RADIOCAESIUM IN LOCAL AND REGIONAL COASTAL WATER MODELLING EXERCISES

P E BRADLEY¹, E M SCOTT², M S BAXTER³ AND D J ELLETT⁴
¹SURRC, East Kilbride, Glasgow, G75 OQU
²University of Glasgow, Glasgow, G12 8QW
³IAEA, Monaco, MC98000
⁴Dunstaffnage Marine Laboratory, Argyll, PA34 4AD

ABSTRACT

In this paper we review briefly the last fifteen years of measurement of radiocaesium in Scottish coastal waters, present its geographical dispersal on both local and regional scales and consider the temporal variation in radiocaesium concentrations over the period of study. Results from a comprehensive modelling exercise are interpreted in terms of the physical hydrography of the area. We conclude with a discussion of the advantages and disadvantages of the modelling approach taken in this work.

INTRODUCTION

Radiocaesium discharged into the Irish Sea acts as a valuable tracer in local and regional studies of the UK coastal water system. The particular area of study of this work comprises that region of the inner continental shelf between the North Channel and the Outer Hebrides of Scotland as shown in Figure 1, which also indicates sampling stations used throughout the period of study. Isopleths of $^{137}$Cs concentrations from a representative cruise are also shown and indicate the extent of geographical dispersal.

Radiocaesium isotopes discharged from the Sellafield nuclear fuel reprocessing plant in Cumbria have been shown to pass through the region [1-8] and to provide a useful tracer system for the study of the rate and direction of the movement of water originally labelled within the Irish Sea. The radiocaesium isotopes of interest ($^{137}$Cs and $^{134}$Cs) are of particular value as they exhibit relatively conservative behaviour and hence long residence times in coastal water [9]. They are present at easily detectable levels in Scottish coastal waters and their quantification is relatively straightforward using ion-exchange and $\gamma$
spectroscopy techniques [10].

In addition, since Sellafield discharges of radiocaesium have been seasonally pulsed, the short-term temporal trends in activity may be matched to observed trends in a number of geographical locations and a full compartmental model for the region developed. We

![Survey area and geographical dispersal of $^{137}$Cs, 1985](image)

Figure 1. Survey area and geographical dispersal of $^{137}$Cs, 1985 describe the development of such a compartmental model, its calibration, validation and interpretation for the region of study.

DATA

Radiocaesium distributions have been measured regularly over the previous fifteen years, and a total of 2000 radiometric measurements have been made by the Glasgow/SURRC laboratories. Sampling has been undertaken over a wide geographically dispersed grid, making use of transect sampling on cruises, in addition to sampling at identified