4. THE LPOOL MODEL

CONTENTS

4. THE LPOOL MODEL

4.1. Introduction

The EVAP model describing the evaporation of liquid pools, as available in HGSYSTEM version 1.0 (or NOV90), has been replaced by a completely new pool model called LPOOL.
LPOOL is based on the LSM90 model developed by Exxon Research and Engineering Company (USA). Technical information on the LSM90 model is given in references [1,2].

LPOOL can calculate transient (time-dependent) evaporative fluxes coming from a multi-compound liquid pool on ground or water. LPOOL can treat boiling and non-boiling pools. It allows for the specification of a circular dike (dam or bund).
LPOOL allows the user to specify liquid spill rates, but it can also *calculate* spill rates from a (pressurised) cylindrical vessel using either choked flow or liquid Bernoulli relations.

All basic technical information concerning the LPOOL/LSM90 model can be found in [1]. Here only the specific LPOOL features will be discussed.

4.2. Differences between LPOOL and LSM90

The LPOOL model is basically the same as the LSM90 model of the Exxon Research and Engineering Company. However, it was necessary to modify some aspects of the LSM90 model. These differences are listed here.

4.2.1. Physical properties database

The LSM90 uses the proprietary *physical properties database* DIPPR. DIPPR is sponsored by the American Institute of Chemical Engineers (AIChE).
To enable unrestricted public release of HGSYSTEM, the use of DIPPR had to be replaced by the use of the HGSYSTEM database program DATAPROP.
DIPPR is used as an on-line database, however, DATAPROP can only be used as a separate model prior to an LPOOL model run.

4.2.2. Updating physical properties

In the original LSM90 code, all compound properties were fully updated as a function of temperature. In LPOOL, properties as generated by DATAPROP at a representative temperature are used. The saturated pressures of all compounds are still evaluated as full functions of fluid temperature.

Two properties, not available in DATAPROP, were given a constant value for all compounds which is a good approximation as these properties are not very important in the simulation.

These properties are: liquid surface tension (used value is 0.02 N/m^2 = 0.02 kg/s^2) and liquid thermal conductivity (used value is 0.15 W/(m·K)). *These two properties are only used in the (optional) auto-aerosol calculation and then only for single-compound mixtures.*

Tests have shown that the differences caused by using DATAPROP rather than DIPPR are smaller than 10 % in calculated average evaporative fluxes and pool properties.

4.2.3. Input parameters

The structure of the input file for LPOOL is the same as that of other HGSYSTEM modules and quite different from the LSM90 input file format. However, almost all LSM90 input parameters are still available to LPOOL users. The LSM90 parameters that are used in the auto-aerosol algorithm (Weber number, N density etc.) are used with their default values and cannot be changed by setting LPOOL input parameters.

Some LPOOL input parameters are not used by LSM90 directly, but are only relevant for the specific HGSYSTEM implementation. For example DTLINK in the CONTROL input block, which is used to write the HEGADAS-T file.

Using the LPOOL input data, a standard LSM90 input file (LSM90.IN) is written and then the LSM90 model is invoked.

File names associated with an LPOOL run are completely in line with the HGSYSTEM file naming conventions as explained in Chapter 3, paragraph 5 of the HGSYSTEM User's Manual.

4.3. References

1. Cavanaugh II, T.A., Siegell, J.H., Steinberg, K.W., '*Simulation of vapor emissions from liquid spills*', J. Hazardous Materials., vol 38, 41-63, 1994.
2. Cavanaugh II, T.A., Siegell, J.H., Steinberg, K.W., '*Simulation of vapor emissions from liquid spills*', Paper 92-155.09, Air & Waste Management Association, 85th Annual Meeting & Exhibition, Kansas City, Missouri, USA, June 21-26, 1992