DELIVERABLE D3.1.

INDIVIDUAL PARTNER REPORTS ON DEVELOPED NUMERICAL MODELS RELATING TO MINE WATER ISSUES – SUMMARY

TASK 3.1: MODELLING AND SIMULATION OF ENVIRONMENT IMPACTS ON MINE WATER QUANTITY AND QUALITY

Task 3.1 focuses on modelling physical impacts associated with both the quality and quantity of mine water that may result following changes in precipitation brought about by climate change. The particular impacts relate to the rise of mine water and the effects in terms of discharge rates, loads and flooding.

Results of works within this Task are presented in 3 separate reports.

DMT as a leader of this task, conducted numerical modelling and simulation using different modelling software and further developed the well-established BoxModel tool for prediction of mine water rise in advance. For a precise investigation of the climatic effects on the mining sector, investigations were carried out for different application sites. Various mining locations in Germany that have an adequate basis of information are modelled and investigated in detail. In particular, a recent extreme weather event is analysed here, which led to severe flooding in parts of Germany. Other study sites included two sites in the Upper Silesian Coal Basin (Poland) – carried out with support of GIG and one site each in Asturias (Spain), and the Saar region (Germany).

UNEXE has been involved in selecting and validating a modelling tool, and developing a process for carrying out spatial and temporal modelling of the impact of precipitation on water flow from spoil tips during heavy rainfall events, to evaluate the potential for flooding. In particular, in order to make the technique as applicable as possible to potential users, it has been an aim to use software with a low computational overhead. To fulfil this aim, a software tool called CAFlood, which was developed at the University of Exeter, was chosen. The location of the spoil heap of the abandoned Isabella Colliery in Blyth, Northumberland and the specific flooding event, was used as a case study for spoil heap runoff simulation using CAFlood. Following the verification of CAFlood by studying a historical flood event involving runoff from a spoil heap, the same spoil heap was used to model the effect of an extreme rainfall event in a future climate change scenario. The results were broadly similar to those of the historical event. Water accumulated in the railway tunnel to a greater depth, although there was no evidence that this would have caused any subsequent damage or disruption.

SUT with the input of TWD have undertaken hydrodynamic and hydrochemical modelling of ground water flow in the area of waste dumps. First, the model of groundwater flow for a large catchment area containing the heap was created. Secondly, in a numerical model, changes in hydrogeological and environmental conditions under the influence of climate changes, mainly excessive precipitation were simulated and a method of treating contaminated groundwater polluted due to a sudden inflow of

leachate was presented for an area of the Janina waste heap in Libiąż. For this purpose, a detailed model was developed containing the southern part of the heap and the area adjacent to the heap to the south, i.e. the area of groundwater runoff towards the Vistula River. Moreover, the report proposes a new way of monitoring the level of groundwater pollution caused by mining heaps, which create the effect of acid mine drainage, caused by excessive precipitation due to climate change. In addition, the simulation - based on two scenarios of greenhouse gas concentrations RCP4.5 and RCP8.5 – of the water balance for the years 2046-2050 for the area of the analyzed heap was developed.