Human factors aspects of remote operation in process plants

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Following the 1999 ‘competition of ideas’, Human Reliability Associates (HRA) was commissioned by the Health & Safety Executive (HSE) to carry out a study of human factors aspects of remote operation in process plants.

The work conducted consisted of a literature review and a survey of the current state of remote operation in process plants. The survey was conducted using a combination of self-completion questionnaires and site visits. This report defines the areas of interest, summarises the main findings of the survey, discusses the benefits and problems associated with remote operation and provides suggestions for optimising remote operations.

Many of the sites surveyed had increased, or were planning to increase, their level of remote operation. The main reasons given for these changes were to improve productivity, to satisfy regulatory requirements and to keep pace with technology. There was little hard evidence that these alterations led to improvements. The survey indicated that the introduction of remote operation has significant effects on the way work is conducted. This was particularly apparent in areas such as communication between Field Operators and Control Room Operators and information acquisition. Very few sites systematically examined and managed the impact of these changes.

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EXECUTIVE SUMMARY

Following the 1999 'competition of ideas' process, Human Reliability Associates (HRA) was commissioned by the Health and Safety Executive (HSE) to carry out a study of human factors aspects of remote operation in process plants. HRA developed a proposal that consisted of two phases of work. The first phase, described in this report, was a survey of current practices in industry. The second, which has not yet been commissioned, was to involve the application of the survey results to develop a tool to assist companies introducing remote operation and to audit existing operations.

The work carried out in the first phase consisted of two separate but complementary stages: a review of literature relevant to this topic area (Annex Report 1), and a survey of the current state of remote operation in process plants based on the findings of the literature review. This report defines the area of interest, summarises the main findings of the survey, discusses the benefits and problems associated with remote operation, describes potential strategies for managing a change in remote operation and provides suggestions for optimising remote operations.

The survey, although not of sufficient scale to produce statistically significant results, was very successful at establishing trends in industry and collecting anecdotal evidence of benefits and problems. In particular it demonstrated that the vast majority of process plants surveyed were remotely operated and that many were planning, or had recently completed, further increases to the degree of remote operation at their sites. A striking finding of the survey was that the opportunity had often been taken to carry out several changes simultaneously, for example centralisation, de-manning, upgrading of control systems and increased automation.

The main reasons given for increasing the degree of remote operation were: to improve efficiency/productivity, to keep pace with technology and to satisfy regulatory requirements. The effects of these changes were wide ranging, for example, Control Room Operators were often expected to take more responsibility following an increase in remote operation. However, training provided tended to focus on the process and control system rather than on human issues such as communication and problem solving. The introduction of remote operation had significantly altered the style of communication used in most companies. Opportunities for face-to-face communication between Control Room Operators and Field Operators tended to reduce. There was a corresponding increase in radio communication. Information received from instruments had also changed, electronic displays replaced analogue and the amount of local gauges and displays reduced. Direct perception (sound, smell, sight) was not considered an important source of information. There was evidence that remote location had forced Field Operators to plan their excursions in detail.

Very few organisations surveyed could provide more than anecdotal evidence regarding improvements in safety, productivity, efficiency or quality resulting from changes to work organisation. This was surprising in view of the scale of investment that the changes required. The main benefits were seen to be in regulatory compliance and reduced manpower costs. The lack of hard evidence of benefits suggests that the effects of changes are not being closely monitored and provokes some concern about change management strategies. It must be said, however, that none of the companies implicated remote operation as a partial or main cause of a major safety incident or process upset.

To summarise, the main issues to arise from this research included the influence of remote operation upon the information acquisition of operators. However, this importance was not reflected in the understanding of the survey's participants as very few had assessed how operators receive plant data or communicate with others. Most assessments tended to focus on the technical system (e.g. control systems) to the exclusion of human issues. Secondly, many of

the companies surveyed had carried out simultaneous changes (e.g. manning levels, process displays, level of automation) when introducing remote operation. It was not clear that these changes were being adequately managed. Finally, Control Room Operators emerged as key figures in successful remote operation. However, the depth of training provided did not reflect this significance. It is recommended that further work be conducted to ensure that companies adopting any level of remote operation are equipped to evaluate and manage socio-technical system issues related to remote operation.