

VIEWRISK: RISK CALCULATION SOFTWARE

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ViewRisk is a new software tool to calculate individual and societal risks presented by chemical, oil, gas and pharmaceutical facilities. It can also be used to assess the risks associated with the road, rail and pipeline transport of hazardous materials.

Within the specialised risk market the software is currently unique, in as much that it uses pre-configured 'components' held in a user library. These components contain all the technical know how (i.e. frequency and consequence information, are configured for point and click, and are re-useable.

Essentially, all the skill of the risk analyst is contained within the components. The user simply needs to know What have I got? and Where is it? The user then selects the components and positions appropriate ones on a map of the facility under investigation.

This paper outlines the development of ViewRisk, which was part-funded by the UK Health and Safety Executive (HSE), and the intended use of the software by HSE in determining land-use planning zones (around major hazard installations). The paper also describes the key features of the software, and how the software can greatly reduce analysis time and cost, and ensure consistent results regardless of user.

INTRODUCTION

Part funded by the UK Health and Safety Executive, ViewRisk is a tool to calculate and present individual and societal risks.

The software uses pre-configured 'components' held in a user library. For example, a component for a chlorine tank would contain all the information related to accident/leak scenarios, the likelihood of each scenario and the resultant consequences.

Using pre-configured components no frequency estimation or consequence modelling is needed. The user simply needs to know *what have I got?* and *where is it located?*

The components are positioned on an appropriate map (e.g. site plan), and the results calculated. The results are presented as:

- risk contours overlaid on a map or photograph;
- risk transects (e.g. a graph of risk with respects to distance);
- point risk (e.g. simply move the cursor over the screen to see the risk at any location);
- major risk contributors (e.g. view the contribution of hazards to the overall risk or risk at any given location);
- societal risks (e.g. as an expectation value or as a graph).

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The principal benefits of ViewRisk can be summarised as follows:

- greatly reduced analysis time and cost; and
- with pre-configured components, consistent results regardless of user.

The following sections outline the development of ViewRisk, its key features, and the intended use of the software by the UK Health and Safety Executive (HSE) in determining land-use planning zones (around major hazard installations).

DEVELOPMENT

ViewRisk was conceived in June 2001 as a further development of the risk calculation and analysis tool, Riskplot Graphic.

In 1990 Riskplot was developed by Environmental Resources Management (ERM) to minimise the potential for calculation error, and to reduce study time. Following extensive use, Riskplot was commercially released in 1995. With further development for UK HSE between 1998 and 2000, an Enhanced version was released in June 1999, followed by Riskplot Graphic in September 2000.

Since this time Riskplot Graphic was used by industry, government and consultants to calculate and present the risks associated with major hazard installations, major hazard pipelines, and the transport of hazardous materials by road and rail.

In particular, Riskplot Graphic was used by HSE as part of the EU Assurance Project investigating the uncertainty of QRA results to input and modelling approaches [1, 2]. It was also used by the Irish Health and Safety Authority as part of its activities in implementing Seveso II.

In June 2001, ERM presented the concept and aims of ViewRisk, that is:

- to increase assessment speed whilst maintaining assessment accuracy;
- input to be pre-defined at corporate/specialist level for use by non-specialists;
- easy to use, with intuitive and interactive input;
- extensive set and depth of results without the need for time consuming re-runs;
- use of the established calculation engine within Riskplot Graphic.

Following this, as part of an internal evaluation, HSE agreed to part-fund the development of ViewRisk. This evaluation focused on HSE's risk and hazard assessment tools used for land-use planning. The evaluation identified a number of areas where improvements were necessary to HSE's methodology for the assessment of risks from activities involving toxic substances. Various approaches were considered, including streamlining the risk assessment process using ViewRisk.

The advantages to HSE of using ViewRisk include:

- the utilisation of 'components' makes the method simple to use;
- isopleths for different harm criteria are considered in a single study and weightings can be applied to them to produce a range of results;
- it has the ability to calculate risk of death by a cumulative method;

- results from a range of source term and dispersion models can be incorporated as required;
- individual risk and societal risk can be calculated simultaneously;
- ViewRisk in future may be integrated with a national population database tool;
- with the same 'components' anyone outside of HSE would be able to replicate HSE's results.

The principal development team consisted of: Dr Paul Davies (ERM, original concept and Development Director); Daniel Quinn (ERM, quality control and Development Manager); David Carter (HSE, advisor) and John Cooper (ERM Associate, programmer).

As with many software development programs, it took far longer to bring ViewRisk to fruition than planned, and the first version was only released in February 2005. The principal problems during development were related to interfacing of the components.

KEY FEATURES

Figure 1 illustrates the input to, and output from ViewRisk. The input is illustrated by the light grey rectangles and the output by the dark grey rectangles.

Essentially, the user imports one or more electronic maps of the site and surrounding area, places and positions hazards and populations, and selects the most appropriate weather. ViewRisk then calculates the results required.

The pre-configured hazards, populations and weather are selected from a user library. For example, a hazard component might be a chlorine vessel, a population component might be a typical urban population, community centre or control room, and a weather component might be the rich weather set for say, the north-east of England. The structure of a hazard component is illustrated in Figure 2.

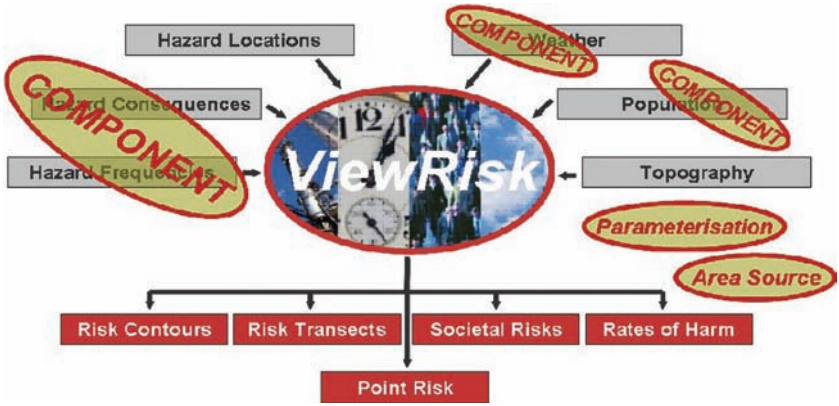

Figure 1. Input to and output from ViewRisk

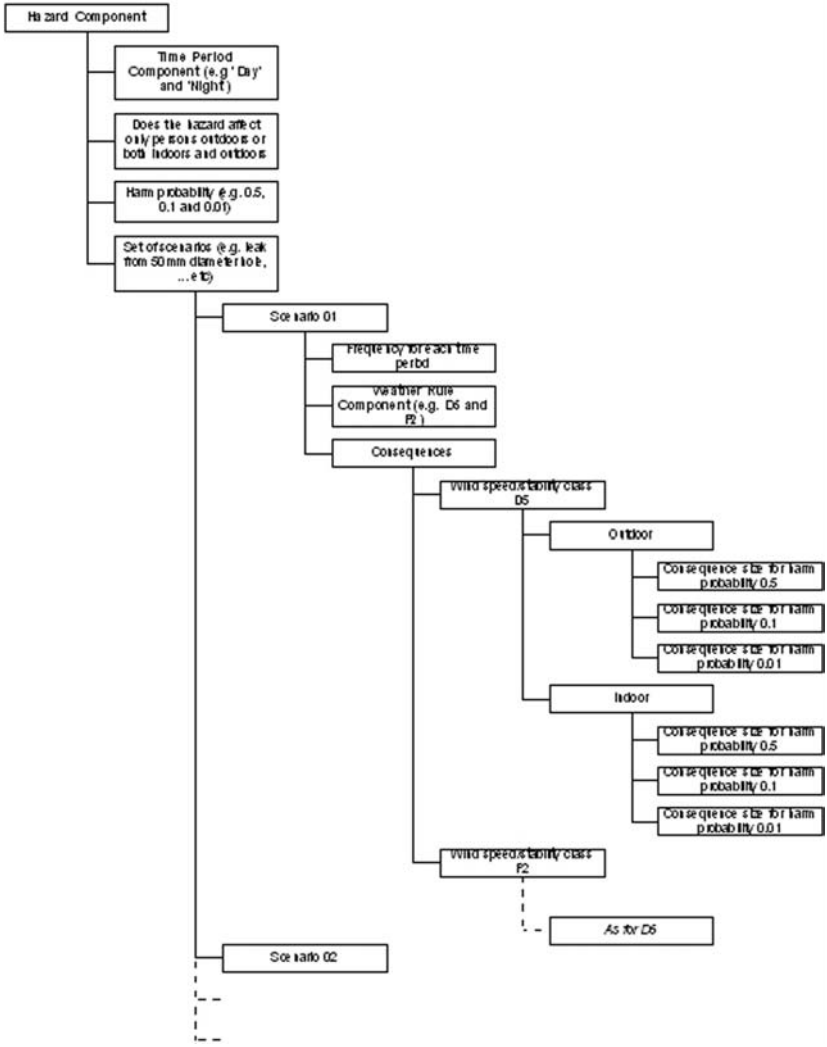

Figure 2. Overview screen for a parameterised chlorine tank component

The user also specifies time periods of interest (e.g. night and day, weekends), topographic features that might influence the consequences (e.g. a hill altering the dispersion of a gas), and any weather rules that might apply (e.g. for simplicity, the user might wish to aggregate certain weather conditions).

In addition, the hazard might be described by a *parametrised* or *area source* component. Basically, the *parameterised* component represents a range of say, chlorine vessels (e.g. 20–80 te) rather than a single discrete vessel (e.g. 30 te). This increases the component's utility and greatly reduces the number of components held in the library. Essentially, the component requires the user to enter some base input, such as, vessel capacity, and then ViewRisk uses this to calculate the associated range of consequences using a user specified 'in-built' parameterised equation. By comparison, the *area source* component can be used to represent hazards whose location might vary. For example, within a given area, drums might be stored for some or all of the time at *location X*, and equally at *location Y*, *location Z*, etc.

Although ViewRisk is principally aimed at the calculation of risks to people, people need not be the target. The focus can be any specified target, for example, the environment (e.g. a river, or site of special scientific interest), plant equipment (e.g. storage vessels), or buildings (e.g. control room, administration building, community centre). As such, the calculated risk is case specific, and may relate to fatalities, injury, pollution, money, or a specified level of damage, etc.

INTENDED USE - GENERAL

Typical uses of ViewRisk include:

- land-use planning/Hazardous Substances Consent;
- protection of persons in Occupied Buildings;
- Seveso II/COMAH/MHI risk assessments;
- helping to establish ALARP;
- identifying effective risk reduction measures;
- site selection;
- optimising plant layout;
- comparing options/designs; and
- selecting transport routes.

Essentially, ViewRisk is a decision tool, providing management with additional information and insight into managing risks.

A recent example of its use involved the assessment of a major chlorine manufacturing facility covering transfer, compression, cooling, filtering, liquefaction and storage. With the aid of parametrised hazard components, no consequence analysis was required, and very rapidly 21 site specific components were made. Similarly, with the weather component pre-configured there was no need to analyse weather data; the weather component was simply selected from the library. As well as individual risks, societal risks were calculated, and this simply required a location map to be loaded and the user to *click* population locations and assign an appropriate population component.

Figures 3 to 8 illustrate screen-shots for a typical parameterised hazard component for a chlorine storage tank.

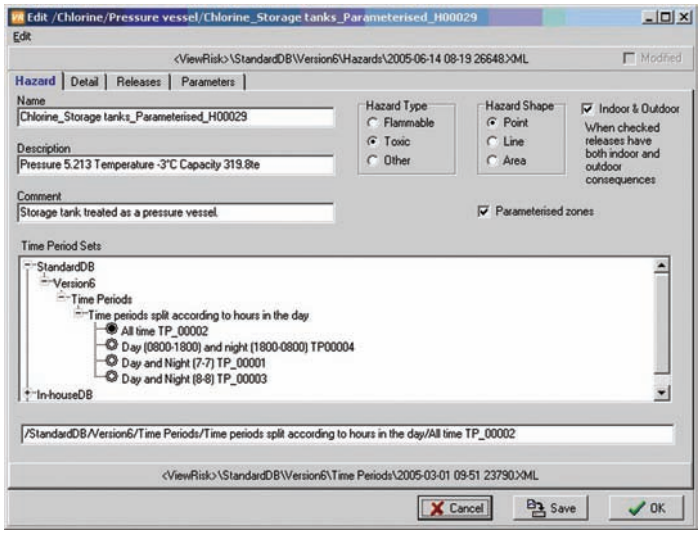

Figure 3. Overview screen for a parameterised chlorine tank component

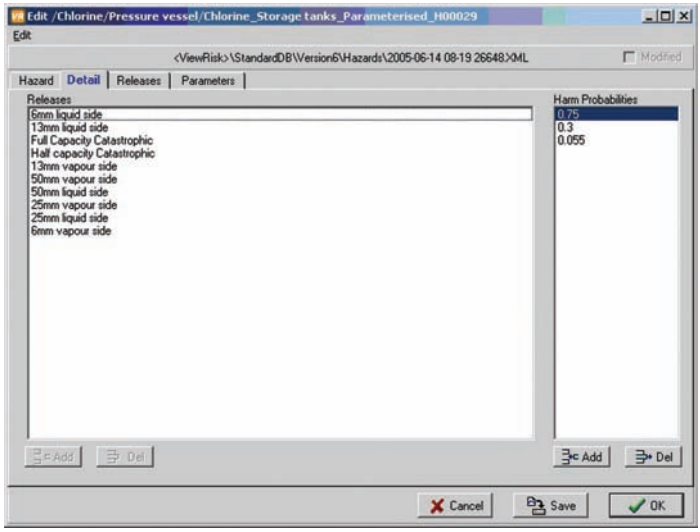

Figure 4. Release categories and harm probabilities associated with a parameterised chlorine tank component

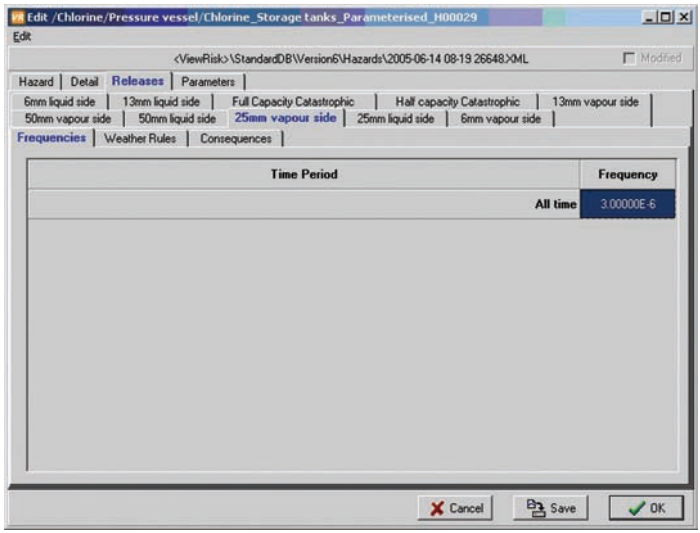

Figure 5. Frequency of a release from a 25 mm diameter hole from a parameterised chlorine tank component

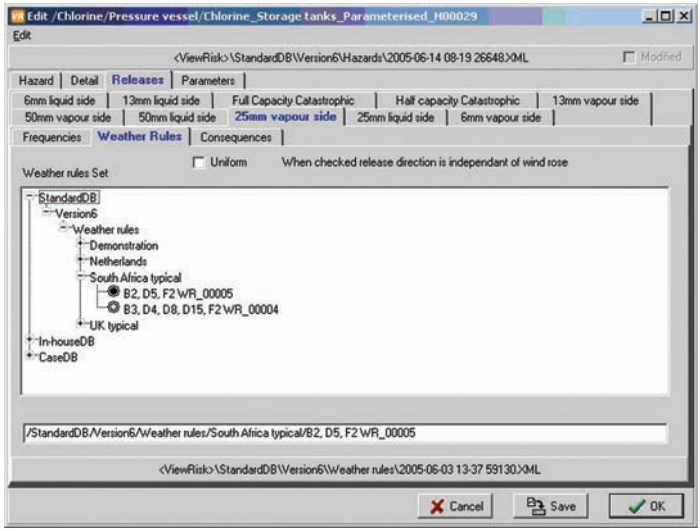

Figure 6. Weather rules associated with a parameterised chlorine tank component

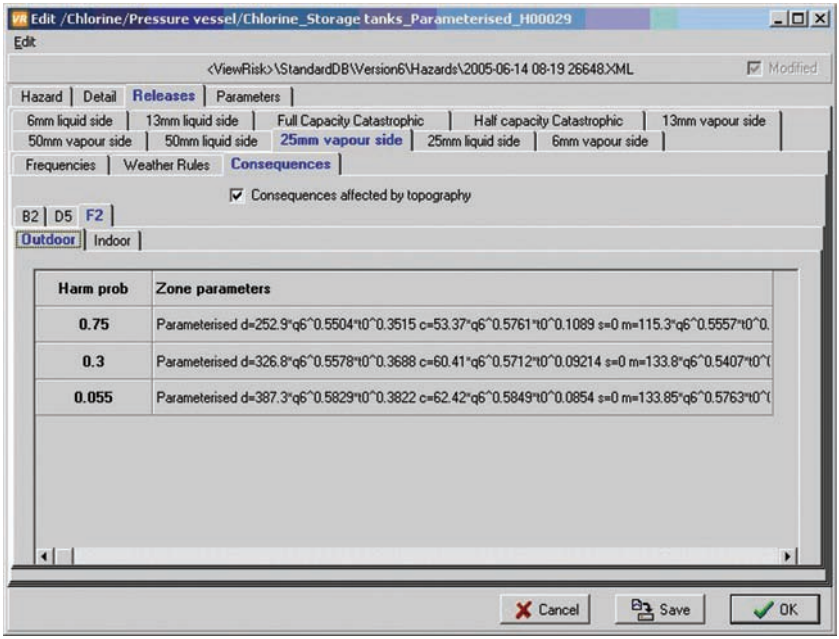

Figure 7. Parameterised equations used to determine the consequences associated with a parameterised chlorine tank component

INTENDED USE BY UK HSE

A project is proposed by HSE to assess the work required to implement ViewRisk within HSE. It is proposed that the project will have three phases to ensure that the new method gives adequate functionality in HSE's land-use planning assessments. A review is proposed at the end of each phase.

The proposed three phases are:

- Phase 1 – implementation of ViewRisk for a passively dispersing substance;
- Phase 2 – implementation of ViewRisk for a liquefied toxic gas; and
- Phase 3 – implementation of ViewRisk for generic substances.

A new method for the calculation of risks for land-use planning purposes will be developed throughout the project.

CONCLUSIONS

ViewRisk is a *time-saving* software tool for the calculation of individual and societal risks. This saving is a result of representing input as re-useable *components*. The software is also

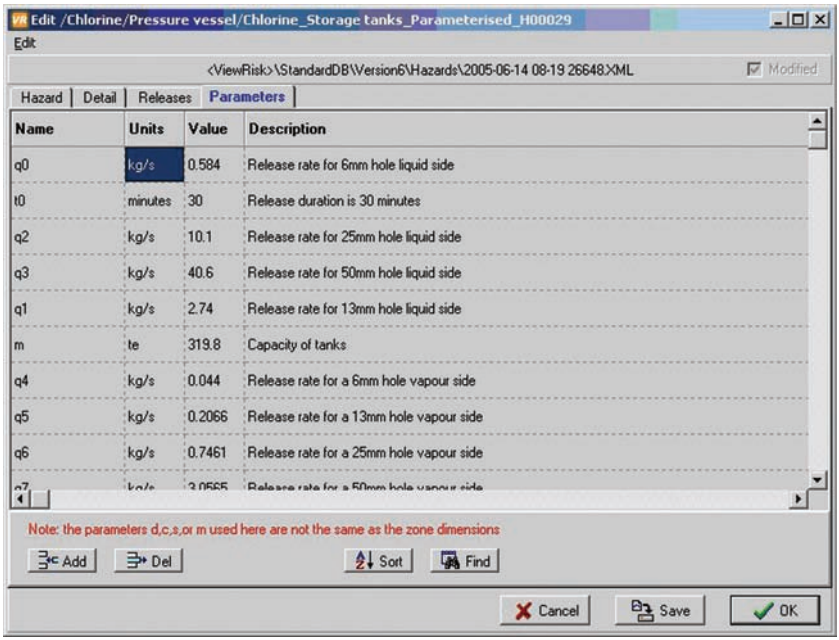

Figure 8. Overview of the specific parameters used in a parameterised chlorine tank component

versatile, and can be used to assess the risks from chemical, oil, gas and pharmaceutical facilities, and road, rail and pipeline transport of hazardous materials.

REFERENCES

1. Lauridsen, K., Christou, M., et al., 2001, Assessing the uncertainties in the process of risk analysis of chemical establishments: Part I, *Proceedings of ESREL 2001, Towards a safer world, vol. 1, 592-598, 16-20 September, Torino.*
2. Lauridsen, K., Christou, M., et al., 2001, Assessing the uncertainties in the process of risk analysis of chemical establishments: Part II, *Proceedings of ESREL 2001, Towards a safer world, vol. 1, 599-606, 16-20 September, Torino.*