

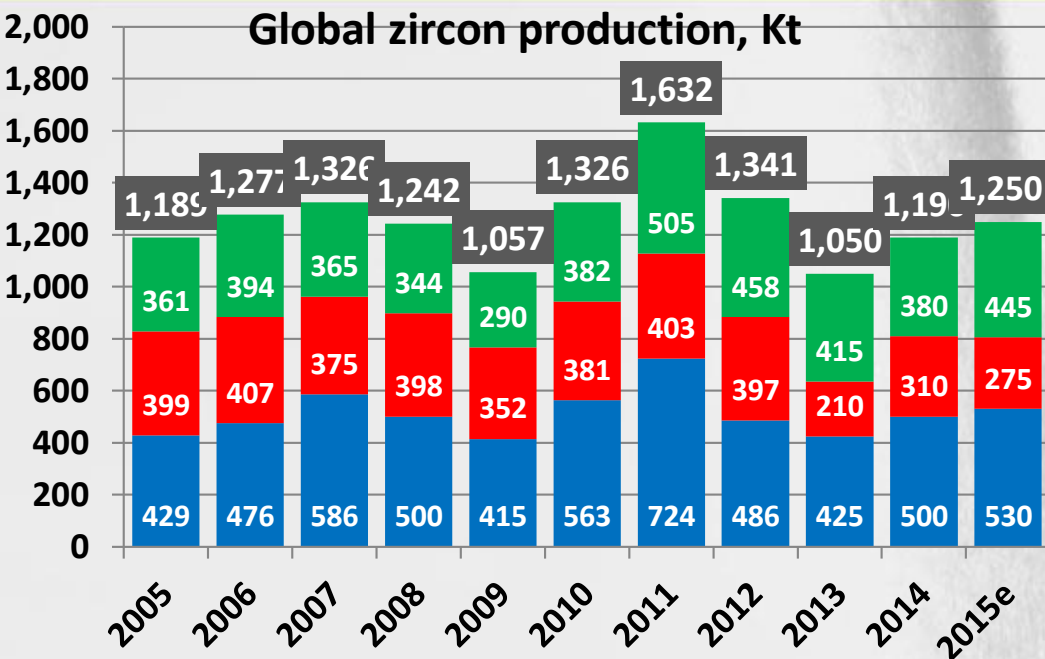


The milling of zircon in the EU – a NORM perspective
Dr K Harlow: ZIA Executive Director

EAN-NORM Workshop, Stockholm, December 2016

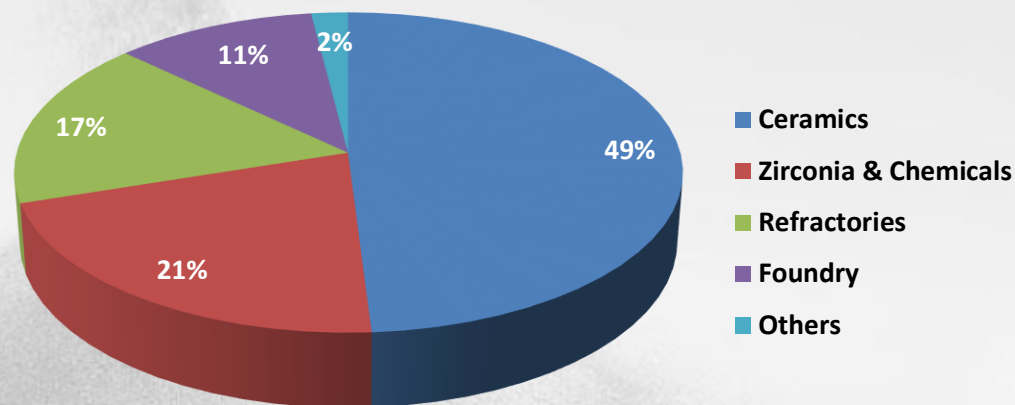


Zircon market in brief



USD 1 billion
global value

225K tpa
EU milling capacity



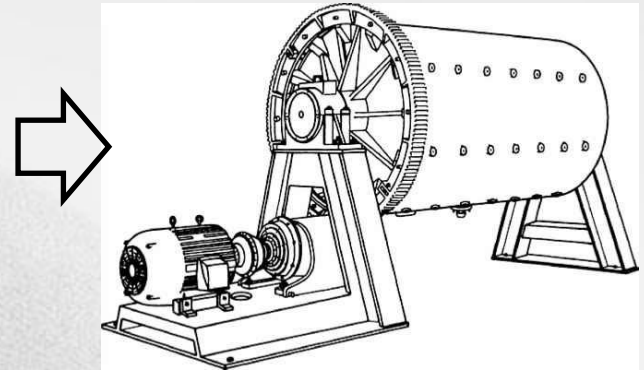
Data source: TZMI



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Milled zircon

- Prior to end-use, approximately 70% of zircon sand is milled into flour or micronized for opacifiers, while 20% is processed into Zr-based chemicals.
- The remaining 10% is used directly for end-use applications.



Aims of the survey (questionnaire)

- Awareness-raising of EURATOM 2013 & BSS + preparedness for 2018 implementation
- Understand the positive / negative aspects of milling
- Highlight any areas to address
- Share best practice techniques
- Continuous improvement

Eight* companies surveyed from five EU countries**

*representing 85% of EU milling capacity

** FR, UK, G, SN, IT



Activity concentrations of radionuclides

Nuclide	Activity range (Bq/g)
^{238}U in zircon	2 – 3.5
^{232}Th in zircon	0.5 – 1.0
^{40}K in zircon	Approx 0.002
^{238}U in monazite concentrate	10 – 50
^{232}Th in monazite concentrate	70 – 400



Basic milling operation

Gamma exposure
Radon inhalation

Dust <10µm
Leakage
Disposal of consumables

Dust <10µm
Spillage

Zircon sand
storage

Milling
(dry / wet)

Zircon flour
packing &
dispatch



Topics for survey questionnaire

Focus on five areas of potential exposure:-

- 1. Storage**
- 2. Processing**
- 3. Waste management**
- 4. Health and safety**
- 5. Final product handling**

Responses to ZIA, consolidated findings reported back to those that responded and all other milling members.

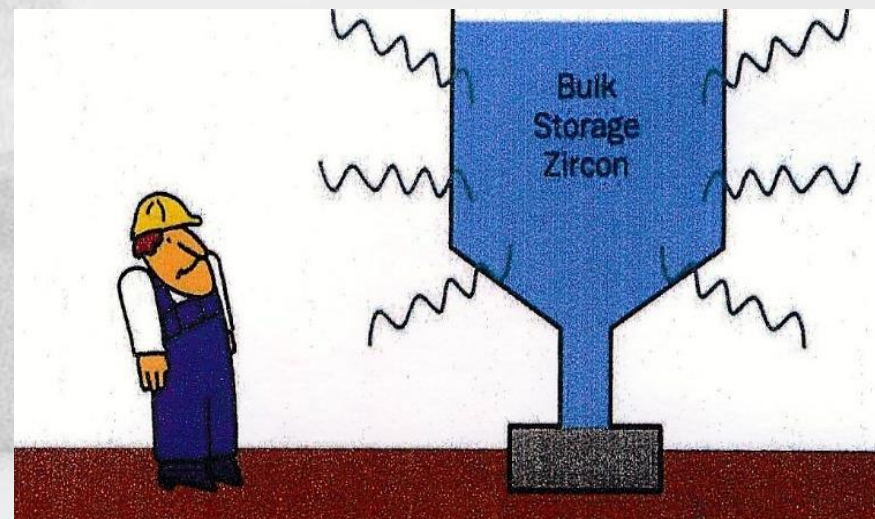
1. Zircon storage

Ventilated stores¹: **7/8 yes**

Controlled access²: **5/8 yes**

Zircon stored as loose bulk³: **7/8 yes**

- ¹ Minimises radon exposure
- ² Minimises gamma exposure
- ³ Possible gamma exposure - needs careful management



2. Processing

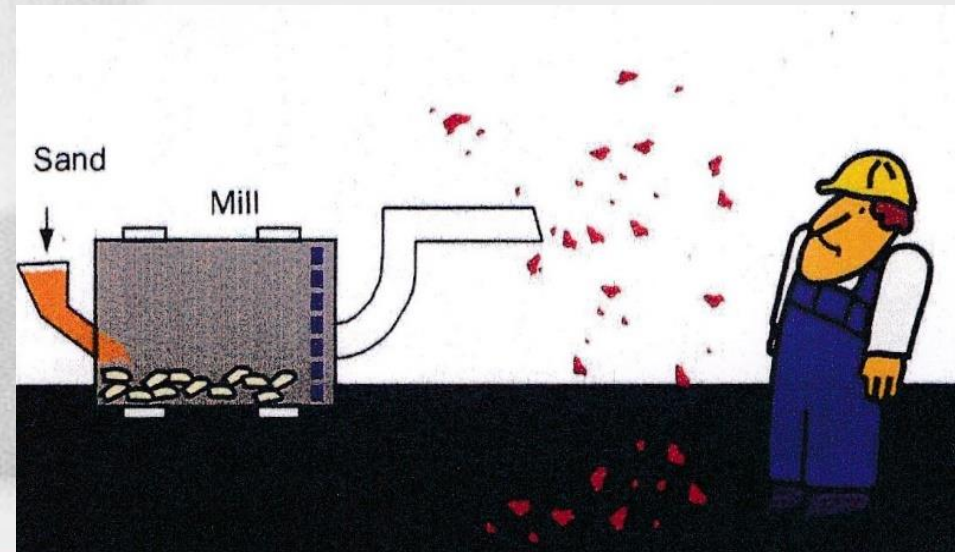
Zircon flour $<10\mu\text{m}^1$: 8/8 yes (incl. micronized zircon to $4\mu\text{m}$)

Dust control system used²: 8/8 yes (filter cartridge and baghouse)

Floor cleaning by sweeping³: 7/8 yes (2/8 exclusively)

Air discharge stacks fitted⁴: 4/8 yes

- ¹ Higher risk particle size
- ² Minimises dust exposure in plant
- ³ Risk of dust re-suspension
- ⁴ Minimises dust leakage in plant



3. Waste management

- Associated with the landfilling of: -
 - ball mill liners and media: 4/8 landfill, 4/8 recycle
 - spillage & floor sweepings: 3/8 landfill, 5/8 recycle
 - dust from filters: 2/8 landfill, 6/8 recycle
 - No liquid waste from any of the operations.

4. Health & Safety and measured exposures

- Workers radiation protection program: **3/8 yes**
- Operators wear dust masks or dust suppression PPE: **7/8 yes**
- Exposures monitored:
 - workers: **3/8 yes**, - public: **3/8 yes**
- Worker (operation, warehouse and maintenance personnel) exposures that are measured are all **< 1.0 mSv/a, some at < 0.3 mSv/a**
- Public exposures measured are all **< 0.3 mSv/a**



5. Packaging of product for sale

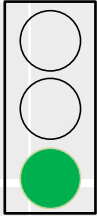
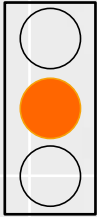
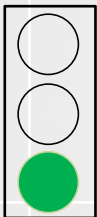
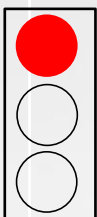
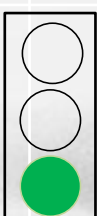
- **7/8** companies use silo trucks or bulk powder tankers
- **8/8** companies use bulk bags / paper sacks
(bulk bags and paper sacks need extra care to prevent damage and spillage of content)
- Safety Data Sheets (SDS) describe the radioactivity of the product - **8/8 companies comply**



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Traffic light summary

STORAGE		Strict control of access to storage area - for essential access only
PROCESSING		Floor sweeping to be avoided in favour of vacuuming. Look to measure zircon levels in stacks/chimneys
WASTE MGT		Maximise recycling of spillage and dust collection in air cleaning equipment. Develop arrangements with landfill operators
H&S		Introduce formal worker Radiation Protection Program Risk assessment of operations Use radiation badges at high(er) risk locations Measure exposure to public around the site
FINAL PRODUCT		Ensure paper sacks are protected and secure on pallet Introduce emergency procedure for road/rail transport



Conclusions

- Zircon milling is a mature, responsible industry in the EU
- Companies are aware of NORM handling and experienced in minimising exposure at site operations
- All surveyed are aware of EURATOM 2013 / BSS
- Whilst the practices used are commendable, there are areas for further improvement:
 - in certain aspects of processing
 - health and safety monitoring of exposures
- Operators aim to complete a risk assessment or update an existing risk assessment
- A best practice millers' guide will be developed by ZIA





Technical handbook on zirconium and zirconium compounds

2015



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Images courtesy of Iluka Resources



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