

Dear Prof. Khitoliya,

We do not have books on HAZOP Analysis. But I have been able to find following websites on Internet which will be useful to you for information about it.

1. **HAZOP Analysis Procedure. HAZOP Analysis Procedure.** Hazards arise in a plant due to deviations from normal behavior; A team of experts examine P&IDs: ...
lips.ecn.purdue.edu/~lips/hazop/slides/tsld005.htm - 2k - Cached - Similar pages
[More results from lips.ecn.purdue.edu]

2. **Hazard and Operability Study (HAZOP). ... HAZOP Overview (link).**
Model-based framework for automating HAZOP analysis (link). ...
www.acusafe.com/Hazard_Analysis/Hazard_Analysis-HAZOP.htm - 5k - Cached - Similar pages

Besides this I have downloaded few experiences of ABS group with HAZOP analysis . These can be utilised by you as examples of HAZOP analysis.

Experiences of ABS group Inc. Risk and Reliability Division.

About ABS

BF Associates, Inc. (JBFA) was acquired by ABS Group Inc. in June 1998. On January , 1999, JBFA changed its name to the ABS Group Inc. Risk & Reliability Division. After ABS Group acquired EQE International, Inc. in 2000, the Risk & Reliability Division was merged with EQE, and now operates under its current name, the Knoxville office of EQE International, Inc., an ABS Group Company.

EQE's Knoxville office specializes in process hazard analysis (PHA), system safety, reliability and availability engineering, quantitative risk analysis (QRA), process safety management (PSM), and risk management programs (RMPs). Its principal engineers are internationally recognized experts who have extensive experience in the analysis of complex engineered systems. The firm's commitment to quality performance and customer service is underscored by its high percentage (75%) of repeat business and its 15% average annual growth over the past 20 years.

From 1978 to 1998, JBFA provided services to over 200 clients, including companies in the following industries:

chemical, petrochemical, oil and gas, nuclear, semiconductor, pharmaceutical, hazardous waste, pulp and paper, manufacturing, mining, exploration, utilities, transportation, defense, and aerospace; U.S. Coast Guard; DOE, DoD, and NRC facilities. Now with the combined resources of ABS Group and EQE, we have expanded our ability to deliver training and consulting services worldwide. We can also draw on the expertise of other ABS Group Divisions, including Compliance and Certification services, Training, Consulting, and Information services, and Engineering and Facility Verification services.

Contract Services

In safety-related work, the EQE Knoxville office now performs and documents an average of 65 hazard analysis and risk assessments each year, utilizing the full range of PHA and QRA methods: HAZOP, checklist, what-if, failure modes and effects, fault tree, event tree dependent failure, and human reliability analysis. We have also performed and documented many consequence assessments and large-scale facility assessments, and we have developed risk management programs and many PSM programs with clients.

In reliability-related work, we help companies implement effective mechanical integrity programs and reliability-centered maintenance programs. We also perform reliability assessments of complex systems to help companies make risk-based decisions; these decisions typically focus on minimizing downtime and other economic impacts.

Training Services

Clients can also get training in key topic areas through our Training Services provided primarily through the Process Safety Institute (PSI) and the System Reliability Institute (SRI). PSI focuses on safety management training, safety implementation training, hazard identification and assessment training, and compliance with governmental, industry, and international safety standards. SRI focuses on improving the reliability of engineered systems, and offers training in topics related to management systems for mechanical integrity, root cause/failure analysis, and proactive and predictive tools for improving mechanical and electrical reliability. We also teach courses through the auspices of AIChE and a companion ABS Group Company, Government Institutes. As our clients' needs evolve, we will find other institutes to specifically address these needs. Our institutes provide comprehensive training to help you and your associates more effectively operate and maintain engineered systems.

Our Engineers: Your Resource

EQE personnel have years of in-plant experience and are especially well-equipped to use the various PHA and QRA techniques, weighing how well each method applies to actual plant systems and operating practices while taking into account the overall analysis objectives.

Our engineers also have considerable experience working with clients to develop programs to satisfy OSHA's PSM regulation, 29 CFR 1910.119, EPA's RMP rule, 40 CFR 68, and international standards, such as SEVESO II. If you want to establish capability in PSM and RMP, we can assemble a team composed of your personnel and our professionals to meet your specific needs. This is the most cost-effective way for you to quickly acquire the capability to satisfy regulatory requirements, industry PSM/RMP guidelines, and quality standards.

Organization

Established in 1977 and incorporated in Tennessee in 1978, JBF Associates, Inc. experienced 15% average annual growth in contract revenues from 1977 through 1998. Revenues in 1998 were \$9.6 million. The company was purchased by ABS Group in June 1998 (becoming its Risk & Reliability Division on January 1, 1999). ABS Group acquired EQE International, Inc. in January 2000, and the Risk & Reliability Division was merged with EQE, as an ABS Group Company, in January 2000. The Knoxville office includes more than 40 engineers (with degrees in chemical, mechanical, and nuclear engineering), plus communications experts, procedure writing specialists, software programmers and developers, technical editors, graphics specialists, and support staff.

Recent Projects

- Process safety management (PSM) audits of industrial facilities
- PSM implementation plans and written programs
- Development of mechanical integrity programs and procedures
- Development/communication of EPA risk management plans (RMPs) for 80 plants
- RMP communication projects (e.g., Kanawha Valley, Calhoun/Victoria, Tampa)
- 1,000+ hazard evaluations, including hundreds of PHAs of OSHA PSM-covered processes
- Hazard and operability (HAZOP) analyses of HF alkylation process units
- Environmental-focused HAZOP study of pharmaceutical manufacturing plant
- Risk assessment of peroxy acid CSTR
- Safety audits of pulp mill bleach plants
- Risk assessment for siting of a new petrochemical complex
- Risk screening of a company's 13 chemical plants
- Development of customized training courses for corporatewide use
- Investigation of major refinery and chemical plant accidents
- Litigation technical assistance for contesting PSM citations
- 100+ safety and hazard analysis tasks in support of safety analysis reports for DOE facilities
- Development of loss exposure analysis methodology for U.S. Coast Guard
- Input and trending of occurrence (incident) data for DOE facilities

Technical Affiliations

ACS, AF&PA, AIChE, ASNT, API, ASME, ASQC, CCPS, CMA, EFCOG, HFS, IEEE, ISA, MTI, NFPA, NSC, NSPE, SPI, SRA, SRE, SSS, TAPPI, TFI, and TSPE

Send requests for further information to: info-jbfa@eqe.com

Send comments on this web page to: smcnutt@eqe.com

Summaries of Experience — General Examples

From 1978 through 1998, ABS Group Inc. Risk & Reliability Division operated as JBF Associates, Inc.

Following are summaries of some of our work experiences during this period, including examples of: process hazard analysis (HAZOP, FMEA, hazards review), process safety management implementation, plans and assessments, risk management programs, risk assessment, facility risk review, quantitative risk analysis, economic risk analysis, and reliability, availability, maintainability analysis.

A Process Hazard Review and FMEA of LPG Handling and Storage

JBFA performed a process hazard review (PHR) and a failure mode and effects analysis (FMEA) of all LPG handling and storage activities at a refinery, including truck and rail loading/unloading, process unit feed/rundown, and tank farm operations. The review examined equipment and procedures for both manual and automated handling operations and documented failures of interest in an FMEA table.

A HAZOP Analysis of an LNG Ship's Cargo Handling System Design

JBFA performed a HAZOP analysis of the proposed design of cargo handling systems for an LNG (liquefied natural gas) ship. The review focused on hazards that could affect the safety of ship personnel and/or the public, or that could result in a major uncontrolled release of LNG. The scope of the analysis included all major process equipment, piping, and instrumentation associated with LNG cargo handling aboard the ship. Other equipment aboard the ship or at the terminals, such as ship mooring, ship ballasting systems, ship hydraulic systems, ship propulsion and steering systems, and terminal loading arms, were also evaluated to identify safety hazards related to LNG handling. This HAZOP analysis resulted in specific recommendations to improve the design and enhance the safety of the proposed LNG ship.

A HAZOP Analysis of a Thermal Oxidizer

JBFA led a HAZOP analysis of a thermal oxidizer system (TO) at an adhesive tape manufacturing plant. The system burns airborne volatile organic compounds exhausted from tape coating stations. The analysis focused on potential accidents that could lead to

fires, explosions, or the release of unburned emissions. The HAZOP analysis resulted in specific suggestions for reducing potential hazards associated with the TO.

A Process Hazard Analysis of an HF Alkylation Unit

JBFA led and documented a PHA of an hydrofluoric acid (HF) alkylation unit at a refinery in Texas. The PHA team used the HAZOP and checklist analysis methods to review the design features, equipment, and operations associated with the HF acid unloading, storage, and transfer systems; hydrocarbon feed and dehydration systems; reaction and settling systems; HF acid regeneration system (including the CBM pit); hydrocarbon fractionation systems; product defluorination and treating systems; and acid and non-acid flare systems (including the neutralization system associated with the acid flare). To satisfy OSHA's PHA requirements, the team evaluated previous incidents associated with the alky unit, performed a checklist review of potential facility siting concerns, performed several human factors reviews focusing on important unit procedures, instrumentation and controls and key operations personnel.

A Process Hazard Analysis of a Chlorine Production Plant

JBFA led a PHA of a chlorine plant using the HAZOP analysis technique to satisfy the PHA requirements of OSHA's PSM regulation. The plant manufactures the chlorine, using diaphragm cell technology, and then dries and compresses the gas to produce liquid chlorine. The analysis team also performed a checklist review to ensure that general safety issues (e.g., utility failures and emergency response measures) were addressed. In addition, the team also reviewed chlorine tank car loading procedures.

A PSM Compliance Audit of an Agricultural Manufacturer

A manufacturer of agricultural chemicals had spent several years developing a PSM program when they enlisted JBFA's expertise to perform a PSM compliance audit. We worked directly with those of our client's employees who were most knowledgeable about all aspects of the covered processes. Based on (1) direct field observation, (2) examination of management and documentation systems, and (3) thorough consultation with our client's employees, we produced a detailed evaluation of all PSM elements. We presented our findings in the form of specific recommendations that corresponded directly to the individual features of the OSHA regulation. This format allowed us to make an orderly and thorough qualitative evaluation of existing programs, how those programs met regulatory compliance, and what would be needed to improve compliance.

A Risk Management Program Plan for a DOE Facility

JBFA developed a program plan that a large DOE facility is using to integrate risk assessment results into its budget planning. The program includes four elements: assessment, control, planning, and documentation.

Under the assessment element, the facility evaluates the risk associated with various operations. The control element includes cost-benefit analyses using the results from the assessment to establish priorities for risk assessments and to integrate risk assessment into the development of new facilities. Planning and controlled-format documentation help ensure the success of the risk management program. To help implement the risk management program, JBFA performed a facility risk review (FRR) on the facility. The purpose of the FRR is to identify potential accidents and rank those accidents by risk. The risk rankings identify the most important contributors to overall facility risks. The rankings allow decision makers to (1) focus attention on potential accidents that should receive priority during loss prevention activities and (2) identify those accidents for which a detailed risk assessment may be desired.

Equipment Integrity Program for a Facility

This company's facility uses hazardous substances, including ammonia, chlorine, and natural gas. They hired JBFA personnel to create and help implement a written Equipment Integrity Program to help satisfy the requirements of OSHA's PSM regulation (29 CFR 1910.119). This system, documented in a format immediately usable to their facility, was designed to mesh with their existing "culture." JBFA personnel provided guidance to the facility in the implementation of the Equipment Integrity Program as well.

Assessment of Activities Related to PSM for a Consumer Product Manufacturer

Early in 1995, JBFA presented its final report to a consumer product manufacturer, who needed an evaluation of its level of compliance with OSHA's PSM regulation. The JBFA team first communicated OSHA's PSM requirements to the client's management and personnel and then interviewed personnel as a basis for identifying materials and processes that would be subject to the OSHA standards. Our team also made tours of the client's facility, obtained knowledge about other facilities operated by the client, and assessed current activities and practices that could become part of a PSM compliance program. With the knowledge gained from these sources, we were able to (1) evaluate the plant's overall PSM compliance, (2) relate the status of current activities to each of the 14 elements of the PSM regulation, (3) recommend general actions to enhance compliance with those 14 elements, and (4) recommend an action plan and timetable for developing and implementing a PSM program.

A Process Safety Management Assessment and Implementation Plan for Three Facilities Belonging to a Fertilizer Manufacturer

A large fertilizer manufacturer hired JBFA to assess process safety management (PSM) activities at three of the manufacturer's facilities. First, we evaluated current PSM activities at each of the facilities. We then defined the desired content of each OSHA PSM element. After we identified the tasks necessary to reach the client's goal, we projected estimates of the time and effort (in terms of staff days) needed for both development and implementation of a well-rounded PSM program. We also addressed

the requirements and estimated effort for the annual activities required beyond initial implementation. To place all necessary activities in a unified perspective, we framed an implementation plan, detailing the efforts necessary at the corporate level as well as at each of the locations in question.

Results From the Initial PSM Analysis of an Ammonia Plant

JBFA led and documented a PSM analysis of an ammonia plant to identify and evaluate current PSM programs and practices at the plant. The review was designed to help the client discover weaknesses in the existing PSM programs and practices so that the plant staff may implement corrective actions to improve plant safety and satisfy (1) the requirements of OSHA's PSM regulation 29 CFR 1910.119 and (2) an informal settlement agreement that exists between the client and OSHA. JBFA supplied detailed checklists of specific PSM compliance requirements that apply to the plant. JBFA engineers rated the client's compliance for each of the fourteen elements.

A Process Safety Management Implementation Plan for a Paper Manufacturing Company

JBFA teamed with a paper manufacturing company to develop a program plan for implementing a PSM system. The team used the requirements of the OSHA PSM regulation as the basis for the program plan. The plan identifies specific tasks (and estimates) for the development and initial implementation of the 14 PSM elements of the regulation. Also, the plan includes the estimated cost for writing a PSM manual (describing the company's approach) and the estimated cost for assessing compliance at the end of the year. The PSM implementation plan was developed by defining the desired content of each PSM element, identifying major activities (and subsequent tasks) for implementing each element, assigning an individual to be responsible for each element's development, estimating the effort required to complete each task, and establishing a target date for completing each task.

A HAZOP Review of an HF Alkylation Unit

JBFA led a HAZOP analysis of an HF alkylation unit at a refinery in Texas. The analysis included evaluation of the existing process for production of alkylate from light olefins. The analysis also included evaluation of several new systems that will be added to the unit: an emergency pumpout system, a feed treating hydrogenation reactor, an acid-soluble oil neutralization system, and a potassium hydroxide regeneration system. The analysis focused on events that could lead to significant releases of hydrofluoric acid or hydrocarbon. The analysis resulted in specific suggestions for reducing potentially serious hazards associated with the HF alkylation process.

A HAZOP Review of an ISOMAX Unit

JBFA led and documented a HAZOP analysis of an ISOMAX unit at a refinery in Canada. The unit was fed with heavy gas oil and the feed was catalytically reacted with hydrogen at high temperatures and pressures to form products in the naphtha and kerosene boiling ranges. The study focused on identifying toxic releases (H₂S), as well as flammable/explosive releases (H₂, propane). Recommendations for improving process safety and reducing the chance of a release were documented in a report of the analysis findings.

Process Hazard Review and FMEA of LPG Handling and Storage

JBFA performed a process hazard review (PHR) and a failure mode and effects analysis (FMEA) of all LPG handling and storage activities at a refinery, including truck and rail loading/unloading, process unit feed/rundown, and tank farm operations. The review examined equipment and procedures for both manual and automated handling operations and documented failures of interest in an FMEA table.

A HAZOP Analysis of an HF Alkylation Unit

JBFA used the HAZOP analysis technique to identify potential accidents that could result in hydrogen fluoride (HF) or hydrocarbon releases at an alky unit. Our personnel led the HAZOP team, documented the HAZOP analysis, and provided recommendations for improving process safety and reducing the chance of process material releases.

HAZOP Analyses of HF Alkylation Units

JBFA used the HAZOP analysis technique to identify potential accidents that could result in hydrogen fluoride (HF) and hydrocarbon releases. Two separate HF alkylation units were analyzed — one was relatively new and the other was more than 30 years old. In both cases, JBFA personnel provided recommendations to improve process safety and reduce the chance of HF and hydrocarbon releases.

Evaluation of Potential Toxic and Flammable Releases from a Refinery

JBFA conducted a review of the potential impact of major accidental process releases from a refinery. The refinery is close to several offices and one residential population. The evaluation included consideration of toxic (i.e., H₂S) fire and explosion effects from major refinery releases. The objective of the study was to identify possible improvements in hardware, procedures, and emergency planning at the refinery.

A Risk Assessment of a Chlorine Storage Area

JBFA performed a risk assessment for the chlorine storage facility of a large chemical plant. The total capacity for the chlorine storage tanks was 1,300 tons. Our assessment identified potential accident scenarios that could result in moderate or large releases of chlorine. We developed a time-dependent model for evaluating the formation and evaporation of liquid chlorine pools. In addition, we used the DEGADIS model to estimate the downwind distances at risk for chlorine exposure. Included in the assessment was an analysis of possible fires with the potential for causing a BLEVE. The risk assessment team was able to demonstrate that installing an expensive concrete dike around the storage area (as suggested by an industry guideline) would provide only a small reduction in risk. The study also showed that improving emergency preparedness planning and training would have a more significant risk reduction impact at a much lower cost. We also found ways to minimize the likelihood of those incidents that would be the most likely causes of a substantial chlorine release.

A Risk Assessment Involving Electrical Classification of Areas

The purpose of this work was to estimate the relative risk among three alternative plans for addressing electrical classification in selected areas. Tasks included developing a preliminary plan for collecting/developing information relating to risk-based decision making; discussing risk-based decision concepts; and taking a tour of the areas. Specific findings from the tour are cited in the technical report. In particular, the assessment team made three general recommendations: use diligence in eliminating ignition sources, evaluate the adequacy of ventilation, and minimize the chances for a release of flammable process material.

Accidental Spill Prevention Study

This study provides a plan useful for effective risk management decisions in regard to reducing or eliminating the risk of discharging materials. The study also addresses EPA concerns. Phase I of the plan develops a risk assessment criteria and a method for evaluating the need for actions to reduce the risk of spills of hazardous materials to storm sewers. Phase II characterizes the consequences and frequency for the release scenarios. The resulting risk matrix enables analysts to rank scenarios and develop recommendations for reducing risk.

Facility Risk Screening Study of a Tissue Mill

JBFA led and documented a facility risk screening study at a tissue mill in Mexico to (1) identify potential accidents involving highly hazardous chemicals (e.g., chlorine, xylene, natural gas, and sulfuric acid) that could directly threaten the safety of employees, the public, and/or the environment, (2) evaluate the frequency or likelihood of each event, (3) evaluate the consequences associated with each event, including dispersion

modeling of chlorine releases, and (4) formulate recommendations to help reduce risk. One goal of the study was to help the client develop an effective risk management strategy that will satisfy certain elements of the Mexican government's proposed program for the prevention of accidents (SEDESOL). The physical scope of the screening study included all major equipment associated with chlorine, xylene, natural gas, and sulfuric acid as well as the diesel/petroleum storage tanks, two liquefied petroleum gas storage tanks, and the acetylene/oxygen storage shelter. The critical risk evaluation resulted in recommendations for further consideration by the mill's management.

A Quantitative Risk Assessment of an Offplot HF Storage Tank

JBFA performed a simplified quantitative risk assessment (QRA) of an offplot HF storage tank. The intent of the QRA was to determine the benefit, if any, of adding an offplot HF storage tank for an alkylation unit. The overall impact of adding the offplot tank depended on two competing effects: (1) the benefit of storing large quantities of HF away from manned areas during turnarounds when potential for release is higher versus (2) the increased leakage risk of an additional tank and associated piping. The team provided QRA results, including risk contribution information, to help the client's management make a decision.

A Quantitative Risk Analysis of Fluoride Releases from an Aromatics Separation Unit

Using event tree analysis techniques, JBFA quantified the expected frequency of potential accidents that could lead to fluoride releases. For each particular accident sequence, fluoride release rates and durations were calculated. Using the estimated releases for each accident, our customer's atmospheric dispersion model predicted how far downwind toxic fluoride concentrations could occur for meteorological conditions at the plant site. JBFA used the results of the analysis to recommend design and procedural changes aimed at reducing the plant risk and also evaluated the risk reduction afforded by various proposed risk reduction projects.

A HAZOP Analysis of a Flare System Upgrade to the Alkylation Unit and Propylene Concentration Units

JBFA performed a HAZOP analysis on a flare system upgrade for an alkylation unit and propylene concentration unit at a large oil refinery. In this review, we identified process hazards and potential operability problems that could occur and result in hazardous consequences and operational problems at these units. The flare system handles mainly hydrocarbon vapors vented during overpressure or emergency situations, and the upgrade modifications mainly consisted of resizing relief valves and discharge lines along with resetting the setpoints on many relief valves. This HAZOP review resulted in specific recommendations to improve the design and enhance the safety of the proposed flare system modifications.

Facility Risk Review of a Plant

JBFA performed a facility risk review (FRR) of a tar sand plant in Canada. All plant operations, from mining tar sands to refining synthetic crude oil, were included in the FRR. The objectives of this study were to (1) set priorities for more detailed risk assessment effort and (2) develop recommendations for reducing plant risk. The FRR team employed failure modes and effects analyses along with preliminary estimates of event frequencies and consequences to identify major risk contributors. These important risk contributors became the focus of risk-reduction efforts. In this FRR we estimated both the business interruption and equipment damage impacts of postulated failure events.

Economic Risk Analysis of a Refinery FCCU-Gas Plant Complex

Using fault tree and event tree analysis techniques, JBFA estimated the risk associated with the operation of a fluidized catalytic cracking unit (FCCU) and its associated gas plant. We ranked the major risk contributors using estimates of the expected frequencies and consequences of fires, explosions, and process accidents. The analysis resulted in specific recommendations for improving refinery profitability through improved unit availability.

Preliminary Hazards Analysis of a Refinery FCCU-Gas Plant Complex

JBFA performed an economic risk analysis of the FCCU-Gas plant complex at a refinery. We used failure modes and effects analysis (FMEA) techniques to determine potential high-risk component failures that could lead to unacceptable economic losses in two process units. JBFA made recommendations for improvements that will increase the availability and profitability of the refinery. The risk assessment results also affected improved plant safety during the major design and operating modernization of the complex.

Preliminary Hazards Analysis at a Synthetic Crude Oil Plant

JBFA provided risk assessment training and consulting services to enable a company to conduct a plant-wide hazards analysis. The analysis scope encompassed all plant activities, from mining tar sand to shipping synthetic crude oil. While the plant personnel postulated events, we served as instructors and reviewers, assessing the expected frequency and consequences (equipment damage, business interruption, and personnel safety impact) associated with each event.

Economic Risk Analysis of a Refinery Hydrocracker Unit

JBFA estimated the risk associated with a hydrocracker unit, using fault tree analysis and event tree analysis techniques. We ranked the major risk contributors, using estimates of the expected frequency and consequences of fires, explosions, and other accidents. This analysis led to the formulation of recommendations for improving refinery profitability via improved unit availability.

Review of a Benzene Storage Facility Risk Assessment

JBFA performed an independent review of subcontractor work on a Risk Analysis Safety and Hazards Mitigation Studies (Vols. 1 and 2). As part of this project, we testified in public hearings and before the city council on the concepts of risk and on the accuracy and completeness of the risk studies.

A HAZOP Review of Vapor Recovery Unit Modifications

JBFA led a HAZOP analysis of capacity expansion projects for two vapor recovery units (VRUs) at a large refinery. The analysis focused on potential accidents that could lead to a hydrocarbon vapor cloud release or to a significant operational upset. Our documentation of the analysis included 50 recommendations to improve the safety and operability of the VRUs.

Reliability Analysis of a Distillation Column Pressure Control System

JBFA performed a reliability analysis on several pressure control/shutdown systems being considered by the customer for several distillation columns. The analysis identified the most reliable design and provided several recommendations for improving this design. The analysis also compared the reliability of these designs to the reliability of relief valves. Based on the results of the study, the customer changed corporate policy for specification of distillation column pressure control systems.

Reliability Analysis of a Hydrocarbon Interface Pressure Control System

JBFA performed a reliability analysis on several pressure control/shutdown systems being considered for installation on the customer's pipeline. For each system, the analysis estimated (1) the probability of the system failing to protect the pipeline in the event of an overpressure and (2) the expected number of inadvertent shutdowns caused by system malfunctions. The study identified the most reliable design and provided recommendations for improving the design.

Extraction Water System Reliability Analysis

JBFA conducted a reliability analysis of an extraction water system (EWS), which provides process water and cooling to critical refinery units at a tar sands plant in Canada. Catastrophic loss of EWS flow can cause severe flare system upsets. Our quantitative

reliability analysis modeled the EWS, estimated the expected frequency of system failure, and provided recommendations to reduce the frequency of EWS failure.

RAM Analysis of a Tar Sand Facility

JBFA performed a reliability, availability, and maintainability (RAM) analysis to estimate the equivalent full-production availability of a proposed facility for extracting commercial tar sand oil.

Reliability Analysis of Utility Systems

JBFA conducted a reliability analysis of six utility systems operated at a refinery in Canada. A qualitative and quantitative fault tree analysis identified design and operational weaknesses, and we made recommendations to eliminate these weaknesses.

Kanawha Valley Risk Management Programs Project

We led 14 Charleston, West Virginia, facilities in development of worst-case scenarios and RMPlans. At the conclusion of the project, we presented the results to the community. The work involved industry, regulators, and the public and is viewed as the groundbreaking pilot study for EPA RMP development and communication to emergency planners and the public.

East Harris County Manufacturers Association Risk Management Planning and Communication Project

Currently, we are leading more than 90 Houston-area facilities in a 4-year project to develop RMPlans for EPA compliance and to communicate RMP information to the public.

Send requests for further information to: contract-jbfa@eqe.com
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