# AREVA Computer Codes for Radiological Consequence Analysis

Silke Torchiani, Oliver Buss, Stéphane Haussler, Oliver Ludwik, Axel Hoefer, Christoph Stiepani
AREVA GmbH, Kaiserleistr. 29, 63067 Offenbach, Germany

To assess radiological consequences, first an evaluation of the source term (i.e. activity release into the environment) has to be performed. This is followed by atmospheric dispersion calculations and dose assessment for the population. There are different purposes for a radiological consequence analysis, among which is the design and licensing of a nuclear installation as well as emergency preparedness and emergency response. For the different purposes, dedicated software tools are needed, which have to be sufficiently flexible to meet current and future needs. In particular, the user shall be able to take into account requirements set by a safety authority or client and to include specific information on a nuclear power plant. This paper describes three different software tools which could be used to calculated activity release from NPP to the environment in different accidental situation.

*Key Words*: Accident Management, Activity release, radiological calculation, radiological data base, Source Term Evaluation, Dose Evaluation, emergency response, emergency preparedness, safety assessment, radiation monitoring, atmospheric dispersion, airborne release, high dimensional ODE solver, high dimensional DE solver, ordinary differential equation solver, COMPACT, DOT, CRCS

## 1. Introduction

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## 2. CompAcT

CompAcT is AREVA's general purpose compartment code for activity transport. It is an intuitive GUI-based program that allows the user to easily model and evaluate arbitrarily complex activity transport problems, taking into account initial inventories, radioactive decay and build-up, activity flows, sources, depositions, filtering, and chemical conversions.

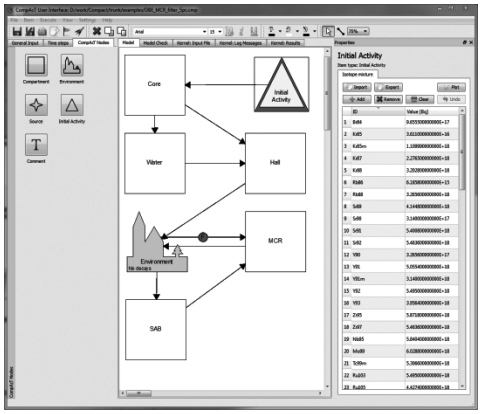


Fig.1: GUI-based modelling of radioactive release path

Major strengths of CompAcT are its numerical stability, flexibility, short computation times, and the full reproducibility of its results.
CompAcT provides integrated quality assurance by preventing user input errors and by internally cross-checking the computation results.
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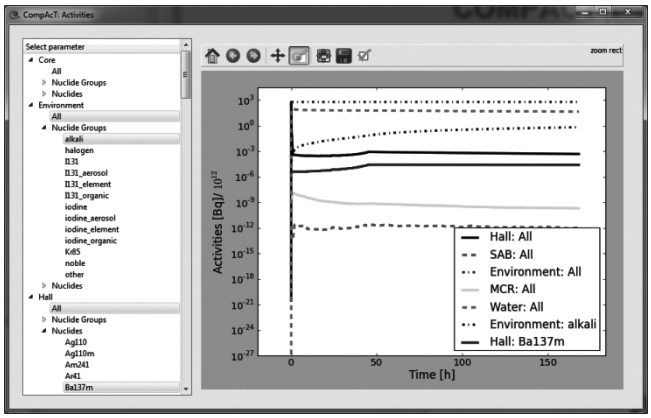


Fig.2: Result presentation in graphical form

## 3. DOT

The AREVA application DOT computes the dose in the environment resulting from a given activity release. It is based on Gaussian atmospheric dispersion and the German Calculation Base for dose assessment and contamination of foodstuff.
The direct linking of CompAcT and DOT provides a complete tool suite for quick assessment of the radiological consequences on the population for accident scenarios.

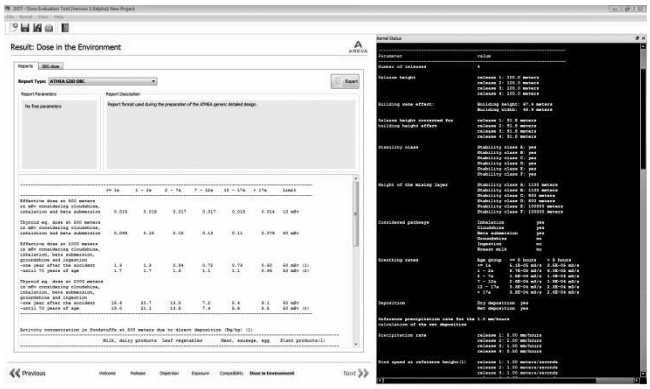


Fig.3: DOT result page

## 4. CRCS

The AREVA computer system CRCS (Central Radiological Computer System) supports the radiation protection staff of a nuclear site during normal operation as well as nuclear emergency situations.
It is directly installed at the nuclear power plant and has real-time access to plant conditions (e.g. primary coolant parameters, core inventory, and system specific parameters such as filter factors and ventilation rates), to measuring devices located at the plant site, and in its surrounding area.

*Normal operation*

The system samples radiological and meteorological data during normal operation. The data could be used for statistic evaluations, training of emergency situations and monitoring of measurements. It could deliver meteorological references during emergency situations. The system can also be used to provide time history support during auditing by public authorities.

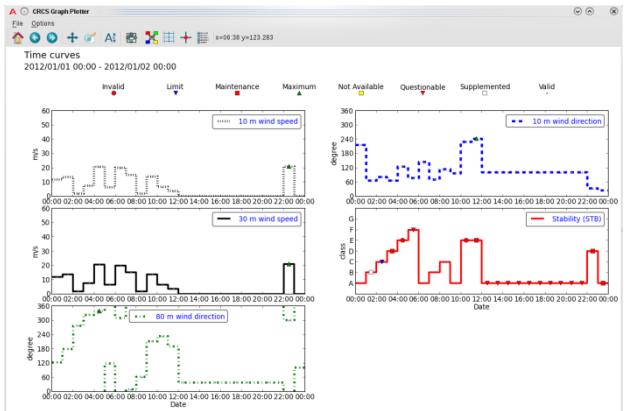


Fig.4: time curves of meteorological measurements

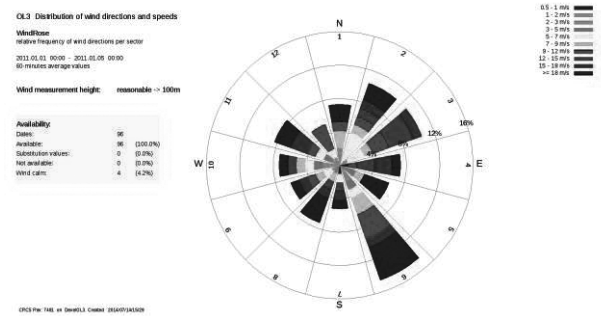


Fig.5: statistic evaluation of meteorological data

*Accidental situations with radioactive release*

CRCS supports the radiation protection staff of a nuclear site during a nuclear emergency in estimating the radioactive source term of an accident, in predicting the impact on the surrounding area, and in minimizing the impact on the population.

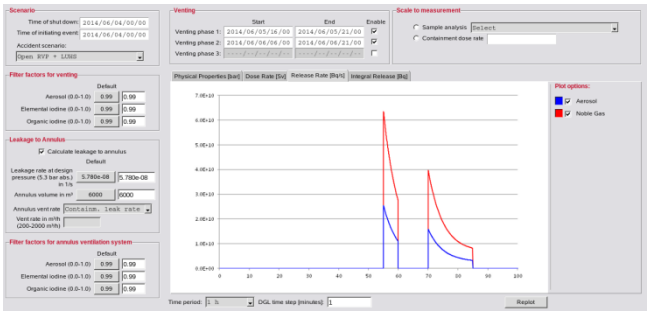

Fig.6: calculated release rates during filtered containment venting

The CRCS design accounts for the fact that real life accidents will not follow fixed scenarios and will deviate from the assumptions of the safety analysis report.
With CRCS, the analyst can combine this real-time data with a variety of accident scenario models in order to provide a best-estimate prognosis of the dose to the population which also accounts for real-time weather data.

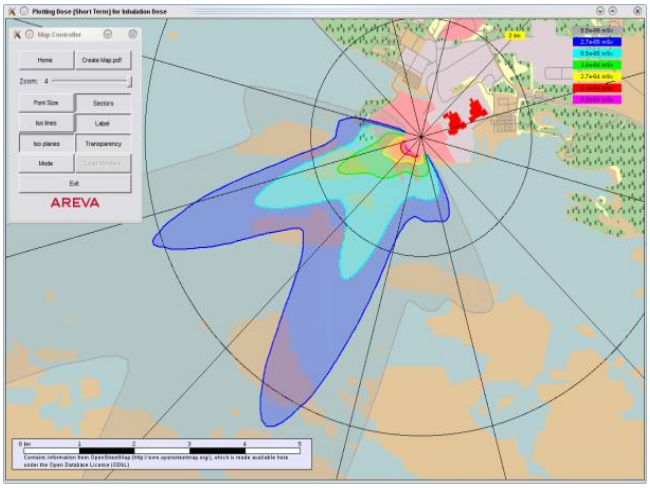


Fig.7: predicted radiological impact to the environment during radioactive release