

SUMMARY:  
MONITORING OF  
POSSIBLE HEALTH  
EFFECTS  
OF LIVING IN THE  
VICINITY OF  
NUCLEAR SITES IN  
BELGIUM  
II

Part A: Thyroid Cancer Incidence

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# WHO WE ARE

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**SCIENSANO can count on more than 700 staff members who commit themselves, day after day, to achieving our motto: Healthy all life long. As our name suggests, science and health are central to our mission. Sciensano's strength and uniqueness lie within the holistic and multidisciplinary approach to health. More particularly we focus on the close and indissoluble interconnection between human and animal health and their environment (the "One health" concept). By combining different research perspectives within this framework, Sciensano contributes in a unique way to everybody's health.**

**For this, Sciensano builds on the more than 100 years of scientific expertise of the former Veterinary and Agrochemical Research Centre (CODA-CERVA) and the ex-Scientific Institute of Public Health (WIV-ISP).**

# Sciensano

## Chemical and physical health risks – Risk and health impact assessment

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## FOREWORD

In 2008, the Belgian Minister of Social Affairs and Public Health commissioned a study to assess, by means of an epidemiological study at the national level, the possible health risks for populations living in proximity of nuclear power plants or other facilities that can be at the origin of a release of radioactive material. The results were published in 2012. The present study is the follow-up thereof, requested on behalf of the Belgian Federal Parliament. The study has been carried out by Sciensano, ex-Scientific Institute of Public Health (WIV-ISP), in close collaboration with the Belgian Cancer Registry (BCR) and the Federal Agency for Nuclear Control (FANC).

For this study, an expert committee has been set up with the following members:

- Professor Elisabeth Cardis, Institute for Global Health (ISGlobal), Barcelona, Spain
- Dr Enora Clero, Institute for Radiological Protection and Nuclear Safety (IRSN), Fontenay-aux-Roses, France
- Dr Bernd Grosche, retired; formerly Federal Office for Radiation Protection (BfS), Munich, Germany

The authors thank the members for their participation in the expert meeting (July 12<sup>th</sup> 2018) and the review of the report.

# SUMMARY

## INTRODUCTION

At the end of 2007, the German KiKK-study on childhood cancer boosted the public concern about the possible health risks associated with living in the vicinity of nuclear power plants worldwide. In August 2008, a radiological incident happened at the Institute for Radio-Elements situated in the nuclear site of Fleurus. In response, the Belgian Minister of Social Affairs and Public Health commissioned a study to assess, by means of an epidemiological study at the national level, the possible health risks for populations living in proximity of nuclear power plants or other facilities that can be at the origin of a release of radioactive material. The Minister's request was first discussed in a multidisciplinary think tank. One of the conclusions was that the study should be considered as a first approach to study possible health risks of living in the vicinity of nuclear sites in Belgium. The results of this study were published in 2012. No higher incidence of thyroid cancer was observed around the nuclear power plants of Doel and Tihange. It was impossible to draw any scientific conclusions for the Belgian territory around the French power plant of Chooz because of instability of the results due to the small population size. For the nuclear sites of Mol-Dessel and Fleurus, a slightly higher incidence of thyroid cancer as compared to the regional average was observed, but similar and higher incidences were also seen at other locations without nuclear sites. Close to the site of Mol-Dessel, the incidence of acute childhood leukemia was higher than expected on the basis of the national average value, but this observation was based on a very low number of cases.

The present study is the follow-up thereof, requested on behalf of the Belgian Federal Parliament and follows the recommendations formulated in 2012:

- "To repeat the epidemiological monitoring within five years, since by that time more cancer data will have become available."
- "To make health data available at smaller geographical level and to develop capacity in small area statistics, so that the next iteration will be more profitable."

The present study is carried out by the Consortium Sciensano (ex-Scientific Institute of Public Health), the Federal Agency for Nuclear Control, and the Belgian Cancer Registry.

## EPIDEMIOLOGICAL STUDY

The present study has an ecological design and investigates the possible health risks for populations living around the major nuclear installations, the nuclear power plants of Doel and Tihange and the nuclear sites of Fleurus and Mol-Dessel. Both in Fleurus and in Mol-Dessel, there is a

combination of industrial and research activities in the nuclear sector.

The study focuses on thyroid cancer in children and adults of all ages. Thyroid cancer is known to occur with higher incidence after exposure to radioactive isotopes of iodine, and latency times are generally long, often a few decades. The Chernobyl accident has confirmed the fact that children are more sensitive than adults and has demonstrated that latency time can be a lot shorter when exposure occurs at younger age and can also diminish with increasing exposure. All nuclear installations examined in this study could potentially be a source of radioactive isotopes of iodine.

More specifically, the study has investigated whether the number of new cases of cancer, or cancer incidence, is higher than expected in the vicinity of the nuclear sites. In a second phase, the study investigated whether there was evidence for a gradient in the occurrence of these cancers with increasing surrogate exposures from the nuclear sites. To this purpose, surrogate exposure was defined, subsequently based on (i) distance to the nuclear site, (ii) wind direction frequency and (iii) hypothetical radioactive discharge estimates<sup>1</sup>. The present study was performed at the level of the statistical sector. Information on statistical sectors is available in the data coming from the InterMutualistic Agency that are reliable from 2006. As a consequence, the present study covered the years 2006 to 2014.

Results showed no higher incidence of thyroid cancer around the nuclear power plants of Doel and Tihange. No gradient for thyroid cancer incidence was observed with the different types of exposure considered in the 20 km around the site (decreasing distance and increasing wind direction frequency). For Mol-Dessel, no evidence for a higher thyroid cancer incidence was observed. The results did not show a significant gradient for thyroid cancer incidence with exposures in the 20 km around the site. In the close vicinity of Fleurus, there was an indication for a slightly higher incidence but this was not statistically significant. A significant gradient for thyroid cancer incidence was observed with the different types of exposure considered in the 20 km area around the site (decreasing distance, increasing wind direction frequency and increasing exposure to estimated hypothetical radioactive discharges).

The present study was performed at the level of the statistical sector. The statistical sector is the smallest basic areal unit defined by the Belgian statistical office and for which cancer cases and population data are available. Compared to the previous study at the level of the communes, such analyses reduce misclassification of the exposure and ecological bias due to reduced within-area variation of the exposure. However, it did not solve this

<sup>1</sup> More precisely: a modelled estimate of the direct radiological impact of a hypothetical release of radioactive gaseous substances from a nuclear plant. Since no actual data were

available, the strictly hypothetical release from the sites was considered to take place under most probable meteorological and technical conditions to estimate an effective release height.

problem. Such an ecological study design allows offering some answers to the public concern of whether there is or might be an increased occurrence of a given disease around a potential pollution source, but since such a study is descriptive by nature it does not allow to draw conclusions with regard to any possible causal relationships. Neither does this type of study allow any conclusion at the individual level.

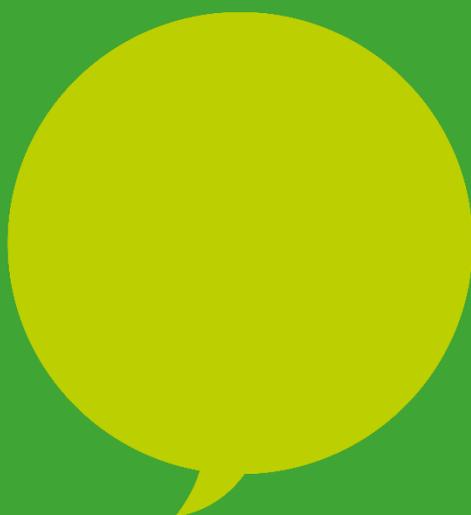
## **CONCLUSIONS**

The possible influence of living in the vicinity of the Belgian nuclear sites has been investigated through a close collaboration between the Federal Agency for Nuclear Control, the Belgian Cancer Registry and Sciensano.

No evidence was found for more incident cases of thyroid cancer in the vicinity of the nuclear power plants. Regarding the industrial and research nuclear sites, no evidence for a higher incidence in the vicinity of Mol-Dessel was observed. In the close vicinity of Fleurus, there was an indication for a slightly higher incidence but this was not statistically significant. A significant gradient for thyroid cancer incidence was observed with the different types of exposure considered in the 20 km area around the site (decreasing distance, increasing wind direction frequency and increasing exposure to estimated hypothetical radioactive discharges). Ecological studies are descriptive and as such do not allow inferring causal relationships on the origin of variations in incidence. Neither do they provide information at the individual level. Thyroid cancer incidence presents geographical variability between the Regions but also within Regions. The clustering of statistical sectors with higher incidence of thyroid cancer can also be observed at places where there are no nuclear sites.

## CONTACT

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