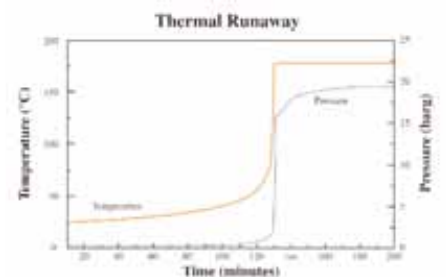




## Chemical Process Evaluation Services

*Improve the safety, yield and profitability of your chemical process.*

- Chemical Reaction Hazard Assessment
- Thermal Runaway Laboratory Studies
- Selection & Specification of Safety Measures
- Emergency Relief Design including Vent Sizing
- Optimization of Existing Chemical Processes
- Development of New Chemical Processes



# Reaction Hazards and Thermal Runaway

Chemical companies around the world regularly perform exothermic chemical reactions as part of the normal manufacture of their products and intermediates. These reactions carry with them an inherent risk of loss of control, with potentially devastating effects on life and the environment as was so tragically illustrated by incidents at Seveso in 1979 and Bhopal in 1984.

## THE CONSEQUENCES OF RUNAWAY REACTION

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- violent loss of containment and severe explosion
- release of flammable substances leading to secondary fires and explosions
- injury or death
- release of toxic or ecologically damaging materials to atmosphere
- serious financial losses and damage to a company's reputation.

## YOUR RESPONSIBILITIES

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Legislation within North America and in many other countries around the world places responsibility for the safety of employees and the protection of the environment with you – the employer. You have to identify potential hazards in your processes and assess the risk that they could present. You must then put in place procedures and equipment to mitigate the hazards and control the risks, with due regard to local standards, regulations and codes of practice.

## IMPORTANT QUESTIONS

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Have you conducted a comprehensive risk assessment of your process?

Is the risk assessment supported by accurate thermochemical test data, including isothermal and adiabatic calorimetry?

Has a safe and cost-effective Basis of Safety been identified and documented?

Have your safety systems been designed according to methods that are acceptable both internationally and locally?

## HOW CAN WE HELP

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With a wealth of experience, technical expertise and specialist equipment we provide a range of solutions from the following services:

Identification and assessment of process hazards

- thermal stability screening tests and thermochemical calculations
- reaction calorimetry including elevated pressure and reflux work
- adiabatic calorimetry and runaway simulation
- environmental discharge studies

Engineering solutions

- safety measure selection and specification
- emergency vent design (DIERS methodology)
- knock-out and quench vessel sizing
- reaction inhibition work.



Chilworth Technology Adiabatic Dewar Calorimeter.

Many existing chemical processes could be run much more efficiently with improved yield, better quality and greater speed. Our experience shows it is perfectly possible to achieve this without compromising safety or increasing environmental impact. Companies should take advantage of these opportunities to achieve financial gain and increased competitive edge. Yet they often do not pursue this potential for improvement for reasons which include:

- A false belief that the costs would outweigh the benefits
- Lack of in-house staff time and resource to research the most appropriate solution
- Lack of specialist equipment to trial new routes or process changes
- Concerns over safety implications of changing the process
- Over-familiarization with the process so possibilities are not even considered.

## WHAT SHOULD YOU DO

The first action is to carry out a technical review. This brings together existing expertise and data, to which is added new knowledge derived from external expertise and laboratory studies. All this can be undertaken with due regard to safety and the environmental implications of change.

## HOW CAN WE HELP

We have state-of-the-art technology and a wealth of experience in chemical process development and optimization work. We can bring fresh, practical ideas to old processes and have the resources available to test and provide speedy solutions to your process improvement needs. We guarantee full confidentiality.

We can:

- Review existing processes and develop new ones
- Conduct automated laboratory reaction studies
- Test under reflux and at elevated pressures
- Perform factorial experimental designs
- Assess safety and environmental implications of process change
- Make practical and economical recommendations.
- Evaluation of highly energetic materials including potential explosives
- Experimental blast chamber facility
- Handling of toxic and highly active materials
- Gas Evolution rate measurements
- Mass spectroscopy

## LABORATORY EQUIPMENT

Equipment	Scale	Temperature (°C)	Pressure (barg)	Test Cell
Adiabatic Dewar Calorimeter	800 grams	30 to 300	0 - 35	Glass, SS
Reaction Calorimeter (RC-1)	70 mL - 1.5 L	-50 to 180	0 - 60	Glass, HC
Micro Reaction Calorimeter ( $\mu$ RC)	1- 100 mg , $\mu$ L	-10 to 200	-	Glass, HC
Accelerating Rate Calorimeter (ARC)	2 - 5 grams	30 to 400	0 - 136	Glass, HC, SS, Ti
Differential Scanning Calorimeter (DSC)	1 - 5 mg	-150 to 600	-	Al, Alumina, SS (gold plated)
Carius Tube (CT)	10 - 15 grams	30 to 400	0 - 35	Glass
Vent Size Package (VSP)	120 mL	30 to 400	0 - 136	HC, SS

*HC - Hastelloy C, SS - Stainless Steel, Ti - Titanium*

# Chemical Process Development and Optimization



*Mettler RC1 Calorimeter.*



# Chemical Process Evaluation Services

# Chilworth

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GLOBAL

## THE BENEFITS

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From Chilworth you obtain:-

- Impartial, professional and confidential advice.
- Access to laboratories which can safely test highly energetic and toxic material.
- Expert guidance on the selection of tests and interpretation of results.
- The availability of experienced process safety specialists to assist with the application of data and hazard assessment on plant.
- Testing to international standards (where applicable).
- Fast and reliable data.
- The confidence of knowing that data comes from ISO/IEC 17025 or GLP compliant laboratories.



## Testing to ISO/IEC 17025 & GLP Standards



Consultancy



Training



## CHILWORTH SERVICES

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### Process Safety Services

- Consulting & Incident Investigation
- Laboratory Testing
- Training

### Areas of Expertise

- Chemical Reaction Hazards
- Gas & Vapor Flammability
- Dust Fire & Explosion Hazards
- Electrostatic Hazards
- Process Safety Management Support & Auditing
- Process Hazard Analysis (HAZOP, LOPA, FMEA, FT)
- Fire Burning Properties of Materials
- Explosives: Recognition, Hazards & Risk Mitigation

For further information and a comprehensive list of services available, please contact one of our offices detailed below.

## CONTACT

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