

**WEST**  
**DEMONSTRATION PROGRAM**

*World Wide Engine for Simulation, Training and Automation*

15/09/2004 - Document2

# CONTENTS

<b>1. INTRODUCTION .....</b>	<b>3</b>
1.1. WELCOME.....	3
1.2. INSTALLATION .....	3
1.3. WEST.....	3
<b>2. PLANT LAYOUT.....</b>	<b>4</b>
<b>3. MODELING ASSUMPTIONS.....</b>	<b>5</b>
<b>4. RUNNING INTERACTIVE SIMULATIONS.....</b>	<b>6</b>
4.1. CHANGING SYSTEM SETTINGS .....	6
4.2. STARTING, ENDING AND CONTINUING SIMULATIONS .....	6
4.3. LOOKING AT THE RESULTS .....	7

# 1. INTRODUCTION

## 1.1. Welcome

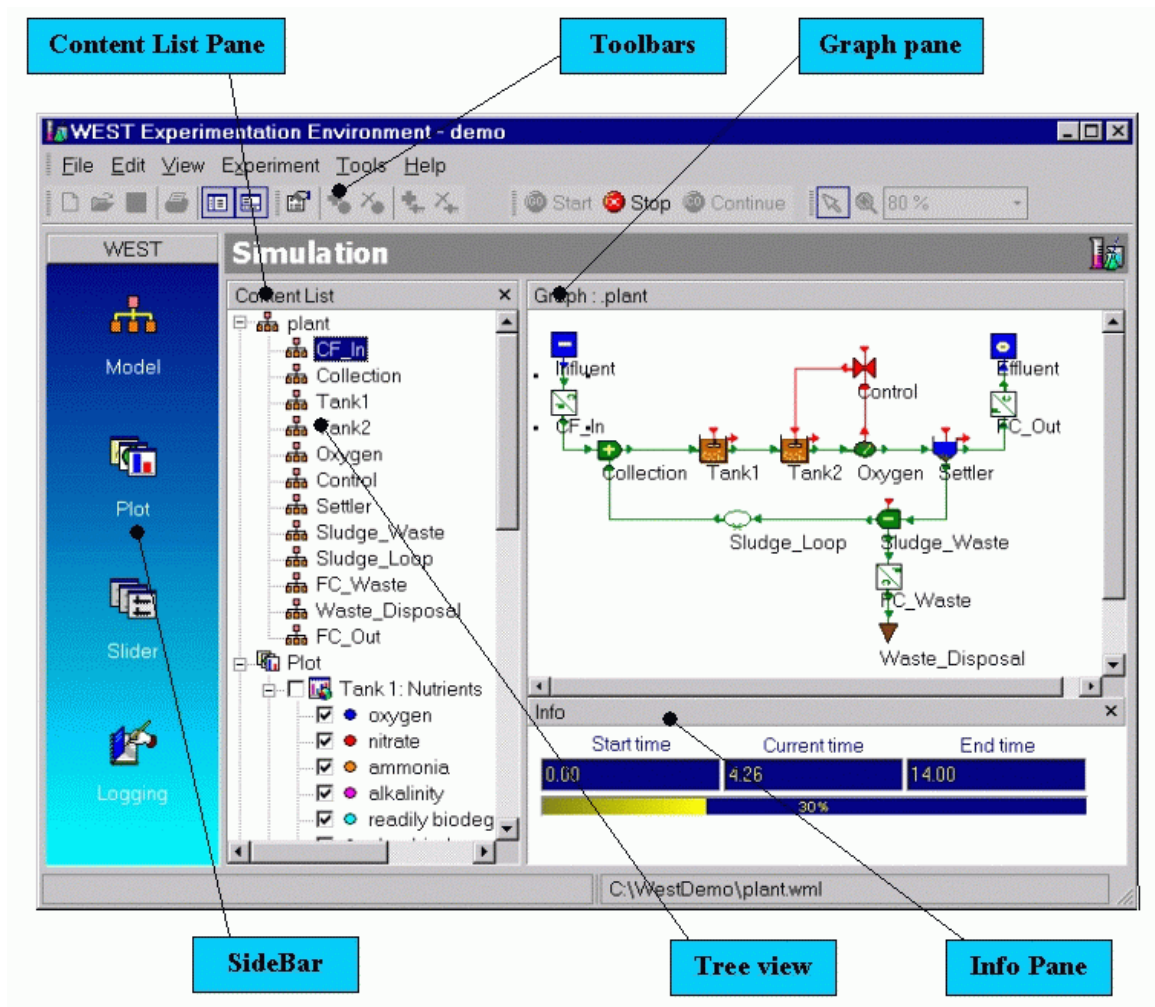
Welcome to WEST-D. This is a limited demonstration program of the WEST modeling and simulation software.

## 1.2. Installation

In order to use WEST-D you must open the zip file and extract all files in a user-specified directory (E.g. C:\WestDemo).

After extracting all files, WEST-D can be launched by opening the WestExp.exe in the user-specified directory ( E.g. C:\WestDemo\WestExp.exe).

## 1.3. WEST



## 2. PLANT LAYOUT

The graphical representation of the plant layout is shown in the **Graph** pane. The tree-view representation of the plant layout is shown in the **Content List** pane.

The plant flow varies between about 0.54 MGD (2054 cubic meters per day) and 1.74 MGD (5600 cubic meters per day), with an average of 1.0 MGD (3789 cubic meters per day).

The wastewater treatment plant is a two-tank system with sludge recycle. The two tanks each have a capacity of 171600 Gallons (650 cubic meters). The detention time in each aeration basin is about 4 hours.

In the second tank the oxygen level is controlled with an oxygen sensor and a feedback controller. The set point of the controller is 2 mg O<sub>2</sub> per liter.

The underflow rate of the settling tank is 1.0 MGD (3789 cubic meters per day).

The waste flow rate is 21120 Gallons per day (80 cubic meters per day) and is wasted from the settler underflow. The part of the underflow that is not wasted is returned to the aeration tank.

### 3. MODELING ASSUMPTIONS

As overall category the activated sludge model n°1 (ASM1), published by the International Association on Water Quality (IAWQ) Task Group on Mathematical Modelling for Design and Operation of Biological Wastewater treatment Processes (Henze et al. 1987), is chosen. ASM1 takes into account carbon removal, nitrification and de-nitrification.

The influent is specified in an input file.

The models are written in fluxes or loads (grams per day). Therefore it is necessary to convert the influent data, which are specified in concentrations (milligrams per liter or grams per cubic meter), to fluxes or loads (grams per day). This is done in the CF\_In node.

Then the recycle flow is added to the influent flow in the Collection tank.

The aeration tank is modeled in two fixed compartments (Tank1 and Tank2), of which the second has a feedback oxygen level control. The oxygen concentration is measured with an Oxygen sensor. The sensor is coupled to a controller, which controls the amount of aeration (Kla or oxygen transfer coefficient).

The settling tank (Settler) is modeled as a point settler. This means that the volume of the settler is neglected. The amount of solids in the effluent is defined by the non-settleable fraction (the fraction of the solids entering the settling tank that does not settle).

The sludge is wasted from the underflow of the settler in Sludge\_Waste.

The data from the sludge waste and the data from the effluent are converted from fluxes to concentrations respectively in the CF\_Waste node and CF\_Out node.

---

**Note: More information about the models and about more detailed models can be found in the WEST Models guide.pdf!**

---

## 4. RUNNING INTERACTIVE SIMULATIONS

### 4.1. Changing system settings

In this demo version a limited set of parameters or system settings (such as flow rates) can be changed during the simulation (in the full version the whole set of parameters can be changed).

The parameters can be changed in the model properties or using a slider.

Compartment	Parameter	Description	Slider
Tank1	K <sub>la</sub>	Oxygen transfer coefficient (amount of aeration)	No
Control	K <sub>P</sub>	Proportional control factor	No
Control	u <sub>0</sub>	No error action	No
Control	y <sub>S</sub>	Setpoint of the oxygen control in Tank2	Yes
Settler	Q <sub>Under</sub>	Settler underflow rate	Yes
Sludge_Waste	Q <sub>Out2</sub>	Sludge wasteflow rate	Yes

In this demo version a number of slider windows has been predefined (see the Content List pane).

- Oxygen level control in Tank2 (visible)  
Between 0.5 and 5.5.  
The effect of changing the oxygen level control set point can be seen in the plot element 'Oxygen' on the plot window 'Tank 2: Nutrients'
- Settler underflow rate (hidden)  
Between 0 and about 2.0 Million Gallons per day (7575 Cubic meters per day), i.e. between 0 and about 200% of the influent flow rate.  
The effect of changing the settler underflow rate can be seen in the plot windows 'Settler: suspended solids', 'Tank 1: Biomass' and 'Tank 2: Biomass'.
- Sludge waste flow rate (hidden)  
Between 0 and 52800 Gallons per day (200 cubic meters per day).  
The effect of changing the sludge waste flow rate can be seen in the plot windows 'Settler: suspended solids', 'Tank 1: Biomass' and 'Tank 2: Biomass'.

The number of slider windows is not limited to this set. The user can add an own set of slider windows.


---

**Note: More information can be found in the Online Help!**


---

### 4.2. Starting, ending and continuing simulations


To start an experiment run:

- Click **Start**  on the **Controlling** toolbar

**To end an experiment run:**

- Click **Stop**  on the **Controlling** toolbar

**To continue a simulation**

- Click **Continue**  on the **Controlling** toolbar

---

**Note: More information can be found in the Online Help!**

---

### 4.3. Looking at the results

In this demo version a number of plot windows has been predefined (See the Content List pane).

- Tank 1: Nutrients (hidden)
- Tank 1: Biomass (hidden)
- Tank 1: Nitrogen balance (hidden)
- Tank 2: Nutrients (visible)
- Tank 2: Biomass (hidden)
- Tank 2: Nitrogen balance (visible)
- Settler: Suspended solids (visible)

The number of plot windows is not limited to this set. The user can add an own set of plot windows.

---

**Note: More information can be found in the Online Help!**

---