

Leaflet on natural radioactivity in foundry chemical products



Background of the communication

On 5 December 2018, the Federal Law Gazette¹ Part I (No. 41, p. 2034) published the "Ordinance for the Further Modernization of Radiation Protection Law"², Article 1 of which is the new „Ordinance against Ionizing Radiation“³ (Radiation Protection Ordinance - StrlSchV)⁴. The StrlSchV substantiates the requirements of the Radiation Protection Act (StrlSchG)⁵, with which the requirements of European Directive 2013/59/Euratom⁶ have been implemented. The StrlSchV came into force on December 31, 2018. Thus, the radiation protection law in Germany has been extensively amended. One aspect of the Radiation Protection Act (StrlSchG)⁷ is the regulation of substances that exhibit natural radioactivity.

Foundry chemical products with natural radioactivity

- Natural radioactivity stems from radionuclides of natural origin. These radionuclides have been present in nature since the formation of earth matter (minerals). Four classes of foundry chemical products which may contain naturally occurring radionuclides are considered a source of radiation by the amendment of the StrlSchG and the specifications of the new StrlSchV: Foundry sand
- Coatings
- Refractory materials
- Inorganic binder systems

Requirements from the German radiation protection law

In addition to naturally occurring radioactivity, German radiation protection law⁸ requires concrete actions to protect occupationally exposed persons in excess of the general precautionary principle, subject to certain prerequisites and the general precautionary principle under certain conditions.

DISCLAIMER: This compilation of specialist information for the practice of handling foundry chemical products containing natural radionuclides does not exempt from the obligation to observe the legal regulations. The information has been prepared with great care. Nevertheless, the authors and the Industrieverband Gießerei-Chemie e.V. assume no liability for the accuracy of the information, instructions, advice and for any translation and printing errors.



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1. Restriction to certain areas of activity

- § 55 (1) and Annex 3 StrlSchG
The „processing of substances containing zirconium in the manufacture of refractory materials“⁹ was newly included in the radiation protection legislation as an area of activity in which radiation protection measures may be necessary. Due to this change there are requirements for an estimation of radiation exposures according to § 55 StrlSchG for which there are transitional provisions until 31.12.2020. If this estimate shows that the effective dose may exceed 1 millisievert in the calendar year (1 mSv / a) additional measures are required according to § 56 StrlSchG..

2. Product responsibility for goods

- Section 153 (1) StrlSchG

Manufacturers, suppliers, transporters or owners of goods which as a result of their radioactivity may cause „other exposure situations“ shall be responsible. For example, in the supply chain of foundry chemical products, evidence of weak radioactivity due to contained naturally occurring radionuclides has recently been communicated. Irrespective of this, waste arising from the use of foundry chemical products with natural radioactivity does not constitute radioactive residues according to § 5 (32) and Annex 1 StrlSchG.

Danger and risk minimization

The natural radiation exposure for humans is composed of the external terrestrial and cosmic radiation exposure („background radiation“) and the internal radiation exposure by the uptake of natural radionuclides via respiration or food. Basically, every person is exposed to background radiation from natural sources which can vary greatly depending on the region. In Germany, for example, on average a natural radiation exposure of 2.1 millisieverts per year (mSv / a), which depending on the place of residence, dietary habits and habits, can vary between 1 mSv / a and 10 mSv / a [cf. BfS website: „Radioactivity in the environment“]¹⁰. In addition to the natural background radiation by applying radioactivity in medicine (Xray diagnostics <0.01 - 1 mSv) and technology one can be exposed to additional radiation doses. Medical applications account for almost half of the average annual radiation exposure and everyday technical applications (e.g., hand baggage security controls) usually cause a significantly lower radiation exposure [cf. BfS Websites: „Applications in Medicine“¹¹; „Applications in everyday life and technology“¹²]. As far as practically feasible radiation protection is intended to reduce additional radiation exposures. An additional load of less than 1 millisievert per calendar year (mSv / a) does not require special radiation protection measures. The following types of exposure may occur when using foundry chemical products that exhibit natural radioactivity: 1. Exposure to an external radiation source

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As far as practically feasible radiation protection is intended to reduce additional radiation exposures. An additional load of less than 1 millisievert per calendar year (mSv / a) does not require special radiation protection measures. The following types of exposure may occur when using foundry chemical products that exhibit natural radioactivity:

1. Exposure to an external radiation source
 - Influenced by quantity, distance, shielding and exposure duration
2. Incorporation by inhalation

Inhalation of dust with natural radioactivity

The manufacturer's safety data sheet should be reviewed prior to processing of foundry chemical products that exhibit natural radioactivity. Due to the precautionary principle an exposure analysis based on the respective workplace and the activity must be carried out in accordance with § 55 StrlSchG. Additional measures according to radiation protection law are not required, provided an effective dose of 1 mSv per calendar year is not exceeded. Measures according to occupational safety legislation, e.g., with regard to the inhalation of dusts, remain unaffected.

Only if the effective dose of 1 mSv per calendar year is exceeded additional measures may be required under the Radiation Protection Act (e.g., notification to the authorities, appointment of radiation protection officers). The limit value for the effective dose for the protection of occupationally exposed persons is 20 mSv / a (§ 78 Paragraph 1 StrlSchG) and lower limit values apply to groups of persons who are particularly vulnerable. This dose limit value will not be reached with foundry chemical products that exhibit natural radioactivity assuming professional work activities and compliance with occupational safety and health practices!

The decisive recommendation for reducing the dose consists primarily of minimizing the dust load and heeding distance control recommendations. For example, permanent jobs should not be in the immediate vicinity of the mold warehouse or storehouse. Furthermore, the following occupational safety measures are recommended, according to their hierarchy (STOP):

- Storage separately from workplaces, physical separation
- Automation of process steps ∅ Shielding, housing, encapsulation ∅ Maximizing distances
- Local extraction, optimization of the room air exchange
- Optimization of processes with regard to dust generation
- Reduction of quantities stored in the workplace
- Task critical personnel only at the workstations, access control
- Limitation of the exposure duration (working time in the danger area)
- Respiratory protection (subordinated to technical & organizational measures)

In addition, both the monitoring of the exposure and control of potential release into the environment (exhaust air, wastewater) are required.

Overall assessment

The German Radiation Protection Act assumes that an additional burden of 1 mSv / a by occupational exposure can be tolerated without further measures. In addition to the general precautionary principle, compliance with this additional burden does not require any specific actions according to StrlSchG and StrlSchV in connection with occupational radiation protection (e.g., notification to the responsible authority, appointment of radiation protection officer).

Literature / List of information sources

Foundry Lexicon, Publisher & Editing: Foundry Technologies & Engineering GmbH;

Link: www.giessereilexikon.com

Act on Protection against the Harmful Effects of Ionizing Radiation (Radiation Protection Law - StrlSchG) of 27 June 2017 (Federal Law Gazette I p. 1966);

Link: www.gesetze-im-internet.de/strlschg/index.html