

About Whitehouse

Whitehouse Consulting is an independent consulting organisation specialising in the application of advanced process control and information systems. It has no connection with any system vendor or installer. Further it does not itself provide such technology. Its consultants each have about 35 years of relevant experience, working on behalf of a large number of companies in the process industries.

Whitehouse offers a blend of technical, commercial and organisational advice. Recommendations are based on a sound understanding of the business, the available technology and the organisational change necessary to fully exploit the profit improvement potential.

Services from Whitehouse

Whitehouse's aim is to establish a guiding partnership with its clients, to identify the profit improvement opportunities available with advanced control and information systems and to ensure that these are fully exploited. Because of the wide variation in the areas of expertise already within its clients, its services are designed to be adaptable.

Whitehouse will often begin its relationship with a client with a study which addresses the profit improvement opportunities either briefly or in great detail. Whitehouse tackles such work from an understanding of the process requirements and its economics. Technology is only recommended if proven and where there is a clear economic or strategic reason for its installation.

Whitehouse will often assist its clients in progressing the appropriation request. It can present the economic arguments to senior management and help resolve their concerns. It can arrange visits to other users of the proposed technology to demonstrate its effectiveness and to discuss the experiences of the users.

Whitehouse's flexible approach means that its assignments are often a blend of services, adapted to meet the client's specific needs. The client may already have completed the economic analysis and has project approval. Alternatively he may wish only to supplement his own organisation, or that of his contractor or supplier, with expert help from Whitehouse.

Pre-project services include:

- awareness seminar
- competitive positioning
- opportunities survey
- master plan
- benefits/feasibility study
- troubleshooting
- organisation studies

Project support services include:

- training
- conceptual design
- technology evaluation
- invitations to bid
- bid evaluation and selection
- project co-ordination
- post-project audits
- staff evaluation

For suppliers of control and information systems, Whitehouse offers a unique insight into the process industry and can assist with evaluation of potential products and the development of market strategies.

Whitehouse values greatly its long term working relationships and treats all of its clients with equal priority, irrespective of the size of the contract or the types of systems installed. It recognises its clients' preference to deal with known individuals within Whitehouse and, wherever possible, also maintains these personal relationships.

Contact Details

Whitehouse Consulting

Redway House, East Lane, Merstone, Isle of Wight, PO30 3DJ, United Kingdom

tel +44 (0)1983 529931 email mykeking@compuserve.com
fax +44 (0)1983 530651 mobile +44 (0)7802444229

Whitehouse

Whitehouse's Clients

ABB Lummus Global BV
ADGAS
Agip
Aker Oil & Gas Technology
Akzo
Albright & Wilson
APV South East Asia
Aspen Technology
Babcock Contractors
BASF
Belgian Refining Corporation
Borealis
BP Chemicals
BP Exploration
BP Oil
BP-TNK
Brown and Root
British Gas
Burghuizer Papierfabriek NV
Carbon Black Nederland
Chevron
Chicago Bridge & Iron
Continental Engineering
ConocoPhillips
Crosfield
DSM Chemicals
DSM Fibre Intermediates
DSM Resins
Du Pont de Nemours (Nederland) BV
Du Pont Singapore
Du Pont UK
Elf Petroleum Norge
ENCI Nederland
Fluor
Health and Safety Executive
Hellenic Petroleum
Holborn Europa Raffinarie
Honeywell Control Systems
Huntsman
ICI Engineering
ICI Petrochemicals and Fertilisers
ICI Films
KBC Process Technology
Kemira
Kennedy & Donkin
Keuken & de Koning BV
KTI
Kuwait Oil
Kuwait Petroleum Europoort
Lyondell Chemie
Marathon Oil
Mobil Oil
National Petroleum Refineries of
South Africa
NBM
Netherlands Energy Research
Foundation
Netherlands Refining Company
Newcastle University
North Sea Petrochemicals
Nippon Petroleum Refining Company
Petrochemical Corporation of
Singapore
Petrogal
Petronas
Repsol
Saras
Sasol Synthetic Fuels
Saudi Basic Industries Corporation (SABIC)
Shell Chemicals
Shell Exploration
Shell International
Star Petroleum
Stork Comprimo
Technip
Thomassen International
Tioxide
Total Indonesie
Total Oil Marine
Total Raffinaderij Nederland
UOP NV
Veba Oel
Vestolit
Vietsovetro
Yokogawa
Zeneca Fine Chemicals

Process Control Training

The practical application of advanced control technology can have a significant impact on process performance. In many processes it can double profitability. Whitehouse places great importance on helping its clients develop expertise in this area and offers a range of training options.

Course delegates will learn not only the importance of process control but also how it is applied. Successful implementation depends also on the awareness of others of the benefits and effort involved in installation. The course is of value therefore not only to those directly involved in implementation but also to process management and other technical support groups who have responsibility for maintaining and improving process profitability. Delegates would include control engineers, process engineers, mechanical engineers, instrument engineers, instrument technicians and plant supervisors.

The courses stress the *practical application* of basic and advanced control techniques, using the minimum of control theory. They comprises a number of relatively short classroom sessions each followed by more lengthy 'hands-on' work. Delegates work in small groups on a process simulated on a PC.

Whitehouse Consulting offers process control training both in-company and, in partnership with others, as open-access courses. It also licenses its training software for long term use by its clients to meet internal training needs. If required Whitehouse can continue to support the client, providing advice on the implementation of technology and in project execution.

Open-Access Courses

Selected topics are included in five open-access courses which are presented regularly throughout the world. Clients with only a few personnel to train, and whose needs closely match the course content, will find this the most cost effective approach. It also gives the opportunity to meet people from other companies and industries. More details of each module are given later in this brochure.

In-Company Courses

Clients with more than four potential course delegates will probably find it more economic to commission Whitehouse to present a course in-house. This also permits the course content and timing to be tailored to the client's needs. The material available is more extensive than the modules included in open-access courses and new modules are developed regularly. Full details follow.

PACT

Whitehouse presents a major part of the Dynamics and Control of Distillation Columns presented as part of PACT's MSc course at Newcastle University in the UK.

Course Tutor

The course tutor, Myke King, has over 35 years experience in the practical application of process control. His early career was spent with ICI and Esso. For the last 25 years he has been an independent consultant working for many of the world's leading companies. He has taught process control to over 1,500 engineers. Delegates will have the opportunity to discuss, with Myke, application of the technology to their own process. Most delegates are able to return to their plant and make an immediate impact on its performance. Myke can similarly offer advice on how larger projects should be progressed and which vendors and technologies should be considered.

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Course Modules

A detailed description of Whitehouse's course modules is given below. Whitehouse regularly generates new modules to meet client demand. Those currently available include:

Introduction (2 hours)

- benefits
- regulatory control
- constraint control
- optimisation
- terminology
- hierarchy of control

Process Dynamics (4 hours)

- gain, deadtime and lag
- concept of order
- simplifying approximations
- dynamics from plant tests
- linearity
- non-self regulating processes

PID Control (8 hours)

- published tuning methods
- setpoint and load changes
- manipulated variable response
- cascade control
- split-ranging and dual-acting
- anti-reset windup

Signal Conditioning (3 hours)

- linearisation
- gas flow compensation
- heating value compensation
- steam drum level correction
- filtering noise
- impact on controller tuning

Level Control (4 hours)

- tight vs. averaging control
- tuning methods
- error squared algorithm
- gap control
- linearity
- problem of noise

Feedforward Control (4 hours)

- use and advantages
- ratio and bias algorithms
- types of decoupler
- tuning feedforward controller
- impact on feedback controller
- compensation for process gain changes

Deadtime Compensation (3 hours)

- use of predictive techniques
- Smith predictor
- dynamic reconciliation
- tuning
- impact of modelling error
- limitations

Non-linear Control (4 hours)

- use of linear algorithms
- gain scheduling
- PV linearisation
- programmed adaptive control
- model reference control
- application to pH

Constraint Control (8 hours)

- types of constraint
- PID based techniques
- single input, single output
- multi-input, multi-output
- 2x2 decoupling
- multivariable techniques

Optimisation (8 hours)

- optimiser structure
- steady state detection
- process model development
- impact of model errors
- use with constraint control
- available technologies

Steam Boiler Control (12 hours)

- fuel gas flow compensation
- fuel gas heating value compensation
- total duty control with fuel oil
- 3-element steam drum level control
- cross-limiting, O₂ and CO control
- steam header pressure control

Compressor Control (8 hours)

- compressor types
- discharge throttling
- inlet guide-vanes
- speed control
- anti-surge control
- multi-compressor balancing

Distillation Control (4 days)

This module aims to demonstrate how basic and advanced control techniques may be applied to the distillation process. It assumes that the student is generally familiar with the techniques covered by Whitehouse's introductory courses, although brief refresher material is included where needed.

Process Technology

mechanism of distillation
vapour pressure
relative volatility
azeotropes
key components
cut and separation
impact of column design
modelling correlations
adjusting product quality

Basic Controls

control problems
maintaining energy balance
column pressure control
condenser duty control
internal reflux control
flooded condenser
hot gas bypass
inverse response problems
manipulation of vapour rate
use of split range control
maintaining mass balance
energy vs. material balance
Rijskamp scheme
overcoming reflux drum lag
tuning the drum level control

Quality Control

temperature profile
locating tray temperatures
choice of manipulated variable
pressure compensation
model based control
cut and separation models
feedforward on feed rate
maintaining reboiler duty
feedforward on feed enthalpy
feedforward on composition
 $\Sigma T/\Delta T$ control
steady state decouplers
relative gain analysis
dynamic decoupling
on-stream analysers
dynamic reconciliation
towers with sidestreams
multivariable control packages
technology suppliers

Optimisation

available variables
common constraints
benefits
available technologies
flooding protection
pressure minimisation
energy/yield optimisation

	pre-requisite modules					
	Process Dynamics	PID Control	Signal Conditioning	Level Control	Feedforward Control	Constraint Control
Introduction						
Process Dynamics						
PID Control	x					
Signal Conditioning	x	x				
Level Control		x	x			
Feedforward Control	x	x	x			
Deadtime Compensation	x	x				
Non-linear Control	x	x	x			
Constraint Control	x	x	x	x	x	
Optimisation	x	x	x	x	x	x
Steam Boiler Control	x	x	x	x	x	
Compressor Control	x	x	x			
Distillation Control	x	x	x	x	x	

Training Software (Version 11.0)

Developed by Whitehouse to support its own training courses, the software is available for use by others to develop their own expertise. It is licensed on a site basis, permitting an unlimited number of copies to be in use by personnel normally based on the site. Corporate licences are also available.

The package operates around a dynamic simulation of a typical process plant. It runs under Microsoft Windows. The user interface comprises process graphics, controller configuration panels and configurable trends, much like those used by modern control systems. Throughout the package are interactive context sensitive Help screens which take the inexperienced user through all the process control techniques included.

The in-built tutorial includes full installation and operating instructions along with an extensive structured work programme, similar to that followed by Whitehouse when presenting its own courses. Model answers for the exercises are given in the software under password protection.

Feed drum

This module describes controller tuning techniques for both tight and averaging level control. It allows the user to configure and test a variety of linear and non-linear control algorithms. Measurement noise and filtering can be added to demonstrate the special problem that noise can give and how non-linear algorithms cope with it.

Fired Heater

This allows the user to identify process dynamics from plant testing and to tune a simple feedback controller using a variety of techniques. Both proportional-on-error and proportional-on-PV algorithms can be tested with both setpoint and load changes. The user is also shown how to set up feedforward control. Measurement noise and a variety of filters can be added to explore the impact on control performance.

Effluent Treatment

This addresses the problem of controlling highly non-linear processes. Although the example is based on pH control, many of the techniques covered can be more generally applied. The user can experiment with linear control, gain scheduling, PV linearisation and adaptive control. The effect that temperature has on pH can be investigated.

Compressor

Load can be adjusted by throttling the discharge, adjusting inlet guide-vanes, varying speed and manipulating recycle. The user can develop control strategies based on each of these and investigate their impact on power consumption. A variety of anti-surge schemes can be commissioned and each tested by varying suction and discharge pressures, gas flow rate and molecular weight. The use of equal percentage and quick opening valves can be explored. Operation can be continuously displayed on compressor performance curves.

Reactor

The reactor generates a large process hold-up, permitting the user to apply a number of deadtime compensation techniques in order to control product quality. Each can be tested, showing the importance of model accuracy. It also demonstrates the problem of controlling an exothermic reaction.

Distillation Column

This helps the user understand and explore all of the common distillation control strategies. These start with material versus energy balance control. The user can select tray locations for temperature control, set up pressure compensation, implement inferential properties, specify choices of manipulated variables and establish full decoupling to permit two product quality control. Feedforward on feed rate, feed temperature and feed composition can be commissioned. Energy/yield optimisation can be explored

Steam Boiler

The boiler is one of two. The user initially develops controls for the one that is base-loaded. The boiler fires both fuel oil and gas. The gas is variable in flow, pressure, temperature and composition. Total duty control is first implemented. Three-element level control, with compensation for 'swell', can be installed on the steam drum. Cross-limiting control and flue gas O₂ and CO controls are also commissioned. The boiler is then switched off base-load and steam header pressure control configured.

Process Optimisation

Once the user has properly configured the lower schemes this module can be commissioned to manipulate setpoints. The lower level modules must therefore be in place for this to operate. It develops an overall process optimisation strategy, starting with a single input, single output constraint control strategy building up to a multivariable controller and a full equation-based optimiser.

Toolkit

This comprises a wide range of tools that a control engineer will need. Dynamic models can be identified for both self-regulating and integrating processes. The PID tuning package will tune all the leading vendor-specific control algorithms. Inferential properties can be developed from process data. Pressure compensated temperatures can be developed for distillation column control. A parallel co-ordinates tool can be used to design and support multivariable controllers. Lagrangian interpolation supports curve fitting. Relative gain analysis can be used to design controllers. A vessel volume calculation tool supports the design of level controllers. An engineering unit conversion utility is included. A physical property database is included.