WHITE PAPER 1

# DORI

## Defining Operational Readiness to Investigate


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**WP1**

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# Defining Operational Readiness to Investigate

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# Preface

The Noordwijk Risk Initiative Foundation exists to further understanding and sharing of knowledge in the field of risk management. Based on the belief that a virtuous circle exists between making tools and developing theoretical understanding, the Foundation develops tools for risk management and maintains them in the public domain.

**Purpose of this document**
This document is published as the result of a project to explore the preconditions for the efficient investigation of accidents and incidents. It is provided as a focus for debate and comment. The “Defining Operational Readiness to Investigate” project ran between 2005 and 2006 as a partnership between the NRI Foundation and the UK’s Royal Society for the Prevention of Accidents (RoSPA). This document will be maintained by the Foundation and the authors are keen to hear from any reader with comments and suggestions.

**Philosophy behind this document**
Four principles inform the approach set out this document.

First, it is believed that risk management is achieved through a balance of proactive and reactive approaches. Real life is always more complicated than the models that can be made of it. This means that proactive approaches, such as risk assessment, can never be wholly accurate and complete. Because of this, reactive approaches, such as incident investigation, are needed to inform the effort to manage risk.

Second, it is believed that an organisation can ensure that appropriate resources are deployed efficiently to this aspect of risk management by defining, achieving and maintaining a state of operational readiness to investigate.

Third, the operational readiness philosophy emphasises a ‘systems viewpoint’ in which the elements — procedures, equipment and people — function together within an environment that is conducive to good performance, even when that environment is the chaotic aftermath of a serious accident.

Fourth, low-consequence accidents and low-risk incidents lead to situations that are different from those produced by serious accidents and incidents. These situations present different challenges to attaining readiness to investigate. Although there are many tasks that are common to investigation across the spectrum of seriousness, differences in context mean that the same tasks may be done in significantly different ways. Defining readiness has to recognise and accommodate this diversity.

**Application**
Operational Readiness is a philosophy that can be applied to any purposeful system. Readers of this document are encouraged to apply the operational readiness concept to other systems in which they work. Also, although this document is chiefly concerned with the investigation of accidents and incidents related to safety, the contents can be applied to other types of mishap with only little modification.

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# Defining Operational Readiness to investigate

Developing operational readiness is about creating an organisation that places the right people in the right places at the right times, working with the right hardware according to the right procedures and management controls. Readiness also requires that these elements function in an environment which is conducive to good performance. The first stage in achieving a state of readiness is to define what is 'right' in a given context. To produce descriptions of operational readiness for each distinctive investigative context, the management responsible for developing readiness must follow four paths of decision-making. These are:

(a) **Determine the range of incidents** that need to be catered for as part of a planned approach to investigation. This will determine the different investigative contexts for which readiness is to be achieved. Some organisations call each context a 'level' or 'class' of investigation. Each context may require different things from different people, albeit within a broadly comparable investigative framework

(b) **Determine the tasks to be done** in the course of investigating incidents. These range from recognising that an incident has happened to reviewing the conduct and results of the investigation when it has been concluded. A list of generic investigation tasks is provided in section 1.1

(c) **Establish criteria for how the tasks should be performed**. In the operational readiness philosophy, there are three sources of criteria: functional, risk-based and 'codes, standards and regulations' (C,S&R). The criteria determine what is appropriate for each task depending on the category of the incident:

   (i) *functional criteria*: the investigation tasks are performed in a way that is acceptable to the managers of the investigation and those to whom they are accountable;

   (ii) *risk-based criteria*: the investigation is performed in a way that delivers acceptable risks to the people, assets, quality, timeliness and cost of the investigation. This could also include risks to reputation, pertaining to the investigation process, the individual investigators or the body responsible for the investigation;

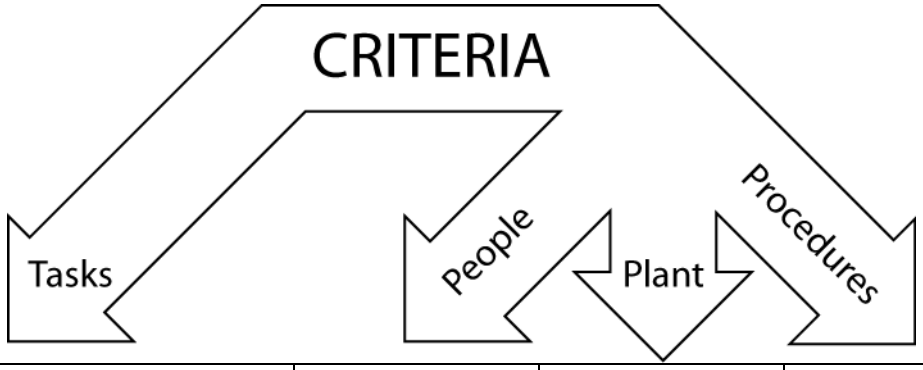
   (iii) *applicable codes, standards and regulations*: these include CS&R established at all control levels inside and outside of the body responsible for the investigation.

(d) **Determine the resources and arrangements required** to perform the tasks. Resources and arrangements can be grouped into three elements: (i) people, (ii) plant & equipment, and (iii) procedures & management controls. For example, the task of recognising that an accident or incident has happened requires[1]:

| | |
|---|---|
| *People* | that people know and apply the criteria that define incidents and know who to notify and how (the people to be considered include those receiving notifications as well as those making them); |
| *Plant & Equipment* | that the physical means exists to make the notification and are functioning as intended; |
| *Procedures and management controls* | that a policy that defines incidents is in place, as is a notification procedure that describes 'who should do what and when', and a review process exists to ensure the quality of this performance. |

[1] The systemic basis of performance means that people, plant and procedures need to be considered jointly to ensure readiness. For example, that the people are able to use the equipment and procedures, that the procedures fit the people who actually use them; that the plant and equipment is available, is compatible with the procedures, and usable by all of the people who might need to make a notification.

The relationship between these four paths of decision-making is depicted in Figure 1 below




| *What needs to be done* | *Done by whom* | *Done with what* | *Done how* |
|---|---|---|---|
| e.g. Notify of occurrence | e.g. All staff, contractors | e.g. electronic forms, special telephone numbers. | e.g. Notification procedure |
| e.g. Identify controls and barriers | e.g. Investigation team, technical experts | n/a | e.g. Barrier Analysis |
| e.g. interview witnesses | e.g. Investigation team, supervisors on scene | e.g. Pro forma (for initial statements), suitable room, recording equipment | e.g. Investigation procedure (interviewing protocol), |
| Etc….. | | | |

**Figure 1. Scheme for defining operational readiness in a given context**

## *1.1 Generic Investigation Tasks*

Listed below are thirty-four tasks; not all of these will be required in every investigation. When readiness is to be defined for a given investigative context, this list can be amended to include tasks that are particular to that setting.

(1) Recognise that something significant has happened
(2) Rescue, first-aid & make safe
(3) Notify of occurrence
(4) Inform families (initial, plus updates)
(5) Preserve/manage scene
(6) Collect (early) statements
(7) Assign the level of investigation
(8) Select team
(9) Inform workforce (initial, plus updates)
(10) Inform customers (initial, plus updates)
(11) Inform insurers and regulators
(12) Inform public and media
(13) Develop terms of reference
(14) Enable/advise/protect Team
(15) Manage team
(16) Liaise with other investigation teams
(17) Catalogue evidence
(18) Record visual data
(19) Collect documents and logs
(20) Collect equipment and material evidence
(21) Collect environmental evidence
(22) Interview witnesses
(23) Structure what happened and how
(24) Develop alternative lines of enquiry
(25) Evaluate/Test hypotheses
(26) Identify controls and barriers
(27) Identify root causes
(28) Write reports
(29) Develop remedial actions
(30) Review investigation
(31) Debrief team
(32) Debrief affected staff/others
(33) Manage recommendations
(34) Return, archive or dispose of evidence

# 2 Developing Operational Readiness to Investigate

Operational readiness is about creating an organisation that places *the right people in the right places at the right times, working with the right hardware according to the right procedures and management controls*. Readiness also requires that these elements function in an environment which is conducive to good performance. Having used the list of investigative tasks to identify who is involved, how and with what equipment (or premises), the route to achieving and maintaining readiness can be plotted.

Within the philosophy of operational readiness, the 'Nertney Wheel' provides a simple representation of the main ideas. The outside of the circle represents the beginning of the development process: at this point none of the developmental tasks needed to achieve readiness have been started. The segments of the circle alternate between subsystems and interfaces. The subsystems correspond to the three elements discussed earlier— People, Plant & Equipment, and Procedures & Management controls. Each of these subsystems needs to be developed in step with the others. Each concentric circle represents a step. For example, the selection and training of personnel needs to keyed to the procedures and management controls for the operational tasks that need to be performed. Similarly, the design of procedures and management controls needs to take account of the characteristics and needs of the people who will actually use them.

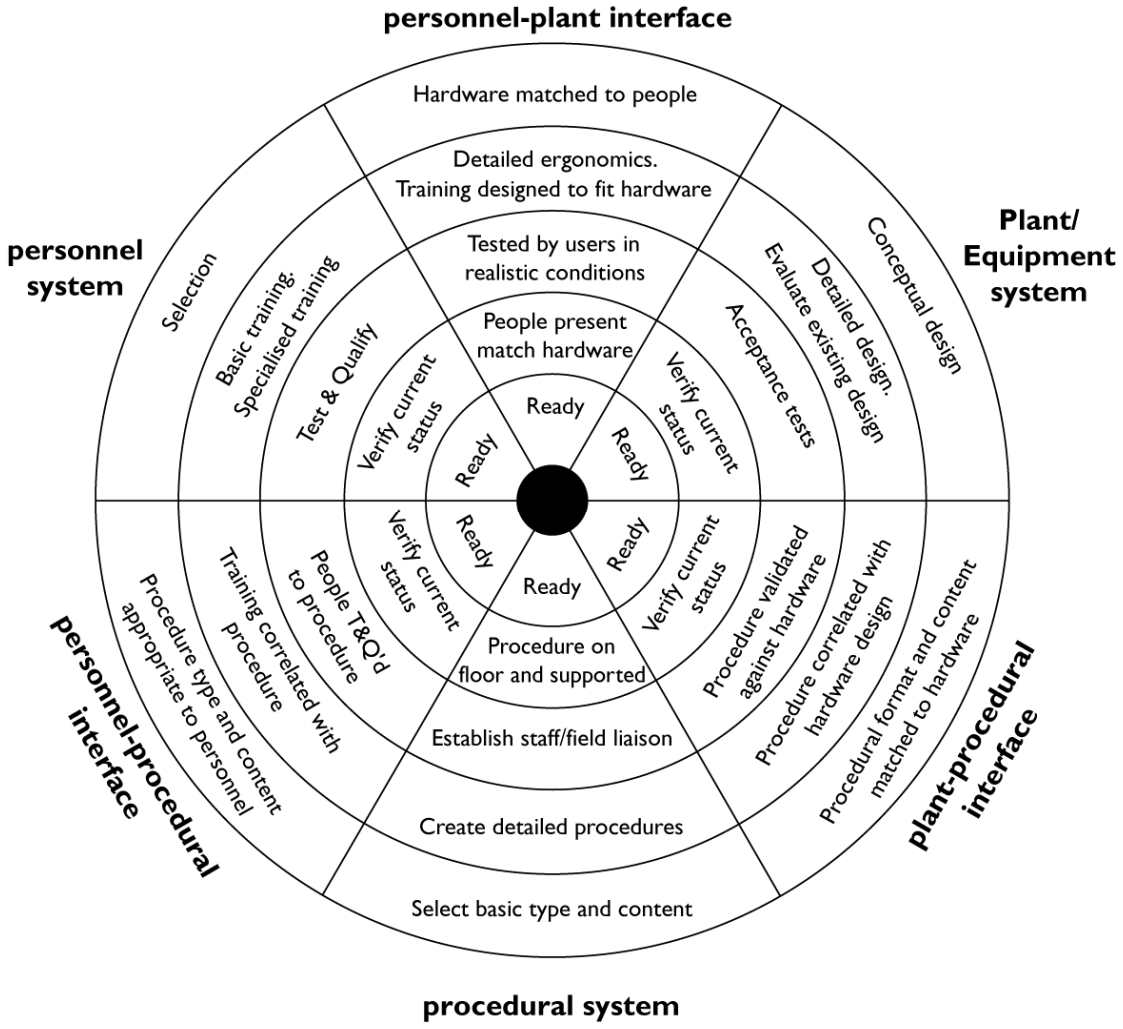



**Figure 2. The "Nertney Wheel" Developmental Model of Operational Readiness**

Within a given investigative context (e.g. “major” accident investigation), every task identified within the operational readiness definition needs to be considered in “Nertney Wheel” terms. This produces a catalogue of development tasks to be undertaken within a project to develop operational readiness to investigate.

## *2.1 Developing an environment that is conducive to good performance*

As stated in the preface, readiness to investigate implies that people work *within an environment that is conducive to good performance*. Environment, which is dependent on investigative context, will include people and groups with a stake in investigations. Stakeholders, their relationships and their expectations, need to be managed as part of achieving and maintaining operational readiness to investigate.

# 3 Programme to develop and maintain readiness

A programme to develop operational readiness to investigate is never complete. After the original project to define and establish readiness, maintenance and verification of an operationally ready state will continue in perpetuity.

Operational readiness programmes need to reflect the particularities of their investigative context and management setting; there will be similarities between programmes but none will be identical. Figure 3 summarises the general picture.

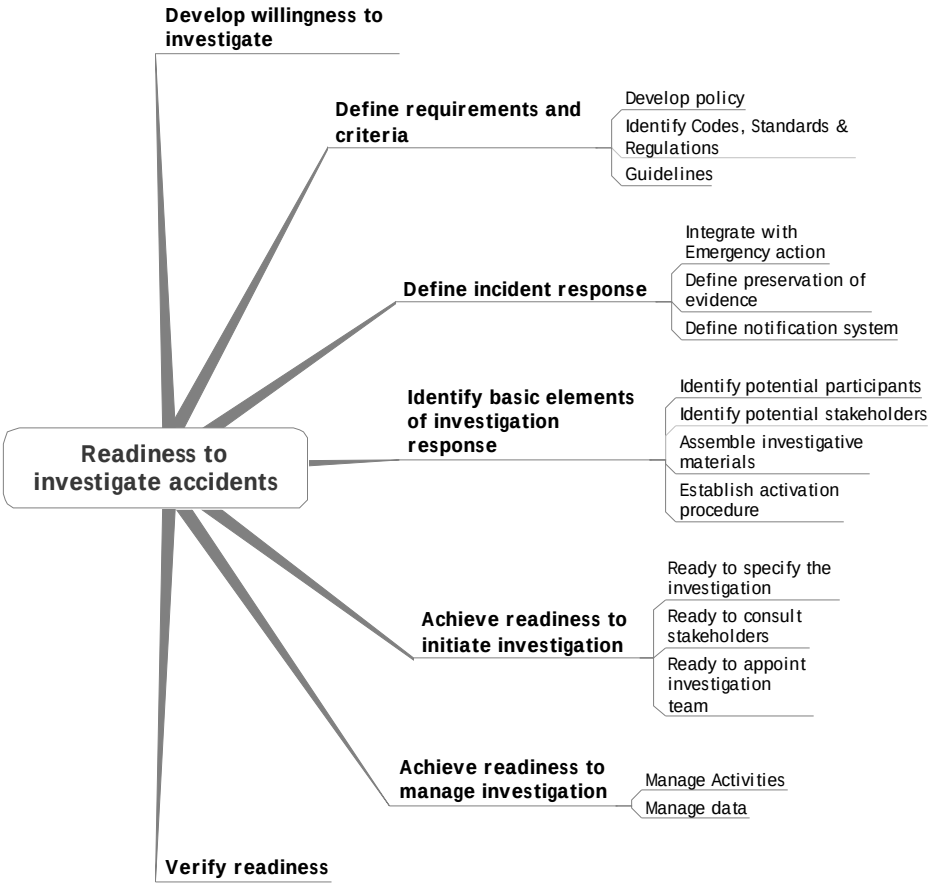



**Figure 3. Summary steps in an investigative readiness programme**

# Bibliography


Benner, L. (2000), "Investigation Programs". In: The Handbook of Industrial Automation., Edited by Shell, R,L. and Hall, E.L., New York, Marcel Dekker.

CCPS, Center for Chemical Process Safety (2003), Guidelines for Investigating Chemical Process Incidents.

Ferry, T.S. (1988), "*Modern Accident Investigation and Analysis"*. John Wiley & Sons.

Frei, R., Kingston, J., Koornneef, F., and Schallier, P. (2002), "*NRI MORT User's Manual*". Ref. NRI-1 (2002), Pub. Noordwijk Risk Initiative Foundation, The Netherlands. Available via internet: www.nri.eu.com/serv01.htm

Frei, R., Kingston, J., Koornneef, F., and Schallier, P. (2003), "Investigation Tools in Context". JRC/ESReDA Seminar on "Safety Investigation of Accidents" in Petten, The Netherlands, 12-13 May 2003. Available via internet: www.nri.eu.com/Tools~final.pdf

Hendrick, K. and Benner, L. (1987), "*Investigating accidents with STEP*". New York, Marcel Dekker.

HSE – UK Health and Safety Executive (2004), *"Investigating Accident and Incidents".* HSG245. Pub. HSE Books.

Johnson, W.G. (1973). MORT - The Management Oversight and Risk Tree. SAN 821-2. US Atomic Energy Commission. Available via internet: www.nri.eu.com/serv01.htm

Johnson, W.G. (1985), "Accident/Incident Investigation Manual". US Dept. of Energy. Ref. DOE 76-45/27, SSDC-27.

Kepner, B.B. and Tregoe, C.H. (1981), "*The New Rational Manager*". Pub. Princeton Press, New Jersey.

Kingston, J. (1998), Unpublished *"Briefing Document for the RoSPA Roundtable discussion of Accident Investigation Policy and Practice*". Royal Society for the Prevention of Accidents, Edgbaston Park, 353 Bristol Road, Birmingham, B5 7ST, United Kingdom.

Kingston, J. (2007) "*3CA – Control Change Cause Analysis Manual*". Second Edition. NRI-3 (2007), Pub. Noordwijk Risk Initiative Foundation, The Netherlands. http://www.nri.eu.com/NRI3.pdf.

Kingston, J., Jager, J., Koornneef, F., Frei, R., and Schallier, P. (2007) "Events and Conditional Factors Analysis Manual". Pub. Noordwijk Risk Initiative Foundation, The Netherlands. http://www.nri.eu.com/NRI4-beta.pdf.

Koornneef, F. (2000), *Learning from small-scale incidents*. Ph.D. thesis, Safety Science Group, Delft University of Technology. Delft University Press, Delft, The Netherlands. pp 109-118. (http://repository.tudelft.nl/file/80846/161980)

Nertney, R.J. (1987), Process Operational Readiness and Operational Readiness Follow-on. US Department of Energy Ref. DOE 76-45/39, SSDC-39.

Trost, W.A.and Nertney, R.J. (1995), "*Barrier Analysis*". US Department of Energy Ref. DOE 76-45/29, SSDC-29.

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