

# OVERVIEW ON NORM INVOLVING INDUSTRIAL SECTORS IN ITALY

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## SURVEY ON NORM INVOLVING INDUSTRIES IN ITALY

A collection of information about NORM involving industries in Italy is still ongoing, considering the list of industrial sectors given in the Italian transposition of 2013 EU BSS. Preliminary results are shown in Fig. 1. Detailed information are summarized in technical data sheets, organized in three sections:

1. information on radiological content of raw materials, residues and effluents (e.g. Table 1 and 2);
2. information about the occupational exposure: most significant scenarios, type of exposure, dominant natural radionuclides, range of doses, etc. (e.g. Table 3);
3. information relevant to the public exposure: residues and effluents, main route of exposure, dominant natural radionuclides, etc. (e.g. Table 4).

Hereby a focus on zircon and zirconia industry as example of the methodology.

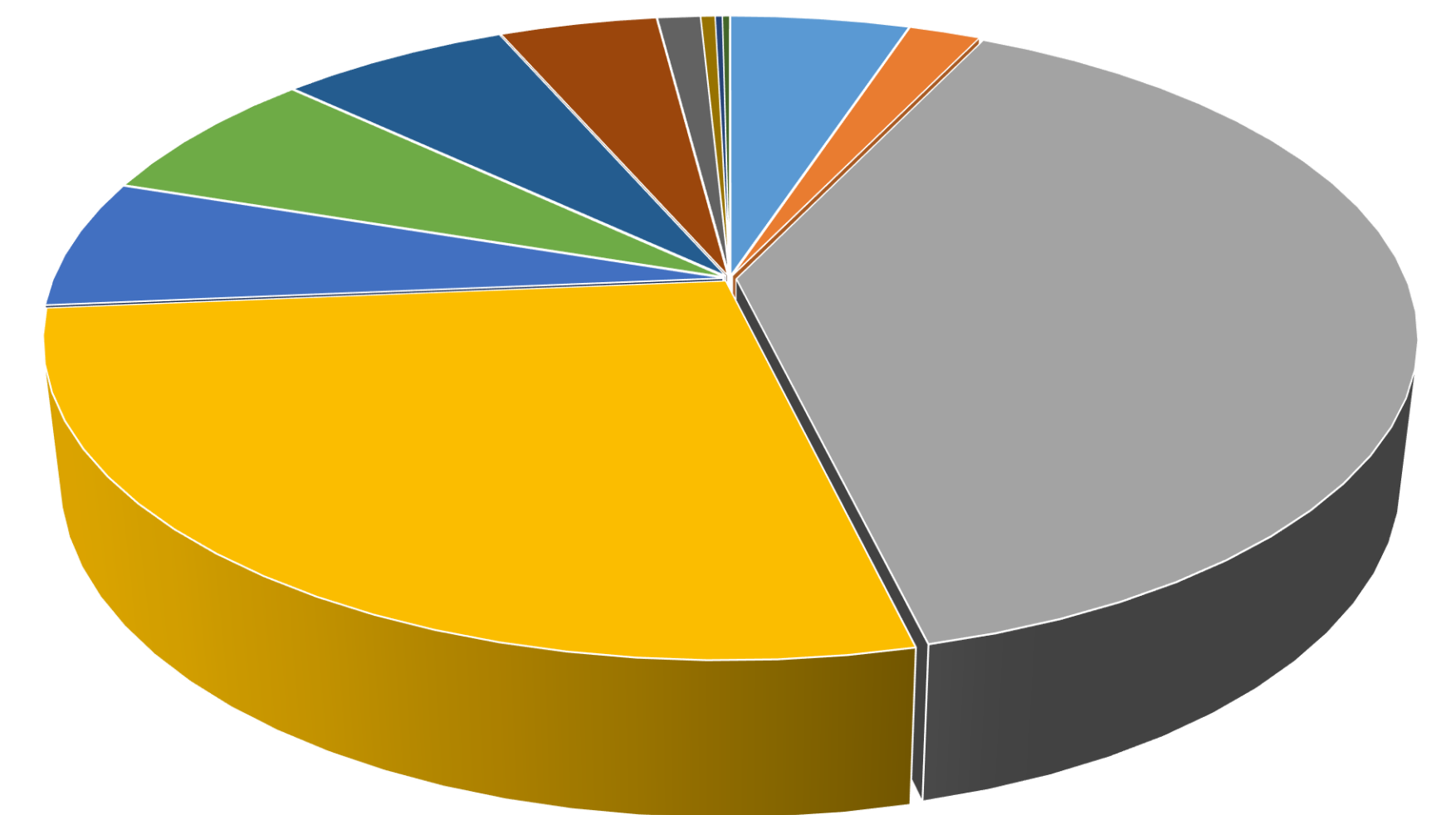
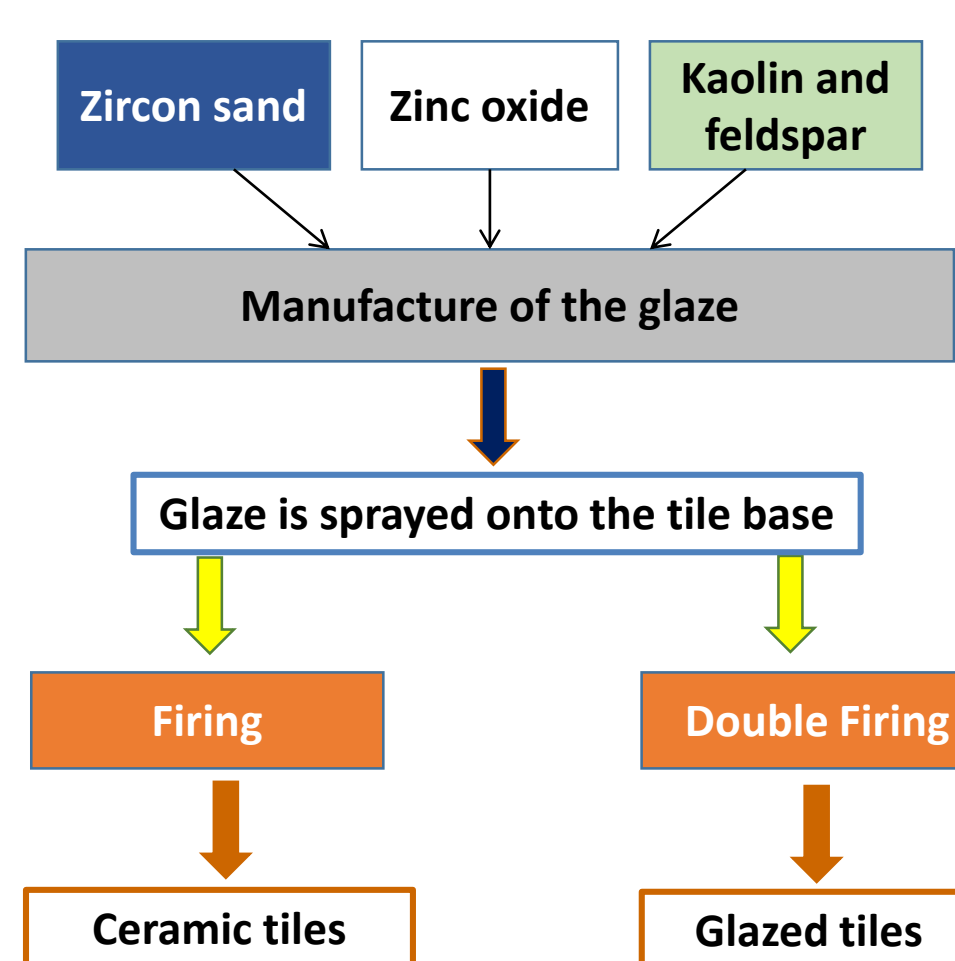


Figure 1. NORM involving industries in Italy. In brackets the number of facilities.

## FOCUS ON ZIRCON AND ZIRCONIA INDUSTRY

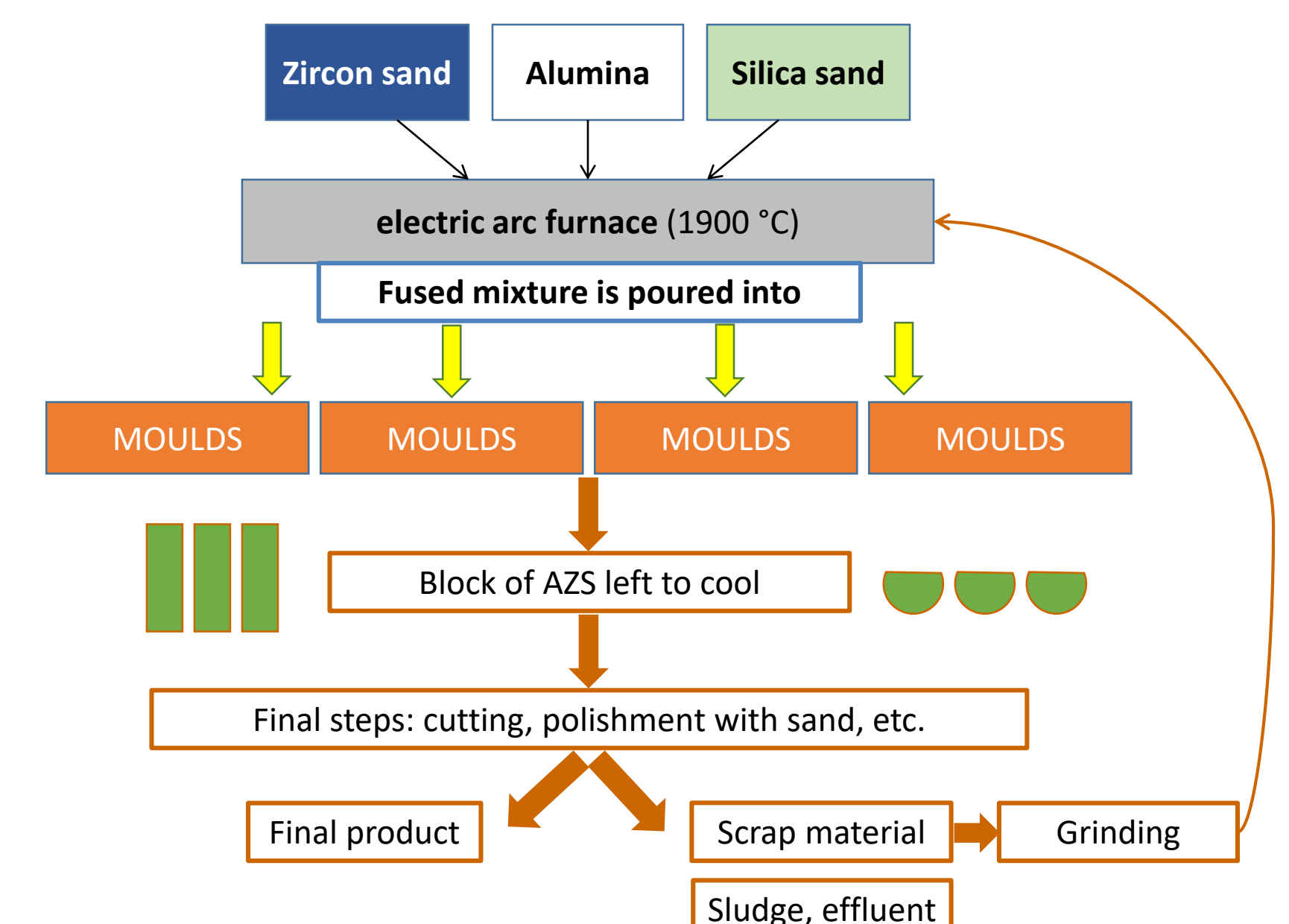
### Ceramic tile production process



### General information

- ✓ In Italy the production of ceramic tiles involves about 150 manufacturers. There are also 35 companies producing refractory.
- ✓ In Italy there are no deposits of zircon sands.
- ✓ Raw material (as zircon sand) is imported from different countries. The radiological characteristics of raw material change upon the country origin.
- ✓ Typically, zircon sands are very rich of radionuclides of the <sup>238</sup>U series.

### Refractory production process



## 1. Information on radiological content

Table 1 – Average radiological content of raw materials and residues

Matrix	Radionuclide	AM* (Bq/kg)	SD* (Bq/kg)	Range (Bq/kg)	# of samples
Raw minerals	<sup>40</sup> K	32	3	26-34	6
	<sup>238</sup> U	<b>2572</b>	684	1830-3613	7
	<sup>226</sup> Ra	<b>3219</b>			1
	<sup>232</sup> Th	462	65	370-520	7
NORM containing residues	<sup>40</sup> K	247	215	10-526	18
	<sup>238</sup> U	436	506	8-1635	18
	<sup>226</sup> Ra	573	657	10-1496	10
	<sup>232</sup> Th	88	98	1-238	18
	<sup>210</sup> Pb	4687	9161	26-21050	10
	<sup>210</sup> Po	<b>7543</b>	15359	91-46100	10

\*AM = Arithmetic Mean; SD = Standard Deviation

In bold values exceeding Italian ELs in terms of activity concentration

Table 2 – Single radiological content of residues

Residue	Matrix	<sup>238</sup> U (Bq/kg)	<sup>40</sup> K (Bq/kg)	<sup>210</sup> Pb (Bq/kg)	<sup>210</sup> Po (Bq/kg)	<sup>232</sup> Th (Bq/kg)
Tile production	Hydrated lime	8-13	16-369	26-425	4660- <b>46100</b>	1-3
	Sludge	68-354	266-427			30-119
Refractory production	Furnace fume	358	10	<b>21050</b>	<b>35000</b>	27
	Dust - collection system in refuse grinding	<b>1191</b>	255	<b>1033</b>	<b>1294</b>	178
	Dust - collection system of general air-exhauster	<b>1000</b>	36			170
	sludge	<b>1635</b>	27	<b>1166</b>	<b>1176</b>	238

## 2. Information on the occupational exposure

- **Exposure scenario for a refractory production factory:** management of dust from fusion furnace, management of dust from scraps grinding, exposure at raw materials heap. Results in Table 3.
- **Exposure scenario for a tile factory:** management of hydrated lime. Results in Table 3.
- **Reference person:** workers (1800 h/y).
- **Exposure pathways:** external irradiation from stockpiles of material, inhalation of airborne dust, radon inhalation from material heap.

Table 3 – Estimated individual effective dose to worker

	Individual Effective Dose Adults
Ceramic tile industry – inhalation of hydrated lime	0.22 mSv/y
Refractory industry – exp. to heap of raw material	2.17 mSv/y
Refractory industry – exp. to dust from fusion furnace	0.71 mSv/y
Refractory industry – exp. to management of dust from scraps grinding	0.32 mSv/y

## 3. Information on the public exposure

- **Exposure scenario:** exposure to airborne dust from stacks for a refractory production factory (fusion oven and refuse grinding stacks) and for a tile factory (baking oven stack). Results in Table 4.
- **Reference person:** adults and infants living 1-2 km far from the factory.
- **Exposure pathways**
  - ❖ Inhalation and external irradiation of airborne dust from stacks.
  - ❖ External irradiation from dust on the ground, inhaled when re-suspended.
  - ❖ Ingestion of food (vegetables, fruits, etc.) grown on contaminated soil.

Table 4 – Estimated individual effective dose to the public

	Individual Effective Dose	
	Adults	Infants
Ceramic tile industry	0.03 μSv/y	0.09 μSv/y
Refractory industry	0.02 μSv/y	0.08 μSv/y

Dose model: PC-CREAM

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