Process Safety-Related Software

Scope:

The aim is to provide a list of process safety-related software available in the United States. The data is organized in two ways: alphabetical order based on the respective company's name or types of software. The former categorization has been provided below, while the latter is available in the attached excel document.

ABS Group:

- **LEADER PHA Software** – PROCESS SAFETY – PROCESS HAZARD ANALYSIS
    - Process Hazard Analysis software
    - Works with LOPA Wizard to produce a complete list of cause-consequence pairs and candidate protection layers for a comprehensive LOPA study
    - Conducts and documents OSHA/EPA-compliant PHA for a full scale chemical plant
- **THESIS BowTie Risk Management Software** – Safety, Risk and Compliance – RISK Management
    - Risk management software application and bowtie approach that can assist with analyzing and managing the full spectrum of diverse risks facing an organization

AeSolutions: Integrates Process Safety, Industrial Cybersecurity and Automation

- **AeShield Safety Lifecycle Management System:**
    - Comprehensive platform for executing sustainable risk management program through automation of the safety lifecycle process
        - Maintains relationships among the risk reduction targets, design verification calculations, inspection and test plans for integrity management, and actual historical data
    - Tracks and analyzes PSI, provides alerts and reports on process safety health in real time
- **AeFacilitator Evergreen Risk Assessment**
    - Tool for process risk management that enables users to facilitate and effectively execute HAZOP and LOPA studies

AKTS (Advanced Kinetics and Technology Solutions): Designs software to predict material decomposition and facilitate processing and transfer of this data into the system.

- **Thermal Safety Software**
    - Enables the calculation of the Time to Maximum Rate under adiabatic conditions (TMRad) while the Fine Element Analysis (FEA) analyzes the thermal behavior under non-adiabatic conditions
    - This permits prediction of the heat accumulation process and the reaction progress for any surrounding temperature profile
    - Supports differential scanning calorimetry, ARC and utilizes varying data processing methods

BakerRisk: provides quality engineering, R&D, investigation, and field testing services to industries and government agencies handling explosive, flammable and toxic materials (PROCESS SAFETY)

- **MaxLoss-TM:**
  - Software used by BakerRisk to carryout insurance risk assessment surveys
  - Allows risk professional to eliminate guesswork of defining a worst-case loss by utilizing program's "drift" feature
- **SafeSite3G:**
  - Consequence analysis program that allows BakerRisk to model potential explosion, fire, and toxic hazards that may be present at an industrial manufacturing storage facility
  - Utilizes discharge, dispersion and blast modelling techniques that are validated by historical data as well as extensive testing performed by BakerRisk
- **PSVTool-TM**
  - Designed to efficiently specify and revalidate open system relief devices
  - Analyses include re-closing pressure relief devices and non-reclosing devices
  - BakerRisk performs full flare and venting system analysis using this in conjunction with other software tools
- **ChemCad**
  - Fully integrated software package that is utilized as a process safety simulator
- **HACTool-c (Hazardous Area Classification)**
  - Explicitly calculations boundary distances instead of using one maximum distance
  - Display HAC contours in both 2D and 3D drawings
  - Easily updated and auditable

Center for Chemical Process Safety (CCPS)

(Note these are downloadable from the CCPS Website due to generous gifts to CCPS!)

- RAST (Risk Analysis Screening Tool)
  - RAST assists with hazard identification, scenario development, consequence evaluation, and risk analysis. As a part of this screening, RAST assists users by providing a comprehensive Layer of Protection Analysis (LOPA), as well.
  - https://www.aiche.org/ccps/resources/risk-analysis-screening-tool-rast-and-chemical-hazard-engineering-fundamentals-chef
- CHEF (Chemical Engineering Hazards Fundamentals) Calculation Aid
  - CHEF documentation provides the theoretical details of the methods, techniques, and assumptions which are used in RAST
- CRW (Chemical Reactivity Worksheet)
  - CRW has data on thousands of hazardous chemicals and can be used to evaluate the compatibility between chemicals and the equipment's materials of construction.
  - https://www.aiche.org/ccps/resources/chemical-reactivity-worksheet-40

CGE Risk Management Solutions

- BowTieXP: Risk Assessment software based on bowtie method
    - Provides an overview of multiple plausible incident scenarios and shows the barriers that have been place to control these scenarios

CISP (Cheminform St.Petersburg Ltd)

- **Thermal Safety Series (TSS)** – analog-free methodology and software for reaction hazard assessment that predicts and prevents runaway accidents involving chemical products and processes. The following are TSS components:
    - **TDPro Software** – (Thermoanalytical Data Processing Software) Processes data by various kinds of thermal analysis instruments (differential scanning calorimetry, DSC, heat flux calorimetry, HFC, isothermal calorimetry, thermal gravimetry, TG, combined methods)
    - ***ADaExpert Software*** – (Processing and Analyzing Adiabatic Data) This is an analog-free program package for thorough processing and analysis of data generated by (pseudo) adiabatic calorimeters of various types.
    - **RCPro Software** – (Reaction Calorimetry Data Processing) Processes data generated by reaction calorimeters of various types.
    - **TFConverter** – (Text File Converter)
    - **IsoKin Software** – (Isoconversational Kinetics) This software is for creating model-free kinetics on the basis of available sets of experimental data generated by methods of thermal analysis
    - ***ForK Software*** – (Formal Kinetics) Used to create complex multi-stage formal conversation-based kinetic models on the basis of available sets of experimental data generated by methods of thermal analysis, adiabatic calorimetry and others. This also offers simulation of processes in a well-stirred batch reactor.
    - **DesK Software** - (Descriptive Kinetics) used for creation of complex multi-stage descriptive concentration-based kinetic models on the basis of available sets of experimental data generated by methods of thermal analysis, adiabatic and reaction calorimetry. This also offers simulation of processes in well-stirred batch, semi-batch and continuous stirred reactors.
    - **ReRank** – Provides reactivity rating of individual substances and mixtures
    - **InSafer** – Utilized for optimization and design of inherently safer batch and semi-batch chemical processes
    - **ThermEx Software** – Utilized for simulation of thermal explosion in solids and highly viscous liquids when convection and diffusion can be ignored. This software works with formal kinetic models of chemical reactions
    - **ConvEx** – Used for simulation of thermal explosion in reactive fluids when convection and diffusion are of significant importance
    - **Mixture** – tool used for calculating physical properties of liquid and gas multi-component non-ideal mixtures
    - **VENT** – Used for steady-state calculation of two-phase flow along a multi-segment pipeline
    - **BST** – Tool used simulate physical and chemical processes in a batch stirred tank

CHETAH: A Chemical Thermodynamic and Energy Release program tool that is utilized for predicting both thermodynamic properties and certain "reactive chemicals" hazards associated with a pure chemical, a mixture of chemicals, or a chemical reaction. This is marketed by ASTM.

DNV:

- **KFX** – CFD Simulation
- Navigator Software for Ship Operations
- **Synergi** – Software for simulation and optimization
- **Nauticus** – Ship design and verification software
- **Synergi** – QHSE and Risk Management
- **Synergi** – Software for asset integrity management
- **Sesam Software** – Strength assessment of offshore structures
- Maros and Taro software for RAM analysis
- Electric grid reliability and performance

EVision: Provides highly scalable systems to improve productivity and safety. PSRG has also partnered with eVision to help support of the implementation of eVision's software.

- **Permit Vision:**
    - Offers single-asset Saas Control of Work, global enterprise solutions with bidirectional third-party integrations, advanced tools such as interactive P&ID and Cumulative barrier management
- **Shift Vision:**
    - Saas-enabled shift management software that enables you to log shift data, share information and monitor processes with ease ensuring optimal Shift control and vision
- **Change Vision**: deals with complex MOC (Management of Change) processes
- **Barrier Vision:** full function barrier management, cumulative risk management, and real-time SIMOPS in a single solution (includes process safety management)
- **iDiagrams:** Manipulate P&IDs

Exponent:

- **NASCRAC Software**:
    - General-purpose fracture mechanics tool
    - Solve linear and nonlinear fracture mechanics problems that arise in industries
    - Capabilities include evaluation of stress intensity factors, J-integrals, fatigue-crack growth, creep-crack growth, and stress corrosion cracking

Fauske:

- **Adiabatic Calorimetry & Relief System** – PROCESS SAFETY – PROCESS HAZARD ANALYSIS
    - Provides data for relief system design, safe scale-up of chemical processes and changes to process recipes

    - Safe process design requires knowledge of chemical reaction rates, character and energy release. This is obtained from a low phi-factor adiabatic calorimeter such as the VSP2-TM (Vent Sizing Package 2) or ARSST-TM (Advanced reactive System Screen Tool)
- **Vent Sizing Package (VSP-TM):**
    - Bench scale low thermal inertia adiabatic calorimeter
- **Advanced Reactive System Screen Tool (ARSST-TM):**
    - Provides an easy, inexpensive approach to the testing method
    - Two-phase methodology recognized by OSHA
    - Models upset scenarios as loss of cooling, loss of stirring, mischarge of reagents, mass-loaded upset, batch contamination and fire exposure heating
    - Enables users to quickly obtain reliable adiabatic data which can be used for a variety of safety applications including characterization of material compatibility, thermal stability and reaction chemistry.
- **Flow Regime Detector (FRED-TM)**
    - Comprised of a small immersion hater and an attached thermocouple that is positioned in the upper free board space of the test cell
    - Practical Emergency Vent Sizing Software (PrEVent-TM)
    - Handles gassy, hybrid and vapor systems for reactive scenarios and can also accommodate deflagration venting as well as fire load sizing

Gexcon:

- **FLACS Software**:
    - Industry standard for CFD modelling and one of the best validated tools for modelling flammable and toxic releases in the industrial safety context
- **FRED Software**:
    - Shell's consequence modelling tool – gathers Fire, Release, Explosion and Dispersion models that predict consequences of accidental and design releases of products from process, storage, transport and distributions operations

IOMosaic: Process Safety Management

- **Process Safety Office**:
    - Provides end-to-end solution for safety professionals
    - Work on safety focused operation at different levels.
    - Within PSO:
        - **SuperChems:**
            - Consequence analysis, quantitiative risk analysis, facility sitting and PRFS evaluations and design and calculations
        - **PHAGLobal:**
            - Perform PHAs, DHAs, LOPAs, HAZOPs, FMEAs, What-Ifs, Checklist with an intuitive interface
        - **ioAuditor**
            - perform compliance based on OSHA PSM/RMP, CCPS RBPC protocol and corporate protocols

- **ioViper**
    - evaluate vibration induced fatigue in process and relief piping
- **ioLogic**
    - Construct Fault Trees and perform SIL/SIS analysis
- **ioVU**
    - Construct visual piping isometrics
- **ioSecure**
    - Assess the vulnerability and security of chemical facilities
- **ioViewer**
    - generate and view reports from any version of SuperChems

Kenexis: Independent engineering consulting firm

- **Effigy** – PROCESS SAFETY – CALCULATION ENGINE
    - Standardizes the process for the design of fire and gas systems, industry experts, including pioneers at Kenexis
    - Built on performance-based quantitative approaches of the ISA 84/IEC 61511 process safety standards
    - Analyze coverage targets using sophisticated computerized tools
    - Gas mapping software equipped with an algorithm for the calculation of the coverage, both geographic and scenario based, that considers specific application, equipment, and instrument used in the facility under study
- **Vertigo SIS Safety Lifecycle** software –PROCESS SAFETY – FAILURE DATABASE
    - Flexible and effective tool for managing the systems that safeguard process plants
    - Develop conceptual designs, documenting, tracking, proof testing and maintaining throughout the entire life of the system
    - Keeps track of Safety Requirement Specifications (SRS) and C&E tables and every protective function
- **Arbor** – PROCESS SAFETY – MODEL BUILDER
    - Featured Fault Tree Analysis application built
    - Develop complex system reliability models through a simple and efficient interface
- **Open PHA** – PROCESS SAFETY – HAZARD ANALYSIS
    - Powerful HAZOP and LOPA software tool
    - Open-source data structure
- **MAAP – Modular Accident Analysis Program**
    - An Electric Power Research Institute (EPRI) owned and licensed computer software
    - Fast-running computer software
    - Simulates response of light water and heavy water moderated nuclear power plants for both current and Advanced Light Water Reactor (ALWR)
    - Allows users the capability to simulate operator actions allowing the code to simulate the full spectrum of plant response to all types of accidents
- **AKTS-Thermokinetics Software**

    - Critical process safety and thermal stability parameters can be determined quickly and reliably form a modest amount of calorimetry data by using AKTS-Thermokinetics software
    - Utilizes an advanced differential isoconversional kinetic techniques for the precise modeling of runaway chemical reactions
- **C80 Calorimeter**
    - Manufactured by Setaram
    - Reaction, thermal and scanning calorimeter that operates like a larger version
    - Can use glass-lined cells
    - Offers unique level of sensitivity to thermal events and also ability to design cells and vessels to simulate almost any potential condition
- **CHEMISENS CPA202**
    - Chemical Process Analyzer brings reaction calorimetry to the next level
    - Complete, pre-calibrated, precision tool for analyzing chemical processes
    - Retains the versatility of a laboratory reactor while including the techniques and measurements that are essential to effective process development
- **FATE-TM**
    - Can calculate temperatures, pressures, flow rates and compositions for fluids, gases and structures associated with waste management process D&D
    - Combines models for fluid flow and heat transfer with models for aerosol transport and deposition, explosions and fire
- **Modular Accident Response System – MARS-TM**
    - Software suite that monitors and predicts potential future states of a nuclear power plant under abnormal and accident conditions
- **Super Stirrer – TM**
    - Supports stirring operations under both high temperature and high pressure conditions, as well as provide reliable stirring for viscous and multiphase mixtures
    - Offered in two forms: benchtop unit for laboratory use and also as remote stirring unit for operation in caustic environments

National Oceanic and Atmospheric Administration (NOAA)

- **CAMEO Software Suite**

https://response.restoration.noaa.gov/oil-and-chemical-spills/chemical-spills/response-tools/cameo-software-suite.html

PrimaTech – Specialists in Safety, Security and Risk

- **PHAWORKS RA Edition** – next generation of PHA/LOPA software
- **PHAWORKS 5** - conduct Process Hazard Analysis (PHA) such as HAZOP, what-if and MHA
- **LOPAWORKS** - conduct layers of protection analysis (LOPA) for hazard scenarios
- **Tracker** – tract action items from process safety and other studies

Scale-Up Systems:

- **DynoChem Resources**: Provides modelling tools for understanding, optimizing and predicting the performance of batch process unit operations

Simulation Solutions, Inc

- **Operator Training Simulators**
    - Provides a wide variety of Process Simulations which include both a DCS component and a virtual reality operator
- **New Desalination Simulators**
    - Reverse Osmosis Desalination process: brings flow of seawater first through a multimedia filter to remove any large impurities such as seaweed or sand. It is then sent through pair of high pressure pumps which force the flow through a membrane to remove salt from water
    - Multi Effect Desalination: runs seawater through chain of 3 effects to remove salt from input

Mettler Toledo

- **STARe Thermal Analysis Excellence**
    - Supports differential scanning calorimetry and utilizes DSC Curves and Thermal Safety Diagram for data processing. This tool is a complete and comprehensive thermal analysis software that provides evaluation of kinetic parameters such as Activation Energy.

Acronym List

LOPA	Layer of Protection Analysis
OSHA	Occupational Safety and Health Administration
EPA	Environmental Protection Agency
PHA	Process Hazard Analysis
HAZOP	Hazard and Operability Analysis
FEA	Finite Element Analysis
R&D	Research and Development
HAC	Hazardous Area Classification
DSC	Digital Signature Certificates