DOSE ASSESSMENT IN POPULATION LIVING ON CONTAMINATED TERRITORIES AT THE REMOTE PERIOD AFTER THE CHERNOBYL ACCIDENT

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METHODS FOR DOSE ASSESSMENT

MODELS

DETERMINISTIC
Soil → Plants → Animals → Human

Radioecological model ECOSYS-87 (H. Muller, G. Pröhl)

Ecological model’s elements & parameters corrected by the WBC-measurements (I.A. Likhtarev, P. Jacob)

PHENOMENOLOGICAL
Empirical data on radiological environment

\[ D = K_{milk} \cdot C_{milk} + K_{pot} \cdot C_{pot} \]

\( K_{milk}, \ K_{pot} \) – coefficients of relationship between specific activity of \(^{137}\text{Cs}\) in milk & potato and dose;

\( C_{milk}, \ C_{pot} \) – average specific activity of \(^{137}\text{Cs}\) in milk, potato in a settlement

\[ q = 1 \cdot C_{milk} + 1.5 \cdot C_{pot} \]

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SCHEME OF THE EXPOSURE PATHWAYS CONSIDERED IN ECOSYS-87

Activity in Air and Precipitation

Plants

Edible Parts of Plants

Processed Products

Animals

Soil

Soil Sink

Animal Products

INTERNAL (INGESTION) DOSE
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WBC in BELARAS

IAEA EPR Conference 2015
Data Base for the WBC-measurements for the period 1989 – 2014 contains more than 2,8 millions records
### DIRECT AND INDIRECT FACTORS INFLUENCING INTERNAL DOSE FORMATION

<table>
<thead>
<tr>
<th>Direct Factors</th>
<th>Indirect Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Soil contamination of agricultural lands near the settlement</td>
<td>• Social — Number of inhabitants in the settlement</td>
</tr>
<tr>
<td>• Main dose-forming products activity</td>
<td>• Natural — access of forest food products for rural inhabitants</td>
</tr>
<tr>
<td>• Consumption rate of main dose-forming products</td>
<td>• Ecological — prevailed type of soil of agricultural lands</td>
</tr>
</tbody>
</table>

![Graph showing transfer factor vs. distance to forest](image)

![Graph showing number of population vs. size of settlement](image)

![Graph showing transfer factor vs. number of population](image)
INTERNAL DOSE VS. SOIL CONTAMINATION, 2009

<table>
<thead>
<tr>
<th>Region</th>
<th>Correlation coefficient</th>
<th>Confidence level for Correlation coefficient</th>
<th>Parameters of Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Free member</td>
</tr>
<tr>
<td>Polesje</td>
<td>0.98</td>
<td>0.0006</td>
<td>0.2018</td>
</tr>
<tr>
<td>Center</td>
<td>0.91</td>
<td>0.0125</td>
<td>0.1150</td>
</tr>
<tr>
<td>North-East</td>
<td>0.92</td>
<td>0.0002</td>
<td>0.0579</td>
</tr>
</tbody>
</table>
**Region** | **Correlation coefficient** | **Confidence level for Correlation coefficient** | **Parameters of Equation** | **Regression coefficient**
--- | --- | --- | --- | ---
Polesje | 0.87 | 0.0006 | 0.1570 | 0.0028
Center | 0.91 | 0.0128 | 0.0767 | 0.0007
North-East | 0.95 | 0.0002 | 0.0342 | 0.0008
### AVERAGE ANNUAL EFFECTIVE DOSE DISTRIBUTION

#### Parameter | AAED
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1992</strong></td>
<td><strong>2004</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Average, mSv/year</td>
<td>0.99</td>
</tr>
<tr>
<td>Median, mSv/year</td>
<td>0.70</td>
</tr>
<tr>
<td>Standard Geometric Deviation</td>
<td>2.01</td>
</tr>
<tr>
<td>Low Limit of the Average Error, mSv/year</td>
<td>0.35</td>
</tr>
<tr>
<td>Upper Limit of the Average Error, mSv/year</td>
<td>1.41</td>
</tr>
</tbody>
</table>
### Number of Settlements and Population in Which Dose Exceeded and Is Equal 1 mSv/year

<table>
<thead>
<tr>
<th>Dose, mSv/year</th>
<th>Region</th>
<th>2009</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Settlement</td>
<td>Number of Population</td>
<td>Number of Settlement</td>
</tr>
<tr>
<td>&gt;1</td>
<td>Brest, Gomel, Mogilev</td>
<td>191</td>
<td>48 128</td>
</tr>
<tr>
<td>=1</td>
<td>Gomel</td>
<td>2</td>
<td>6 214</td>
</tr>
<tr>
<td>≥1</td>
<td></td>
<td>193</td>
<td>54 342</td>
</tr>
</tbody>
</table>
IMPLEMENTATION

The Catalogue of AAED of Settlements of Belarus, along with the density of soil contamination is the basis for next in turn regular document of the Council of Ministers of the Republic of Belarus for classification of the settlements by zones of radioactive contamination. It will be actual for the period 2016 - 2020
THANK YOU!