

# ISO 18589-5:2019-12 (E)

## Measurement of radioactivity in the environment - Soil - Part 5: Strontium 90 - Test method using proportional counting or liquid scintillation counting

---

| <b>Contents</b>    |  | <b>Page</b> |
|--------------------|--|-------------|
| Foreword .....     |  | v           |
| Introduction ..... |  | vi          |
| <b>1</b>           | <b>Scope .....</b>   | <b>1</b>    |
| <b>2</b>           | <b>Normative references .....</b>                                      | <b>1</b>    |
| <b>3</b>           | <b>Terms and definitions .....</b>                                     | <b>2</b>    |
| <b>3.1</b>         | <b>Terms and definitions .....</b>                                     | <b>2</b>    |
| <b>3.2</b>         | <b>Symbols .....</b>   | <b>2</b>    |
| <b>4</b>           | <b>Principle .....</b>   | <b>3</b>    |
| <b>4.1</b>         | <b>General .....</b>   | <b>3</b>    |
| <b>4.2</b>         | <b>Chemical separation .....</b>                                       | <b>3</b>    |
| <b>4.3</b>         | <b>Detection .....</b>   | <b>4</b>    |
| <b>4.3.1</b>       | <b>General .....</b>   | <b>4</b>    |
| <b>4.3.2</b>       | <b>Source preparation for liquid scintillation counter .....</b>       | <b>4</b>    |
| <b>4.3.3</b>       | <b>Source preparation for proportional counter .....</b>               | <b>4</b>    |
| <b>4.3.4</b>       | <b>Background determination .....</b>                                  | <b>4</b>    |
| <b>5</b>           | <b>Chemical reagents and equipment .....</b>                           | <b>5</b>    |
| <b>6</b>           | <b>Procedure of strontium desorption .....</b>                         | <b>5</b>    |
| <b>6.1</b>         | <b>Principles .....</b>  | <b>5</b>    |
| <b>6.2</b>         | <b>Technical resources .....</b>                                       | <b>6</b>    |
| <b>6.2.1</b>       | <b>Equipment .....</b>   | <b>6</b>    |
| <b>6.2.2</b>       | <b>Chemical reagents .....</b>   | <b>6</b>    |
| <b>6.3</b>         | <b>Procedure .....</b>   | <b>6</b>    |
| <b>7</b>           | <b>Chemical separation procedure by precipitation .....</b>            | <b>7</b>    |
| <b>7.1</b>         | <b>Principles .....</b>  | <b>7</b>    |
| <b>7.2</b>         | <b>Technical resources .....</b>                                       | <b>7</b>    |
| <b>7.2.1</b>       | <b>Equipment .....</b>   | <b>7</b>    |
| <b>7.2.2</b>       | <b>Chemical reagents .....</b>   | <b>8</b>    |
| <b>7.3</b>         | <b>Procedure .....</b>   | <b>8</b>    |
| <b>7.3.1</b>       | <b>Separation of alkaline metals and calcium .....</b>                 | <b>8</b>    |
| <b>7.3.2</b>       | <b>Separation of barium, radium and lead .....</b>                     | <b>9</b>    |
| <b>7.3.3</b>       | <b>Separation of fission products and yttrium .....</b>                | <b>9</b>    |
| <b>7.3.4</b>       | <b>Strontium purification .....</b>                                    | <b>9</b>    |
| <b>7.3.5</b>       | <b>Yttrium extraction .....</b>  | <b>10</b>   |
| <b>7.3.6</b>       | <b>Determination of the chemical yields .....</b>                      | <b>11</b>   |
| <b>8</b>           | <b>Chemical separation procedure by liquid-liquid extraction .....</b> | <b>11</b>   |
| <b>8.1</b>         | <b>Principle .....</b>   | <b>11</b>   |
| <b>8.2</b>         | <b>Technical resources .....</b>                                       | <b>12</b>   |
| <b>8.2.1</b>       | <b>Equipment .....</b>   | <b>12</b>   |
| <b>8.2.2</b>       | <b>Chemical reagents .....</b>   | <b>12</b>   |
| <b>8.3</b>         | <b>Procedure .....</b>   | <b>13</b>   |
| <b>8.3.1</b>       | <b>General .....</b>   | <b>13</b>   |
| <b>8.3.2</b>       | <b>Chemical separation of yttrium .....</b>                            | <b>13</b>   |

|   |  |    |
|---|--|----|
| 8.3.3   | Source preparation to be measured by PC .....  | 14 |
| 8.3.4   | Source preparation to be measured by LSC .....   | 14 |
| 8.3.5   | Determination of the chemical yields .....   | 14 |
| 9   | Chemical separation procedure by chromatography (crown ether resin) .....  | 15 |
| 9.1   | Principles .....   | 15 |
| 9.2   | Technical resources .....  | 15 |
| 9.2.1   | Equipment .....  | 15 |
| 9.2.2   | Chemical reagents .....  | 15 |
| 9.3   | Procedure .....  | 16 |
| 9.3.1   | General .....  | 16 |
| 9.3.2   | Chemical separation of the strontium .....   | 16 |
| 9.3.3   | Determination of chemical yield .....  | 17 |
| 10  | Measurement .....  | 17 |
| 10.1  | General .....  | 17 |
| 10.2  | Liquid scintillation counter .....   | 17 |
| 10.3  | Gas flow proportional counter .....  | 17 |
| 10.4  | Calculation of counting efficiency .....   | 18 |
| 11  | Expression of results .....  | 18 |
| 11.1  | General .....  | 18 |
| 11.2  | Determination of $^{90}\text{Sr}$ in equilibrium with $^{90}\text{Y}$ .....  | 18 |
| 11.2.1  | Calculation of the activity per unit of mass .....   | 18 |
| 11.2.2  | Standard uncertainty .....   | 19 |
| 11.2.3  | Decision threshold .....   | 19 |
| 11.2.4  | Detection limit .....  | 19 |
| 11.3  | Determination of $^{90}\text{Sr}$ by the $^{90}\text{Y}$ .....   | 19 |
| 11.3.1  | Calculation of the activity per unit of mass .....   | 19 |
| 11.3.2  | Standard uncertainty .....   | 20 |
| 11.3.3  | Decision threshold .....   | 20 |
| 11.3.4  | Detection limit .....  | 21 |
| 11.4  | Determination of $^{90}\text{Sr}$ in presence of $^{89}\text{Sr}$ when $^{90}\text{Sr}$ is in equilibrium with $^{90}\text{Y}$ ..... | 21 |
| 11.4.1  | Calculation of the activity per unit of mass .....   | 21 |
| 11.4.2  | Standard uncertainty .....   | 22 |
| 11.4.3  | Decision threshold .....   | 22 |
| 11.4.4  | Detection limit .....  | 23 |
| 11.5  | Confidence limits .....  | 23 |
| 12  | Test report .....  | 23 |
| Annex A (informative) Examples of evaluation models ..... |  | 25 |
| Bibliography .....  |  | 32 |