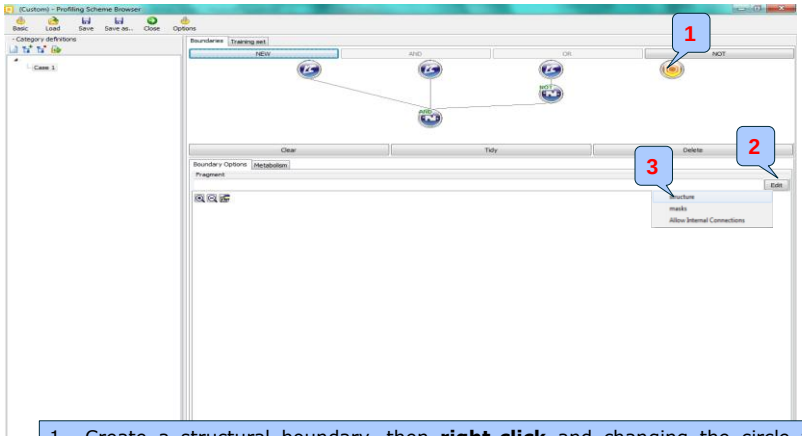
QSAR TOOLBOX

Building of a new profiler
Restriction of the category definition

To complement the category definition add an instruction for ignoring those structures which have the fragment C(=O)(O)c1ccccc1 (where the aldehyde group is deactivated - no binding with protein) - rule 4.

QSAR TOOLBOX

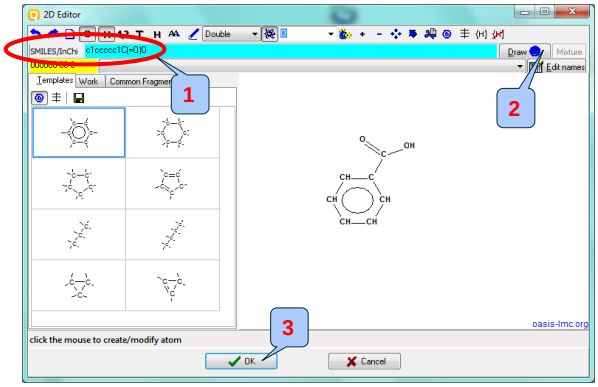
Building of a new profiler
Building the category definition – rule 4



1. Create a structural boundary, then **right-click** and changing the circle to orange ; 2. **Click** Edit; 3. **Select** Structure and (see next screen shot).

QSAR TOOLBOX

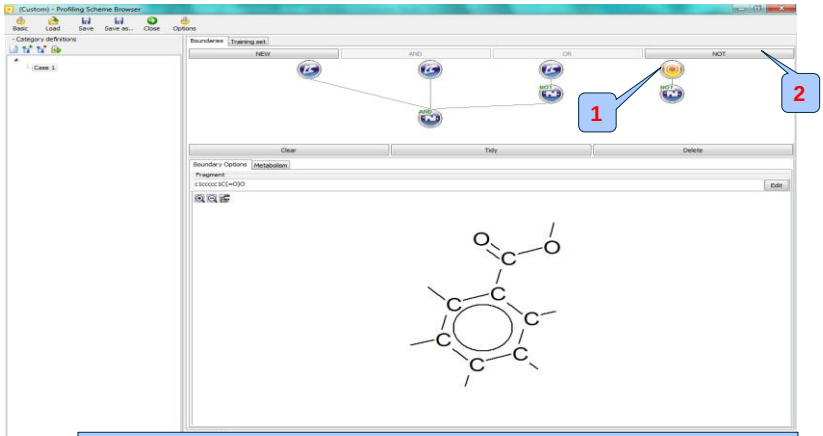
Building of a new profiler
Building the category definition – rule 4



1. Type the SMILES of the fragment (or draw it in the 2D editor window); 2. **Click** Draw; 3. **Select** OK.

QSAR TOOLBOX

Building of a new profiler
Building the category definition – rule 4



1. Right-click over the circle with structural boundary in order to select it (it is orange); then 2. **Click** NOT to negate the boundary.

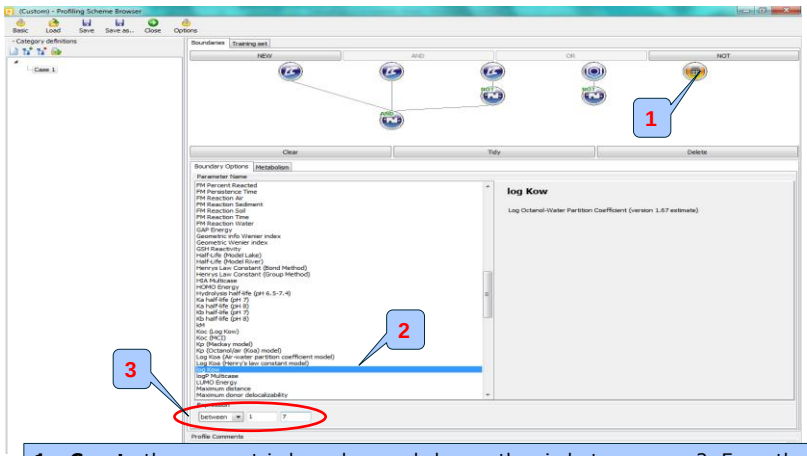
QSAR TOOLBOX

Building of a new profiler
Parametric range

To specify the needed parametric range, add a parametric boundary and combine it together with the rest boundaries in an AND query. The parametric range is log Kow between 1 and 7 (rule 5).

QSAR TOOLBOX

Building of a new profiler
Building the category definition – rule 5



1. Create the parametric boundary and change the circle to orange; 2. From the list with parameters **select** log Kow; 3. **Select** qualifier between and enter the requisite values (1 to 7).

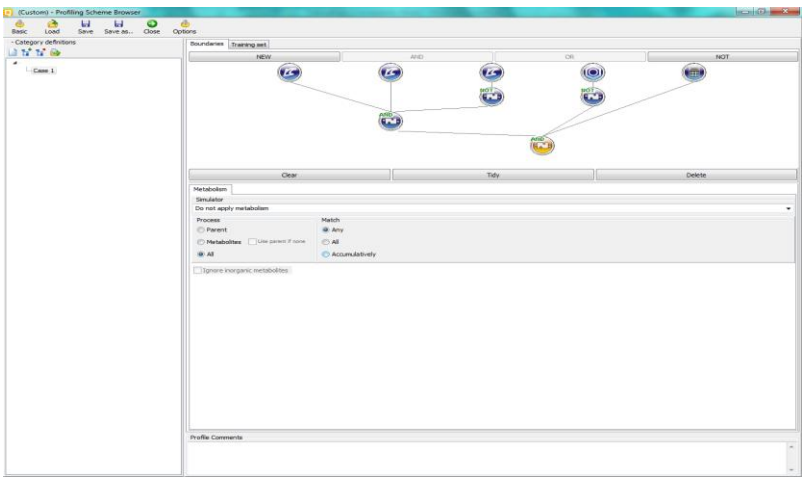
QSAR TOOLBOX

Building of a new profiler
Combine boundaries

Finally, group the combined referential boundaries, the structural restriction and the parametric range in one single AND query.

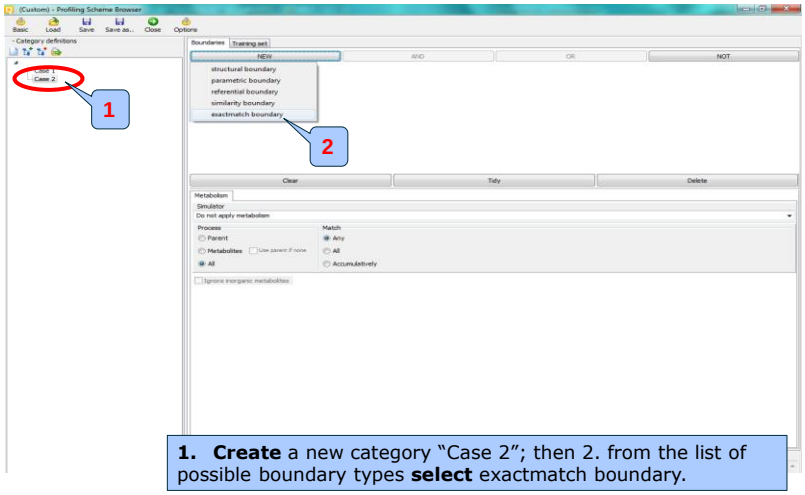
QSAR TOOLBOX

Building of a new profiler
Combine boundaries



QSAR TOOLBOX

Building of a new profiler
Add a new category within the profiler



1. Create a new category "Case 2"; then 2. from the list of possible boundary types **select** exactmatch boundary.

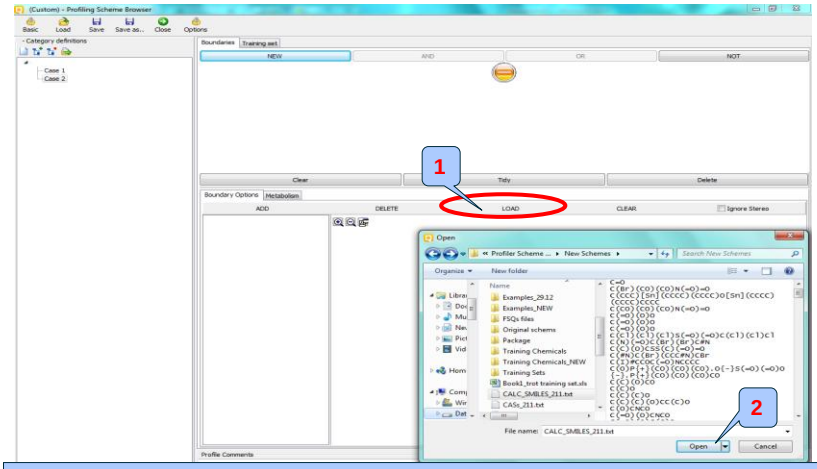
QSAR TOOLBOX

Building of a new profiler
exactmatch boundary

- The exact match boundary presents search by list of structures (SMILES). If the target chemical belongs to the loaded in boundary list, it fulfills the category definition.
- It is possible to logically combine the exactmatch boundary with boundaries of different type.

QSAR TOOLBOX

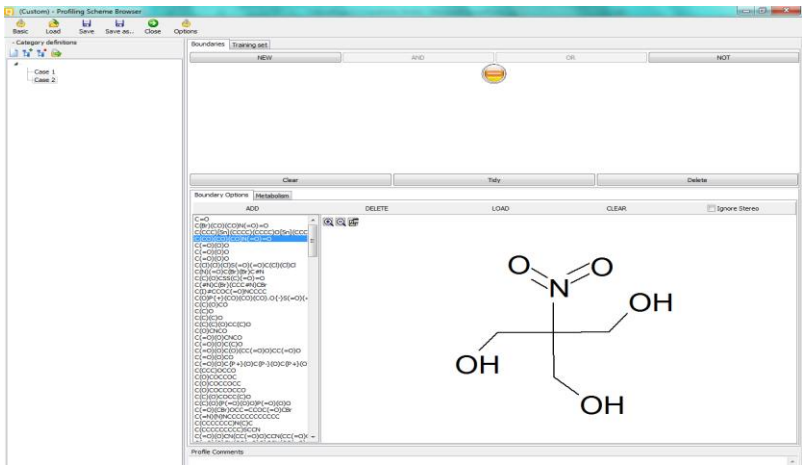
Building of a new profiler
exactmatch boundary



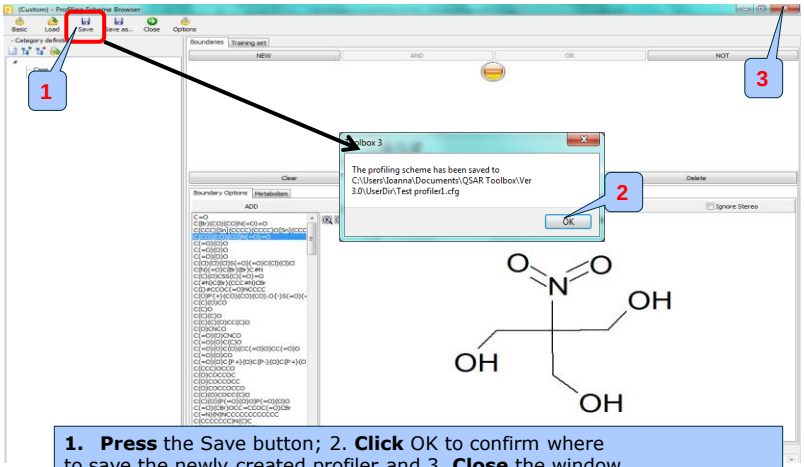
1. **Click** Load to add a pre-defined txt or smi file which contains a SMILES; 2. **Click** Open.

QSAR TOOLBOX

Building of a new profiler
exactmatch boundary



Building of a new profiler
Final step – save the profiler



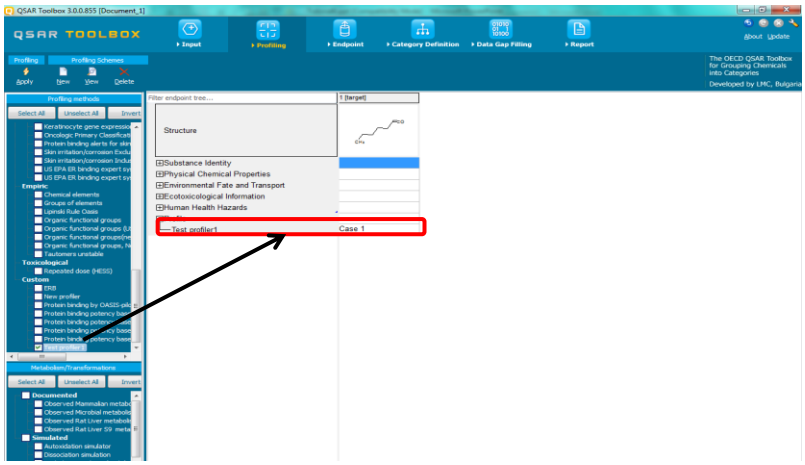
1. Press the Save button; 2. **Click** OK to confirm where to save the newly created profiler and 3. **Close** the window.

New profiler

The new profiler can now be applied to a target chemical or a list of chemicals complying with the newly constructed category definitions (see next screen shot).

QSAR TOOLBOX

New profiler
Results



QSAR TOOLBOX

Congratulation

- You have used several new functions to create a new profiler for use with the Toolbox.
- Continual use of the Toolbox will increase your skills.