

Radiotracers and Radiation Technologies in Mining Industry

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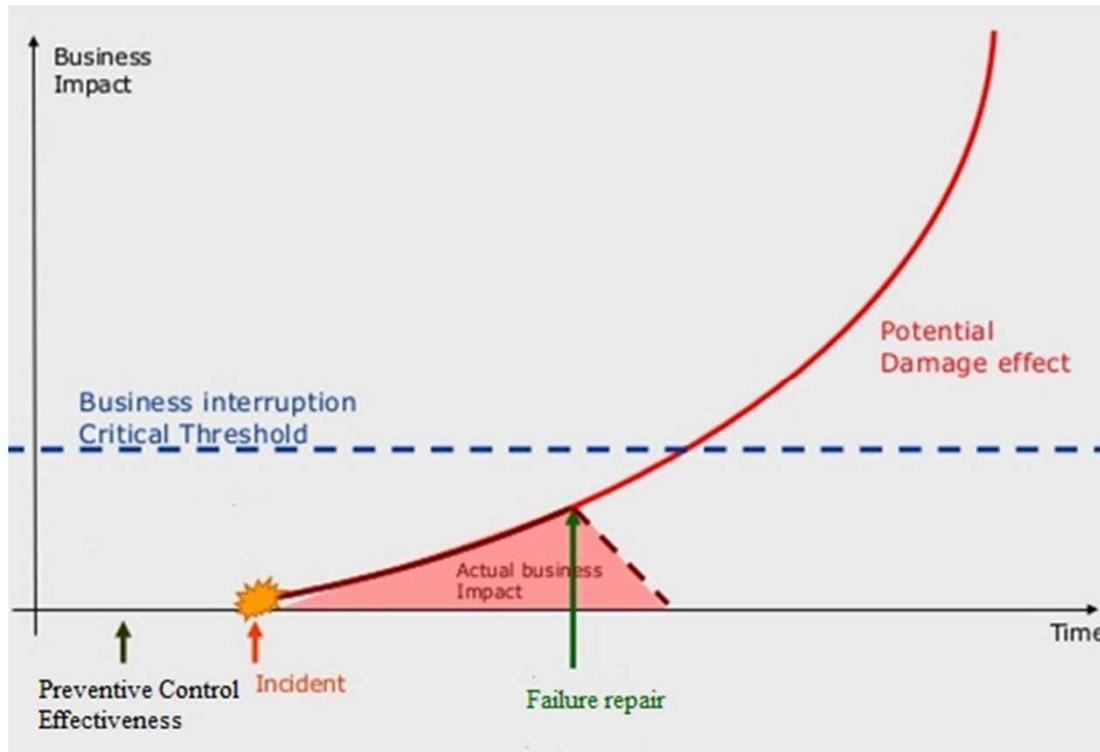
International Atomic Energy Agency Scientific Forum

ATOMS IN INDUSTRY

Radiation Technology for Development

15–16 September 2015, Vienna, Austria

Efficient process control methods provide industry-wide benefits



Improvements achieved by process control in various industries

- ✓ Increased throughput 3-5%
- ✓ Reduced fuel consumption 3-5%
- ✓ Reduced emission levels 3-5%
- ✓ Reduced electricity consumption 3-5%
- ✓ Reduced quality variability 10-20%
- ✓ Reduced refractory consumption 10-20%



Gamma scanning

Interwell tracer test

Thin layer activation

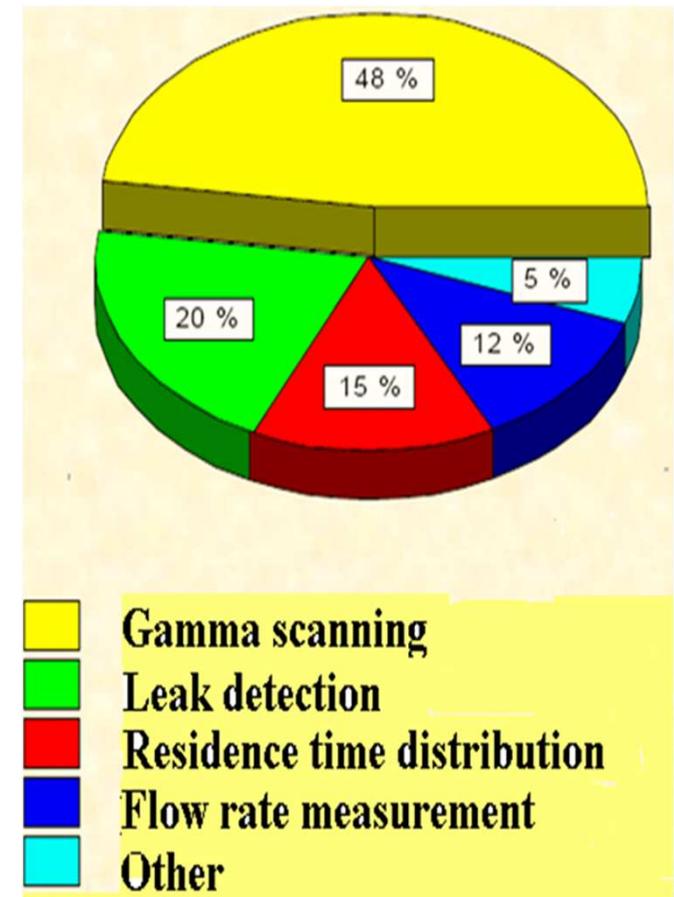
Flow rate measurement

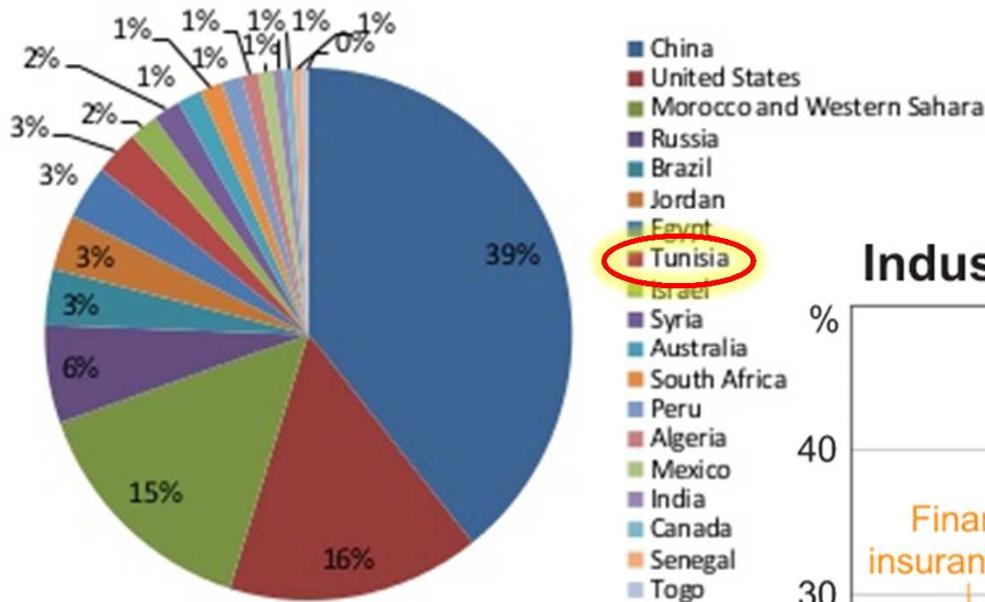
Residence time distribution

Neutron backscattering

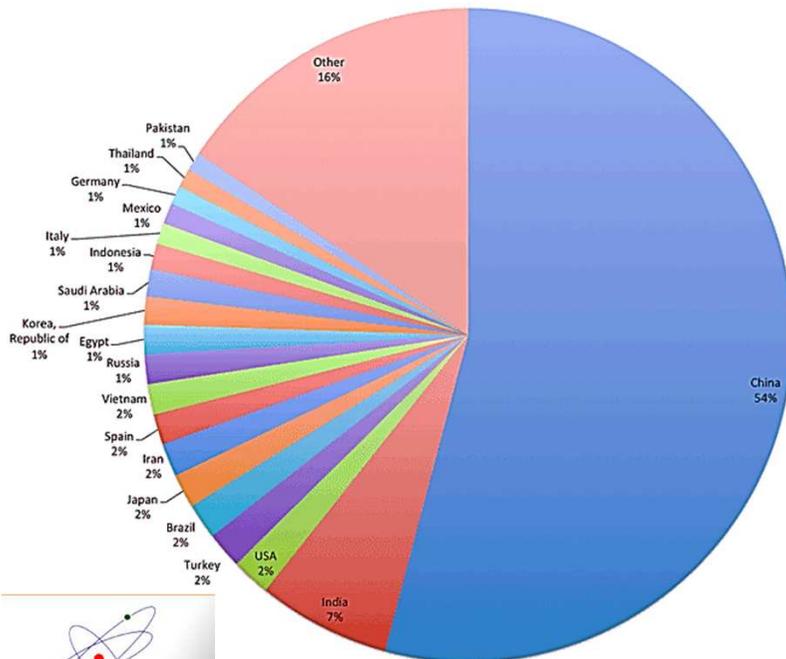
Leak detection

- ✓ dynamic information
- ✓ without disturbing the system
- ✓ high detection sensitivity
- ✓ suitable for processes at high P and high T
- ✓ suitable to track solid, liquid and gas phases
- ✓ enable development/verification mathematical models
- ✓ low to moderate cost
- ✓ easy to deploy in-site



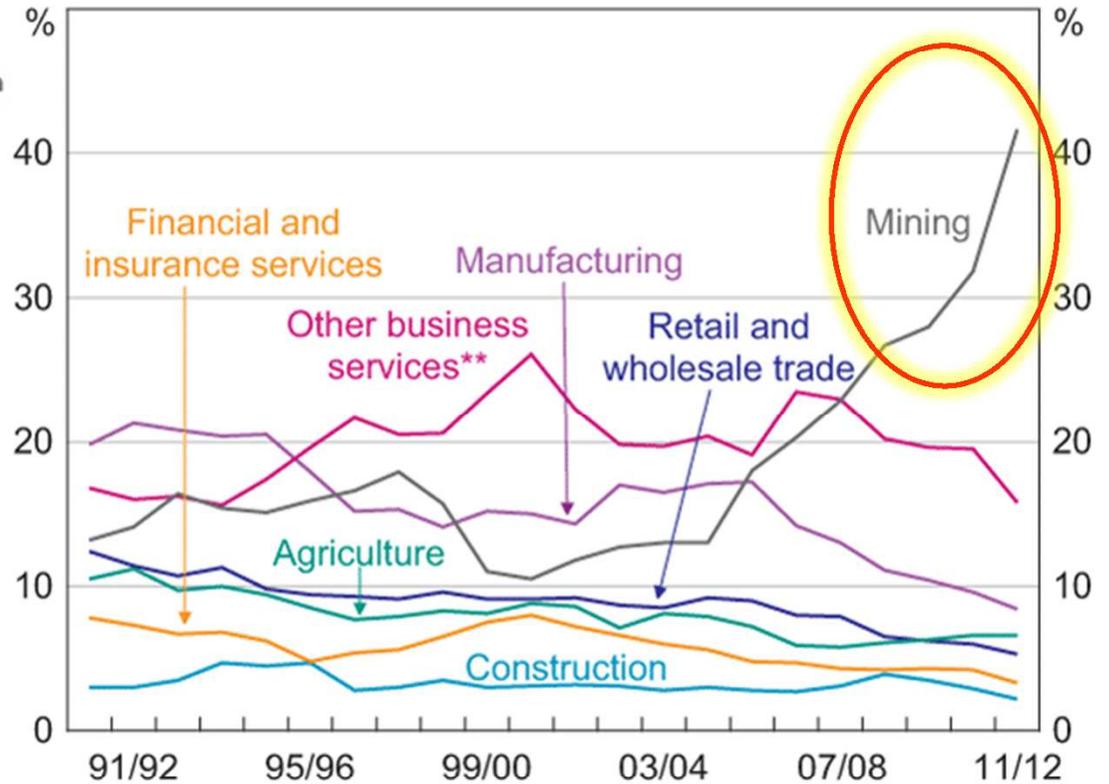


Phosphate production 2011



Cement Production 2010

Industry Share of Business Investment*

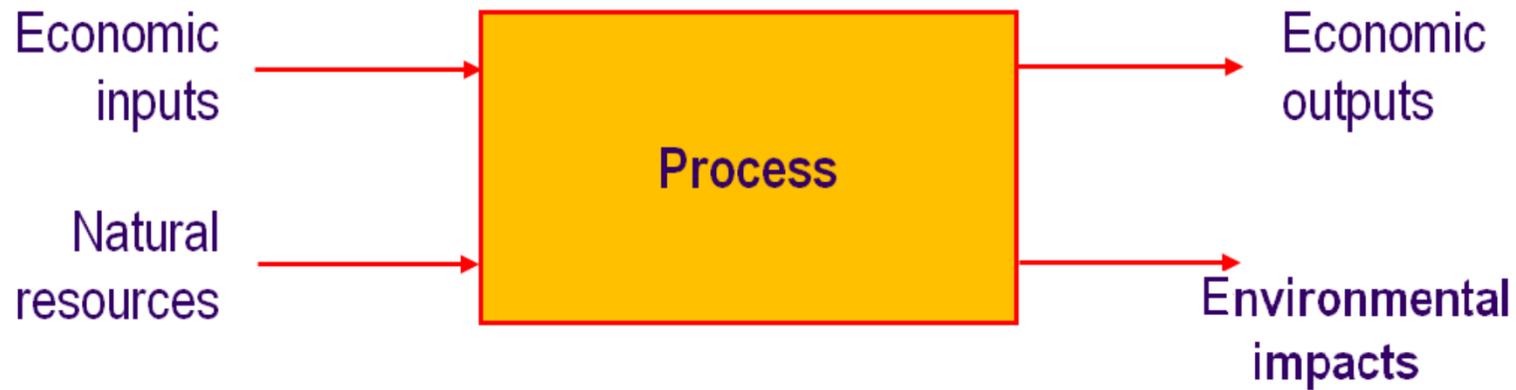


* Nominal

** Includes: information media and telecommunications; rental, hiring and real estate services; professional scientific and technical services; administrative and support services

Source: ABS



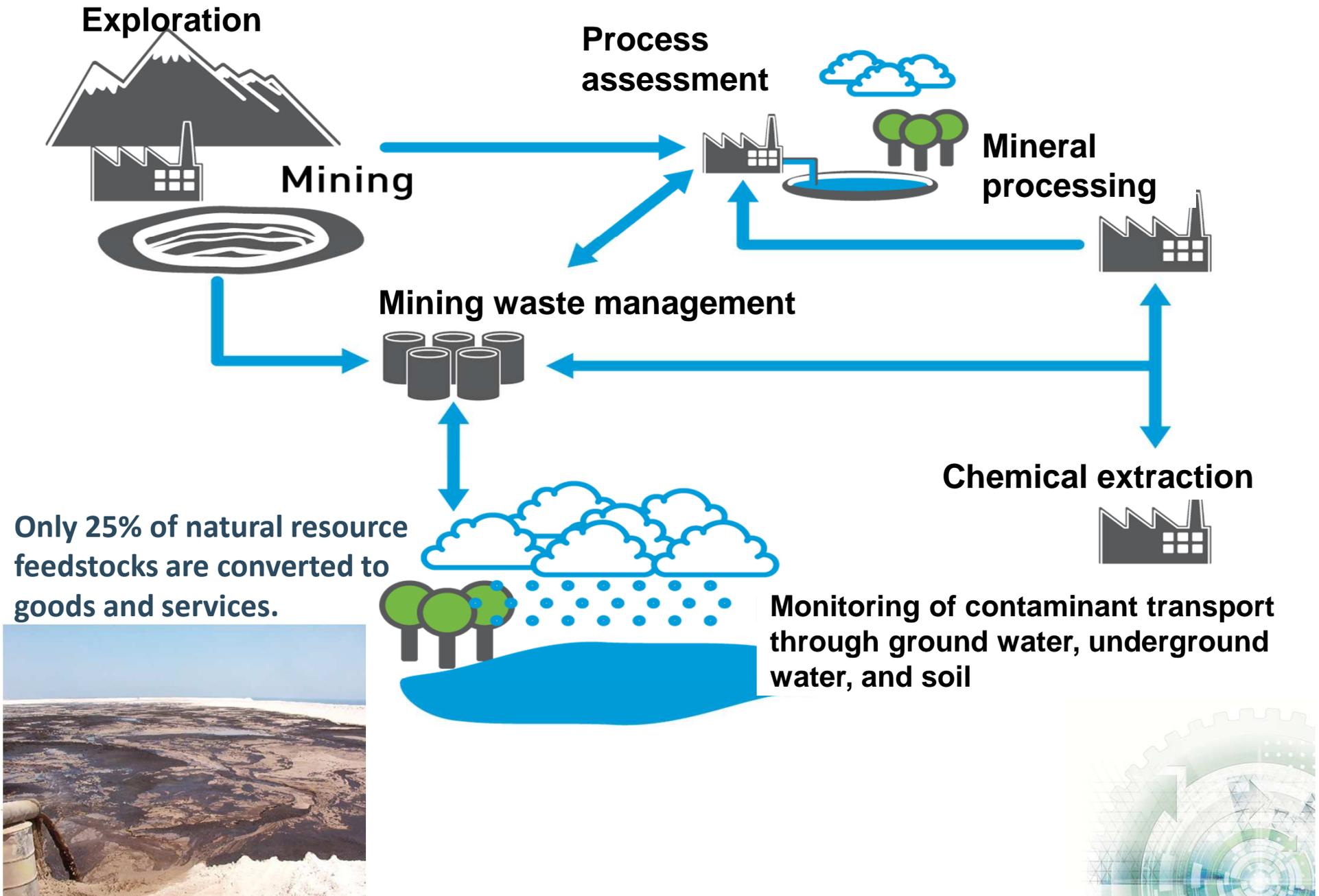


- ✓ Enhance quality, productivity, reliability and safety,
- ✓ Improve efficiency,
- ✓ Reduce production down-time,
- ✓ Make worker's performance easier,
- ✓ Reduce industrial pollution,
- ✓ Save money

support recovery **improvements of the order of 5%**

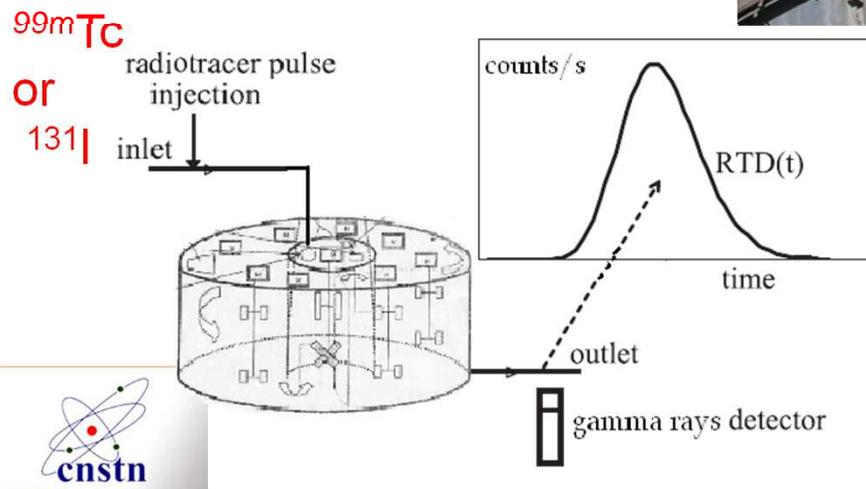
global economic benefit of \$19Billion annually.



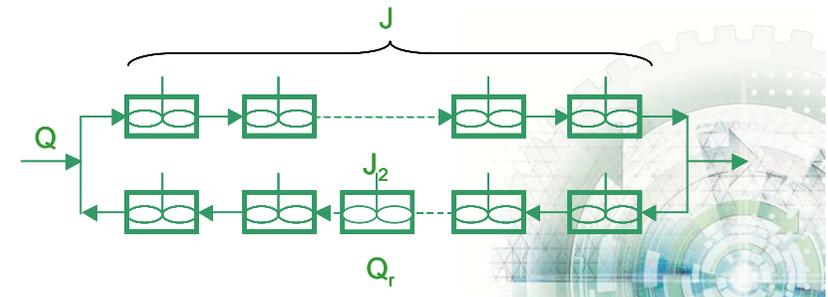
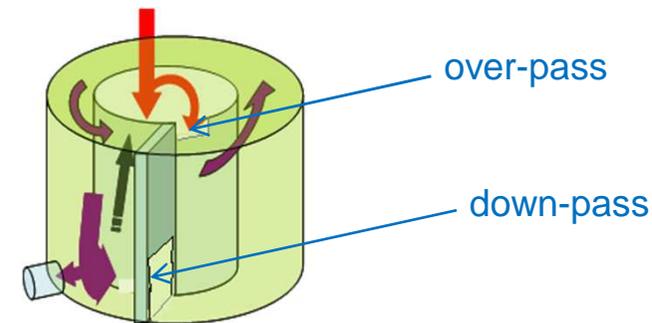
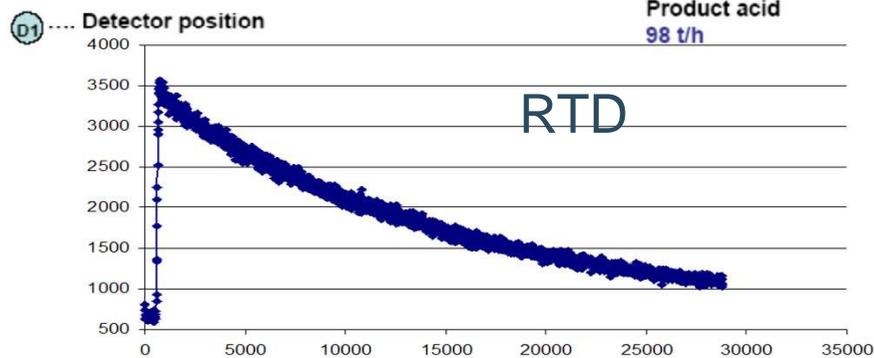
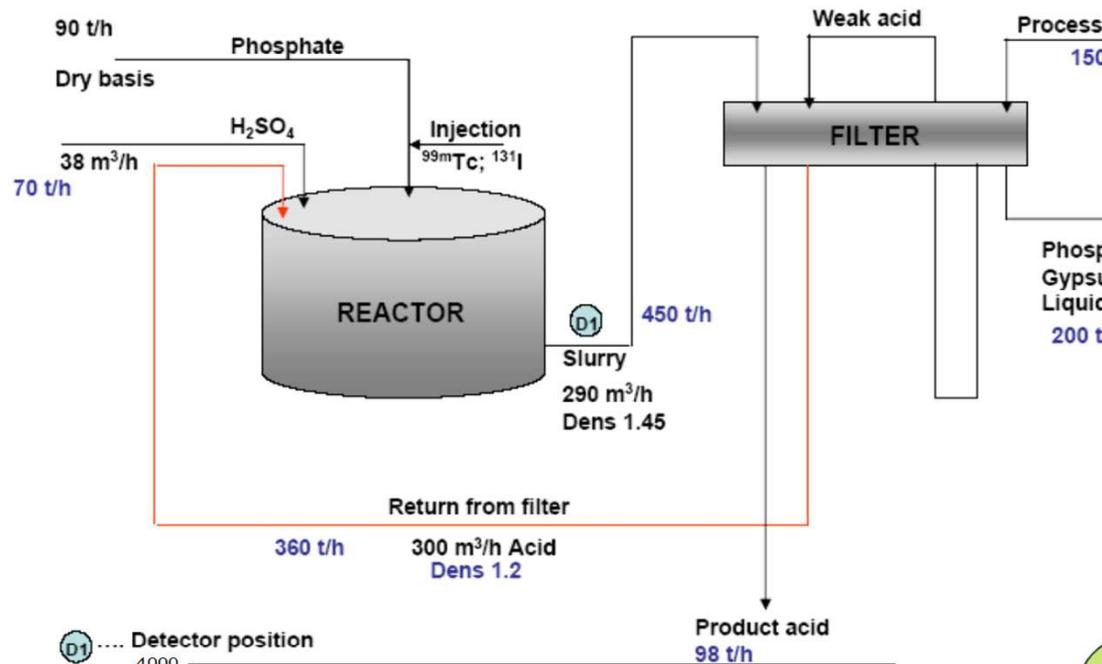


Radiotracer method application for RTD measurement in Tunisian phosphate industry

Tunisian's phosphate processing industry produces about **21.7% of global production** and **31.2% of global exports**.



RTD used to assess and improve the overall performance of the monitored phosphate reactor



- ✓ dead volume (reaching 40% in some cases)
- ✓ internal circulation flow rate
- ✓ Analytical treatment and modeling

Radiotracer method application for grinding mill efficiency measurement



Grinding consumes 1/3 of the power required to produce 1 ton cement, 30-40 kWh/ton



- RTD estimates the grinding probability,
- MRT gives the holdup,
- the Recirculation to the mill gives grinding efficiency of the system.

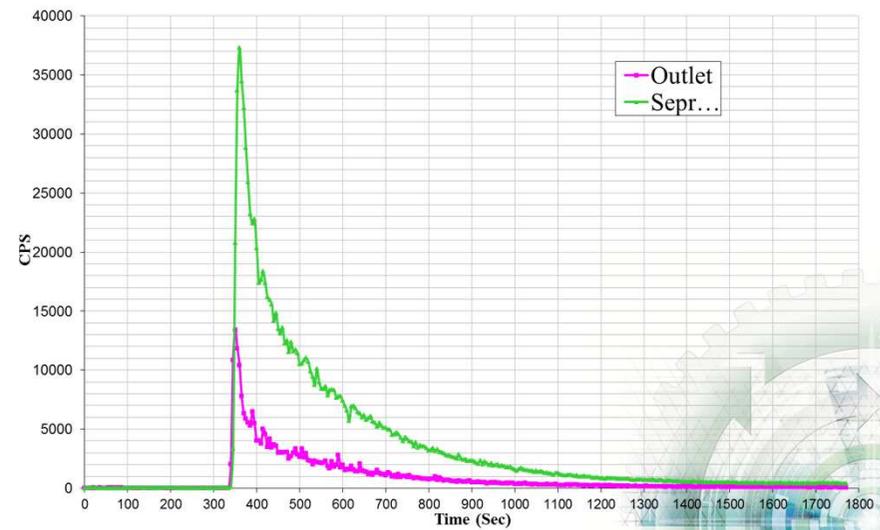
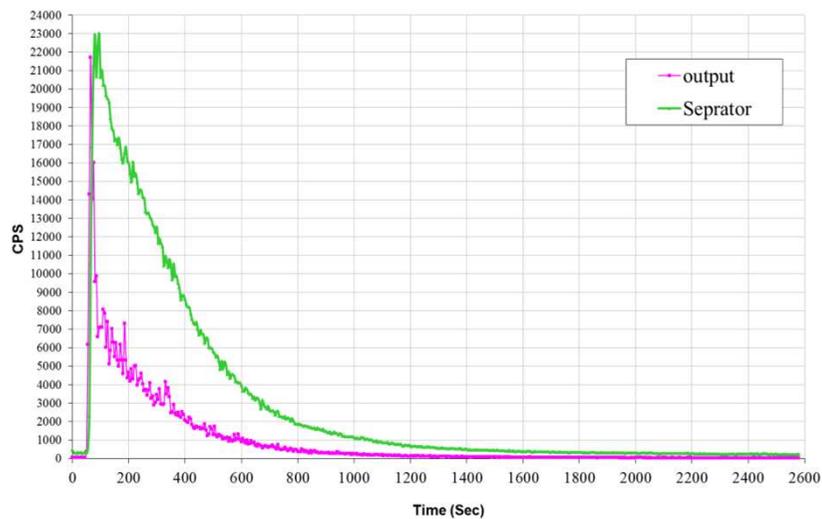


Inside the cement grinding mill



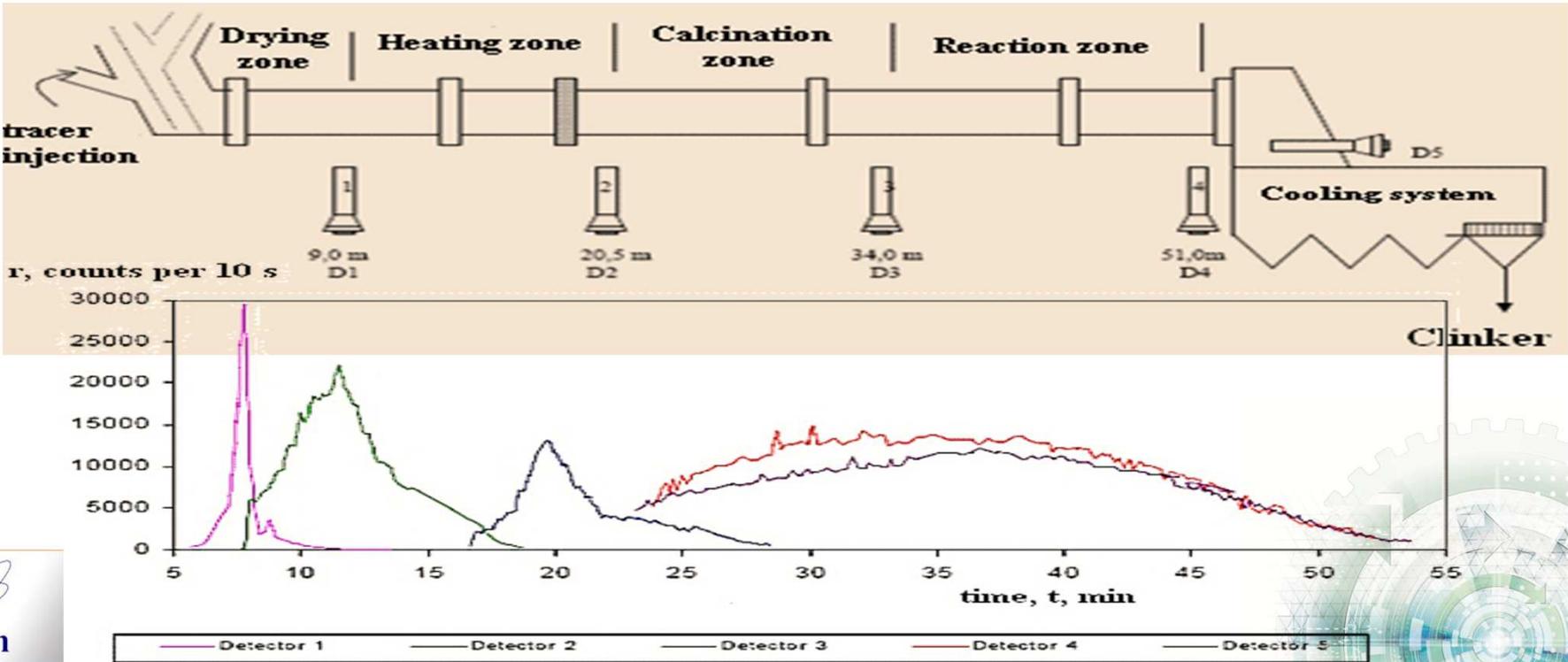
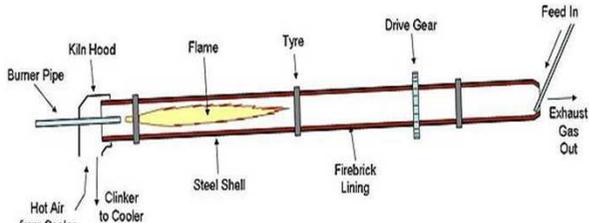
Experiment 2 (Flow rate = 90 T/H) (tracer clays)

Experiment 1 (Flow rate = 90 T/H) (tracer limestone)





RTD of the homogenized fine crude mixture has been determined in different zones of a **rotary kiln**.



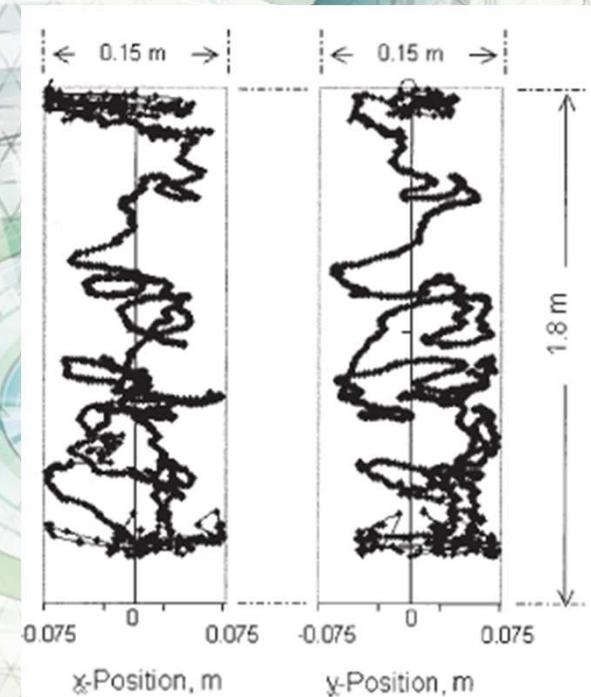
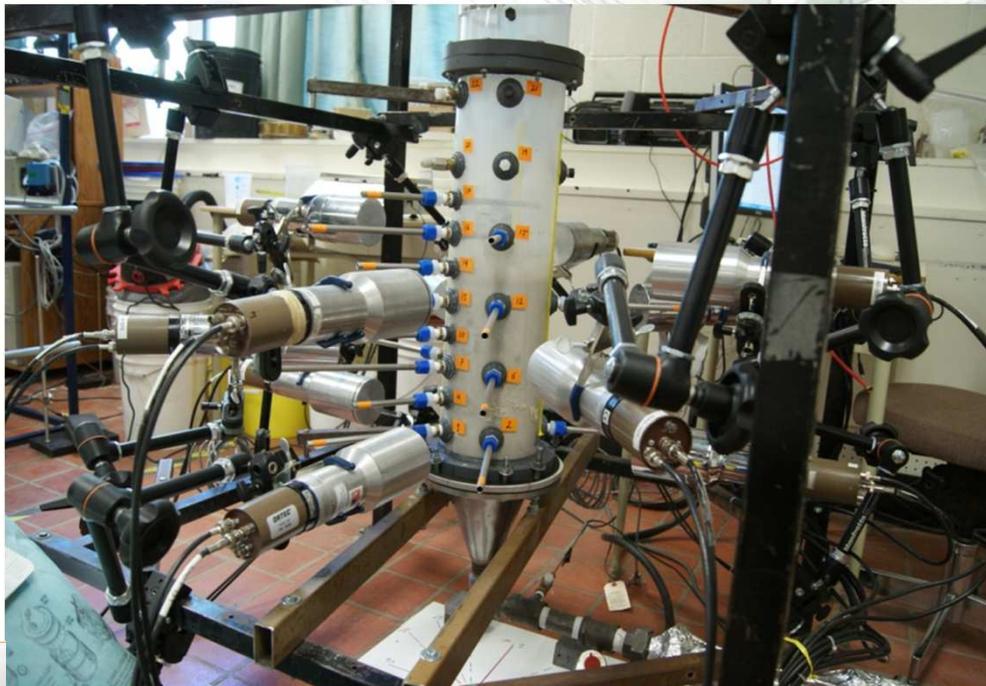
Nucleonic analysis and control systems facilitate real-time monitoring of mining and mineral processing plants



The intrinsic variability of the new feedstocks combined with stringent environmental constraints make the processes much more difficult to design and operate.



Sophisticated measuring techniques are developed and under improvement by advances in computer control and nuclear technology including radiation technology.



Radioactive Particle Tracking (RPT) technique

Thank you!

