



Selection of cooling systems

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THE PREPARATION OF THIS DATA ITEM

The work on this particular User Guide was monitored and guided by the Oil Industry Fouling Working Party, which first met in 1998. The following members assisted in its development:

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SELECTION OF COOLING SYSTEMS

1. BACKGROUND

ESDU have devoted a considerable amount of effort in addressing heat rejection to sea water (see ESDU 03004⁵) and to fresh water (see ESDU 08002⁶). In the latter case, fresh water is defined as including the following categories: cooling tower water (treated and untreated), water containing glycol additives, river water, canal water and lake water. Certain “brackish” waters (*i.e.* waters containing a modest concentration of salt – less than 600-1000 pbm of chloride, say) might also be considered as being similar to fresh water rather than to sea water.

However, as these exercises have proceeded, there has been a growing recognition that *choice* of heat rejection systems (and, indeed, of whether heat rejection should be pursued in any case) is a vital precursor to considering the choice of cooling water system. This present User Guide attempts to address this question of choice by spelling out the options which a process designer has in addressing the problem of cooling a given process stream.

The User Guide aims, therefore, to be a “top down” and generic treatment of the subject of cooling. It should be stressed that the selection process described here refers to an essentially “greenfield” situation, *i.e.* a new plant is being constructed which is essentially independent of other plant in the same locality. In many cases, the choice will be influenced by the situation in adjacent plant – for instance there may be spare cooling tower or air cooled heat exchanger capacity on the site and this will clearly affect the choice of cooling system. There may also be available redundant equipment which can be used at little cost to achieve the cooling objective. Wherever applicable, these local factors should always be considered in deciding on the choice of system. It should also be stressed that decisions on plant selection are strongly affected by the balance between capital and operating costs.

2. FLOW CHART FOR SELECTION OF COOLING SYSTEMS

Sketch 2.1 is a flow chart which aims to help the process designer in systematically addressing the selection of a cooling system. It should be stressed that the selection of an appropriate cooling system is a complex issue and the presentation given in Sketch 2.1 is necessarily simplified; experience and knowledge of local factors is of the essence. Starting at the top left hand corner, the questions asked are as follows:

Does the process stream really need cooling? Usually, the answer to this question will be Yes (why otherwise would the process designer start this selection procedure!) but there are some cases where the process stream may not really need to be cooled since natural heat losses (in storage tanks, etc) might be an adequate means of dissipating the heat. In addition, there are many cases, in new refineries for instance, where it is economic to pass hot streams from one process to another without intermediate storage or cooling.

Is there a cost effective heat recovery integration option? There are often ways of reusing heat within a given process and, thereby, achieving the needed cooling of the process stream. Sophisticated methods of achieving this even in rather complex processes are available through the techniques of *process integration* or *pinch technology*. Certainly, heat exchange with other process streams should always be considered and extensive guidance on the methodologies for evaluating this are given, for instance, in ESDU 87030⁴; ESDU also has a computer code (INTEGRITY) to aid in assessing the viability of reuse of heat in the process. Although process integration often leads to technically feasible options for reuse of heat, these options are not always economically reasonable. Indeed, even if there is an economic case for following this or other options requiring new investment, these options may not be pursued because of restraints on the availability of capital. So the answer to the question is quite often: “No”.

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