Test what you eat!

Monitoring radioactivity in the food chain

Did you know that, since 2013, the total beta activity in animal feed products being exported to Belarus must be shown to be lower than 600 Becquerel per kilogram? And that SCK•CEN carries out these checks on behalf of the professional association of compound feed manufacturers in Belgium? It is just one of the many investigations that SCK•CEN conducts into radioactivity in the food chain.

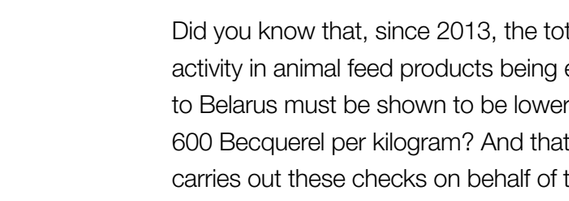
The laboratories for low-level radioactivity measurements (LRM) at SCK•CEN offer a wide range of analyses of radioactivity in foodstuffs. These analyses have been performed for several years for the Federal Agency for Nuclear Control (FANC) and the Federal Agency for Food Chain Safety (FAVV). The criteria for testing foodstuffs and animal feed for radioactivity were established primarily in the aftermath of the nuclear disaster at Chernobyl in 1986. In that same year, the European Commission enacted the first set of regulations laying down the maximum permissible levels of radioactivity in various imported foodstuffs.

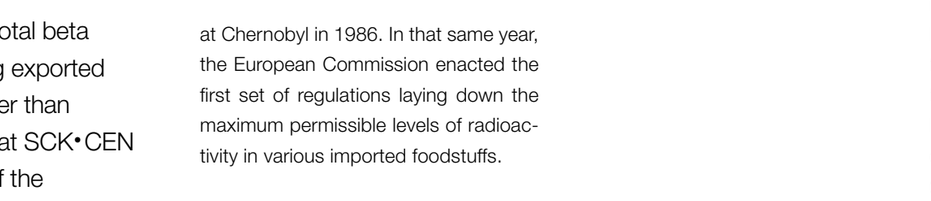
Fast evolving legislation

Today, nearly 30 years after that nuclear disaster, there is still post-Chernobyl legislation in place that applies to the import of certain foodstuffs. The accident in Fukushima in 2011 led to new guidelines for food testing on products being imported from Japan. Nuclear accidents such as those at Chernobyl and Fukushima have left their mark on permissible radioactivity levels which Europe and individual countries set in their legislation. What is permissible today may be outdated tomorrow. The rules are determined by safety considerations, as well as by political and economic motives. There are also big differences between types of foodstuffs: certain products have the tendency to accumulate radioactivity, for example mushrooms and red currants; and this also holds true for the animals that eat them.

Export checks

Besides the tests commissioned by the government, the laboratories also provide many services to other third parties. Industries often have conditions imposed upon them by the regulatory authorities. With SCK•CEN they have a partner to carry out radioactivity measurements. These tests mostly concern foodstuffs requiring export certification. The criteria for those checks may be highly specific. In 2013, the total beta activity in animal feed products for export to Belarus had to be shown to be lower than 600 Becquerel per kilogram. The professional association of compound feed manufacturers (BEMEFA) in Belgium took the initiative to chart radioactivity levels in compound feeds for its members in order to simplify checks. For this purpose, BEMEFA signed a contract with SCK•CEN. Quite an attractive proposition, particularly as the association numbers around 170 manufacturers representing 99% of domestic production. Today, Belarus is the only country to require such export checks. Since the laboratories have a wide range of detectors and measuring equipment, SCK•CEN was more than able to satisfy this demand. This is important, as the smooth export of Belgian animal feed products is dependent on highly reliable radioactivity analyses.





Drinking water testing

Not only food must be tested; high quality drinking water is very important as well. At the end of 2013, the revised European drinking water directive was published; a piece of legislation that had been in preparation for some time. Every Member State has two years in which to implement the directive, which sets out which radioactivity checks must be performed on drinking water. FANC coordinates the implementation of the directive in Belgium. This task will involve a whole host of additional analyses.

Implementation of the directive will take place in two phases. In the first phase, all drinking water sources will undergo a thorough analysis. In the second phase, the periodical checks may be based on so-called screening techniques using overall alpha and beta tests for which upper limits have been laid down. If the tests show that the limit values have not been exceeded, no further nuclide-specific analyses are required. If the screening values are exceeded, decision trees can help to determine which additional tests are required.

Cast-iron guarantee

Testing by screening does not give a 100% cast-iron guarantee that the total indicative dose (the essential parameter) does not exceed the limit value in all cases. This will for instance be the case with a spring of an unknown water type. In that case, screening will have to be combined with prior knowledge of the radiological properties of the drinking water.

This prior knowledge will be collected in phase 1, in which the drinking water is tested for the presence of a whole series of specific nuclides. These targeted and complex analyses will assess trace radionuclides that may be of either natural or anthropogenic origin. To perform all these analyses, specific and specially designed measurement methods are needed with nuclide-specific sensitivities. Testing will also have to be efficient and fast if large numbers of samples have to be checked.

Gamma ray spectrometry

Radioactivity testing of food is done primarily by means of gamma ray spectrometry. This technique does not involve complex sample handling, can detect large quantities of radioactive products, and provides a relatively fast determination of radioactivity levels. Radioactivity testing of food samples in the low-level radioactivity measurement laboratories is done primarily within the framework of various programmes of the Belgian agencies FAVV and FANC. Samples are usually brought to SCK•CEN, but in some cases laboratory staff also go on site to take samples.

Each year, FAVV draws up a programme for food sampling on Belgian territory, plus samples of imported foodstuffs. FANC coordinates the Belgian radiological monitoring programme, which also includes a series of food and drinking water checks.

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SCK•CEN has been carrying out these analyses for quite a few years now, and holds the necessary accreditations to do so, partly on the basis of an accreditation (ISO 17025, issued by BELAC) of the test methods.

The search for faster test methods

Besides radioactivity tests in food, the neutron activation analysis laboratory also carries out checks on food additives. The laboratory analysts check whether the concentrations of certain elements (e.g. selenium and iodine) correspond to the values cited by the manufacturers of the products. The checks consist mainly of routine tests. Where there is a general trend towards shorter turnaround times and detection limits remaining as low as possible, SCK•CEN responds to this in order to keep its services competitive. Accordingly, research is being carried out into newer and faster test methods.

Faster and less labour-intensive

More specifically, the laboratory for low-level radioactivity measurements is investigating how the radionuclides radon-222 and radium-226 in drinking water can be determined more quickly and with less labour-intensive techniques. It is also working on methods to determine actinium-228 and lead-210 radionuclides with a sufficient degree of sensitivity, as well as on rapid test methods to determine strontium-90 in milk and foodstuffs.

Fast testing methods are particularly essential in food checks shortly after a nuclear incident. In this cases, it needs to be decided quickly whether or not a particular foodstuff can be consumed safely. In this context, the laboratories also participate in emergency preparedness exercises in which the sampling of green vegetables and the corresponding laboratory analyses are tested under conditions mimicking a nuclear incident.