# GUIDANCE FOR IMPLEMENTING PROGRAMS FOR OSHA 29 CFR 1910.119

## *PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS*

## PART FOUR

## PRE-STARTUP SAFETY REVIEW

by

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# GUIDANCE FOR IMPLEMENTING PROGRAMS FOR OSHA PSM

## PRE-STARTUP SAFETY REVIEW

This document contains information that may assist a company in establishing, or reviewing and updating, the pre-startup safety review (PSSR) element of their process safety management (PSM) program. The information in this document is based upon the U.S. Occupational Safety and Health Administration's regulation, 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*. However, this information may be of use to anyone developing or updating a PSM program for any purpose.

In 1993 the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) commissioned Primatech Inc. to develop a "training material reference manual" related to 1910.119. The purpose of the manual is to provide OSHA's Office of Training and Education with a resource for training federal and state OSHA field officers on enforcing the PSM regulation.

The training material reference manual features an annotated form of the Program-Quality-Verification (PQV) inspection checklist originally presented in Appendix A of OSHA Instruction CPL 2-2.45A. Example programs are provided to illustrate the positive and negative indicators of the checklist questions. OSHA has agreed to allow Primatech to make this information available to interested parties. This should in no way be construed as acceptance by OSHA of the suitability of the information or examples provided herein.

The format of this document follows the PQV inspection checklist presented in Appendix A of OSHA Instruction CPL 2-2.45A, often referred to as the "compliance directive". For each question in the PQV inspection checklist, clarification is provided on the checklist item along with positive program indicators and negative program indicators for each question. The positive and negative program indicators are intended to provide ideas for the user to help them in assessing their existing or planned program.

The example programs provided in this document illustrate approaches taken by companies seeking to address the requirements of 1910.119. These examples have not been reviewed and/or endorsed by OSHA and should not be construed as model programs.

The example programs provided herein were developed for specific processes, and are not generic in nature. Since the OSHA PSM regulation is performance-based, readers are strongly encouraged to develop programs tailored to their own covered processes.

This document is offered for the user's general guidance only. This document does not attempt to provide any interpretation of the OSHA regulations.

Primatech makes no claims regarding the acceptability to OSHA of the information contained herein to OSHA. Consequently, Primatech can accept no liability for any use which the user may make of the information contained herein. Note that the information contained in this manual does not necessarily represent the opinion of Primatech.

# OVERVIEW

This guidance document is arranged in a tabular format. The following is a description of each of the column headings used in the table:

## PQV Question

The PQV question is derived from the checklist in Appendix A of the OSHA Compliance Directive (CPL 2-2.45A), which is based on the specific regulatory requirements for the element. Note that the verification portion of the checklist includes questions for records review, on-site conditions, and interviews. In order to avoid unnecessary duplication of information, this guidance document references the checklist questions from the records review section only. Specific questions or concerns from the on-site conditions and interviews sections that are not addressed in the records review section are accounted for in the positive and/or negative program indicators column.

## Explanation

The explanation clarifies or provides additional insight into the PQV question. In some cases, the explanation provides an interpretation of the PSM requirement. In no cases should the information contained in this column be viewed as a substitute for the actual regulatory requirement.

## Positive Program Indicators

The information included in the positive program indicators column is intended to provide guidance and examples on what to look for in a well developed program. This column also includes guidance on what to look for when evaluating PSM programs. This column is not intended to contain all conceivable attributes of a good program for all industry types. Rather, it is intended to provide suggestions and ideas on what a good program might include.

**Negative Program Indicators**

The information in the negative program indicators column is intended to provide guidance on possible signs of a poor or incomplete program. This information could be of assistance for identifying potential problem areas when conducting PSM program evaluations. A PSM program that contains one or more of these attributes does not necessarily constitute a poor program. Rather, this information is intended to serve as a guide on what to look for in a less developed program.

It is important for the user of this manual to understand that over 25,000 employers may be covered under the PSM standard. Covered facilities range from large complex chemical, petrochemical, or petroleum facilities, to relatively simple ammonia refrigeration or chlorination systems. This guidance document cannot cover all of the possible ranges regarding the content of PSM program elements in the various industry groups. Additionally, since the PSM standard is a performance based regulation, this guidance document can not address the specific approaches different companies or facilities may choose to implement in complying with the requirements.

In addition to the table, this guidance document contains several helpful appendices, including:

| | |
|---|---|
| Appendix A - List of Acronyms | Contains description of key acronyms used in the guidance document. |
| Appendix B - Glossary of Terms | Contains definitions of key terms used in the guidance document. |
| Appendix C - Technical References | Contains a list of helpful technical references to support the information presented in the table. |
| Appendix D - Example Program(s) | Contains example(s) of how this PSM element has been adopted. Most of the examples are actual programs provided by industrial companies. |

# PSM TRAINING MATERIAL REFERENCE MANUAL

## PRE-STARTUP SAFETY REVIEW [29 CFR 1910.119 (i)]

| PQV Question | Explanation | Positive Program Indicators | Negative Program Indicators |
|---|---|---|---|
| 1. Has a pre-startup safety review been performed for all new facilities and for modified facilities when the modification is significant enough to require a change in process safety information? | New process facilities, as well as modified facilities for which process safety information must be changed, should undergo a pre-startup safety review before startup. The pre-startup safety review serves as a final check to ensure that equipment is installed properly and is in accordance with design specifications; that all necessary procedures are written/updated; that PHA recommendations have been resolved; and, that appropriate employee training is completed. | The employer has established procedures requiring performance of a pre-startup safety review for new facilities, and has established criteria for identifying modifications that require updating of process safety information and performance of a pre-startup safety review.<br><br>Pre-startup safety reviews are performed before highly hazardous chemicals are introduced into new facilities or modified facilities.<br><br>Pre-startup reviews should include: a review of operating procedures; a walk-through inspection of the facility; consideration of the need to update process safety information, emergency response plan, maintenance procedures, and contractor procedures; PHA and resolution of resulting recommendations.<br><br>A safety checklist could be used to assess whether new or modified facilities are ready for startup.<br><br>Authorizations by appropriate individuals may include: engineering; operations; maintenance; and/or safety.<br><br>Capital project procedures should include specifications for a pre-startup safety review. | No policy exists for identifying subject facilities or for addressing the pre-startup safety review of new or modified facilities.<br><br>Pre-startup safety reviews are not performed for new facilities or modified facilities.<br><br>Approvals of the review are not made by the appropriate personnel.<br><br>No documentation of pre-startup safety reviews can be found. |

# PRE-STARTUP SAFETY REVIEW [29 CFR 1910.119 (i)]

| PQV Question | Explanation | Positive Program Indicators | Negative Program Indicators |
|---|---|---|---|
| 2. Do pre-startup safety reviews confirm that prior to the introduction of highly hazardous chemicals to a process:<br><br>• construction and equipment is in accordance with design specifications?<br>• safety, operating, maintenance and emergency procedures are in place and adequate?<br>• for new facilities, a PHA has been performed and recommendations resolved or implemented before startup?<br>• modified facilities meet requirements of paragraph [l]?<br>• training of each employee involved in operating the process has been completed? | The pre-startup safety review should enable the employer to verify that prior to introduction of highly hazardous chemicals to a process:<br><br>• equipment is constructed and installed in accordance with design specifications<br>• all procedures are prepared or updated, and are adequate<br>• a PHA has been performed and all recommendations have been resolved, for new facilities<br>• process safety information is updated<br>• training of each employee involved in operating the process has been completed<br><br>The pre-startup safety review should also enable the employer to confirm that modified facilities meet the requirements of paragraph [l], management of change.<br><br>Conducting a PHA is an efficient means of addressing management of change concerns with respect to modified facilities. | Adherence to appropriate design specifications is documented.<br><br>Interviews with operators, maintenance employees and engineers confirm that construction and equipment are in accordance with design specifications.<br><br>All operating procedures are up-to-date, reflecting changes or modifications.<br><br>Startup procedures and normal operating procedures are fully evaluated to ensure a safe transfer to normal operating mode.<br><br>Records and employee interviews show that training was conducted and is adequate.<br><br>PHA recommendations are reviewed and resolved before startup.<br><br>All process safety information is updated when affected by facility modifications. | No procedure exists for ensuring that equipment is in compliance with appropriate design specifications.<br><br>Operating procedures do not include updates or modifications that reflect changes to the facility.<br><br>Changes to safety, operating, maintenance and emergency procedures are not adequately documented.<br><br>*Recommendations resulting from the PHA* were not resolved prior to startup.<br><br>Modified facilities do not have up-to-date process safety information.<br><br>Interviews with employees show that training of those involved in operating the process has not been completed or does not include all personnel affected by changes. |

## LIST OF ACRONYMS

| | |
|---|---|
| AIChE * | American Institute of Chemical Engineers |
| ANSI * | American National Standards Institute |
| API * | American *Petroleum Institute* |
| ASHRAE * | American Society of Heating, Refrigeration and Air-Conditioning Engineers |
| ASME * | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Material |
| AWS * | American Welding Society |
| BFD | Block Flow Diagram |
| CCPS * | Center for Chemical Process Safety |
| CGA * | Compressed Gas Association |
| CMA * | Chemical Manufacturers Association |
| DIERS | Design Institute for Emergency Relief Systems |
| EPA | Environmental Protection Agency |
| FEMA | Federal Emergency Management Agency |
| FMEA | Failure Mode and Effects Analysis |
| FTA | Fault Tree Analysis |
| HAZOP | Hazard and Operability Study |
| HHC | Highly Hazardous Chemical |
| IDLH | Immediately Dangerous to Life and Health |
| IIAR * | International Institute of Ammonia Refrigeration |
| ISA | Instrument Society of America |

| | |
|---|---|
| LC | Lethal Concentration |
| LD | Lethal Dose |
| MSDS | Material Safety Data Sheet |
| NFPA * | National Fire Protection Association |
| OSHA | Occupational Safety and Health Administration |
| P&ID | Piping and Instrument Diagram |
| PEL | Permissible Exposure Limit |
| PFD | Process Flow Diagram |
| PHA | Process Hazard Analysis |
| PSM | Process Safety Management |
| PQV | Program-Quality-Verification |
| SOCMA | Synthetic Organic Chemical Manufacturers Association |
| SOP | Standard Operating Procedure |
| STEL | Short Term Exposure Limit |

* Mailing address and telephone numbers included

## Referenced Agency Addresses and Phone Numbers

AIChE
American Institute of Chemical Engineers
345 East 47th Street
New York, New York 10017
Phone: 212-705-7338

ANSI
American National Standards Institute
11 West 42nd Street
New York, New York 10036
Phone: 212-642-4900

ASHRAE
American Society of Heating, Refrigerating and Air-Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, Georgia 30329
Phone: 404-636-8400

ASME
American Society of Mechanical Engineers
22 Law Drive
P. O. Box 2300
Fairfield, New Jersey 07007-2300
Phone: 800-843-2763

AWS
American Welding Society
550 N.W. LeJeune Road
Miami, Florida 33126
Phone: 800-443-9353

CCPS
Center for Chemical Process Safety of the AIChE
345 East 47th Street
New York, New York 10017
Phone: 212-705-7319

## Referenced Agency Addresses and Phone Numbers (Continued)

CGA
Compressed Gas Association
1725 Jefferson Davis Highway, Suite 1004
Arlington, Virginia 22202
Phone: 703-412-0900

CMA
Chemical Manufacturers Association
2501 M Street, N.W.
Washington, D.C. 20037
Phone: 202-887-1100

IIAR
International Institute of Ammonia Refrigeration
1101 Connecticut Avenue, N.W., Suite 700
Washington, D.C. 20036
Phone: 202-857-1110

ISA
Instrument Society of America
67 Alexander Drive
P.O. Box 12277
Research Triangle Park, North Carolina 27709
Phone: 919-549-8411

NFPA
National Fire Protection Association
1 Batterymarch Park
Quincy, Massachusetts 02169
Phone: 800-344-3555

# APPENDIX B

## Glossary of Terms

# GLOSSARY OF TERMS

BLOCK FLOW DIAGRAM or BFD[1]

A diagram used to show the major process equipment and interconnecting process flow lines as well as flow rates, stream composition, temperatures, and pressures. The BFD is intended as a simplified diagram.

CHECKLIST[2]

Detailed list of desired system attributes or steps for a system or operator to perform. Usually written from experience and used to assess the acceptability or status of the system or operation compared to established norms.

CONSEQUENCE[2]

The direct, undesirable result of an accident sequence usually involving a fire, explosion, or release of toxic material. Consequence descriptions may be qualitative or quantitative estimates of the effects of an accident in terms of factors such as health impacts, economic loss, and environmental damage.

DECISION TREES[4]

Decision trees are a special case of event tree models used to guide the user through multiple questions and provide a course of action based on the outcome of all of the questions. They provide no logical method of choosing the initiating event.

ELECTRICAL ONE-LINE DIAGRAM[1]

A diagram including legend of the electrical power distribution system that could contribute to a highly hazardous chemical release showing such items as power consumers, the chain of supply back through starters, distribution centers, substations to the main feeder, emergency power supply, and connections to various components. For complex systems, the one-line diagram may be a group of drawings.

FACILITY[3]

The buildings, containers and equipment that could reasonably participate in a catastrophic release as a result of being physically interconnected or of their proximity and in which dangerous substances are used, stored, manufactured, handled, or moved.

FAILURE MODE AND EFFECTS ANALYSIS or FMEA[1]

A specifically designed method to identify the conceivable ways that a highly hazardous chemical equipment or its components can fail and the effect of the failure on the system with respect to a release. The failure and effects are determined in a study of updated piping and instrument diagrams that describe the facility taking into consideration process chemistry, standard operating procedures, maintenance procedures, operator job descriptions, process flow diagrams, inventory tabulations, electrical one-line diagrams and other documents. The resulting qualitative analysis is translated into a quantitative FMEA when probabilities of the failure of components are assigned. The results of the FMEA are reported for a unit or system of a facility on an FMEA table. The results are entered on a FMEA table for each equipment item or component studied are as follows: the identification number of the item, the name of the item, the other equipment potentially affected with the equipment identification number and the effect of the failure on that equipment, a classification of the criticality ranking of the failure based on quantity or rate of the potential release, the probability of the failure and the suggested action in terms of equipment or procedure to prevent the failure or to mitigate the results of the failure.

FAULT TREE ANALYSIS or FTA[1]

The analysis of the logic diagram constructed from a study of the updated piping and instrument diagrams that describe the facility taking into consideration process chemistry, standard operating procedures, maintenance procedures, operator job descriptions, process flow diagrams, inventory tabulations, electrical one-line diagrams and other documents. The logic diagram is called a fault tree and represents a qualitative analysis of the hazards. Results of the FTA are reported for a unit or system on a table. Entered on the table are the descriptions of the various combinations of equipment or procedural failures that can lead to a release. The combinations are determined by solving the fault tree logic diagram for the minimal cut sets, that is, the smallest combination of equipment or procedural failures, which if all occur, will result in the "top event", that is the highly hazardous chemical release. The table is also entered with a criticality ranking based on the quantity or rate of the potential release, a probability for the respective failures and the suggested action in terms of equipment or procedure to prevent the failure or to mitigate the results of the failure. The analysis of the logic diagram includes the identification of "minimal cut sets." When probabilities are assigned to each element of the event sequence, a qualitative fault tree is obtained which gives the probability or frequency of occurrence of the release.

HAZARD[2]

An inherent physical or chemical characteristic that has the potential for causing harm to people, property, or the environment.

HAZARD ANALYSIS[1]

A systematic identification of the potential conditions that may result in an EHS accident.

HAZARD AND OPERABILITY STUDY or HAZOP[1]

A systematic study of updating piping and instrument diagrams that describe the highly hazardous chemical facility taking into consideration process chemistry, standard operating procedures, maintenance procedures, operator job descriptions, process flow diagrams, chemical inventory tabulations, electrical one-line diagrams and other documents. The study is performed by a multidisciplinary team to identify hazard or operability problems that would result in a highly hazardous chemical accident. Deviations from the design value of key parameters (flow, temperature, composition, time, quantity, etc.) of each segment of the highly hazardous chemical facility and its procedures are studied using guide words (such as, more of, less of, none of, part of, more than and other) to control the examination and evaluation. The study team shall consist of trained personnel knowledgeable in the technology and operations, such as process chemistry, the design of the system, the procedures of its operation and maintenance, and the related codes, standards and practices. In addition, the study team shall have technical expertise to answer most questions of the review without resorting to further expertise. The study team shall include a study leader specifically qualified for his or her leadership role by training or previous experience in HAZOP studies and a team secretary who shall record the results of the study. Persons who occupy these team study positions shall be technically trained and be available for the duration of the study. Results of the HAZOP study shall be reported by tabulation for a unit by key equipment, such as vessels or pipelines, and process parameter. The results are entered on the table as follows: guide word, causes of the deviation, consequences of the deviation in terms of a potential release, the criticality based on the quantity or rate of potential release and the suggested action in terms of equipment or procedure to mitigate the deviation.

HIGHLY HAZARDOUS CHEMICAL or HHC[3]

A substance possessing toxic, reactive, flammable, or explosive properties.

HUMAN ERROR[2]

Actions by or failures to act on the part of designers, operators, managers, or other individuals that may contribute to or result in accidents.

MATERIAL SAFETY DATA SHEET or MSDS[1]

A document which describes, at a minimum, the chemical and physical properties and the physical and health hazards of a substance.

MODIFICATION[1]

Any change in existing equipment or procedures that would require a change in process safety information and/or operating procedures. Modification does not include routine maintenance or replacement in kind.

OPERATOR[2]

An individual responsible for monitoring, controlling, and performing other tasks as necessary to accomplish the productive activities of a system. Often used in a generic sense to include people who perform various tasks (e.g.; reading, calibration, maintenance).

PIPING AND INSTRUMENT DIAGRAM or P&ID[1]

One or more detailed drawings including legends and citations of referenced documents showing: every item of highly hazardous chemical equipment and its identification number (including installed spare equipment); every pipe size, flow direction, identification number and identification of ANSI piping specification and break between piping specifications; symbols and identification of every instrument including instrument function to show trips and interlocks represented in accordance with Instrument Society of America standards or a standard adequate for the conduct of a safety review or hazard analysis with an appropriate symbol legend shown, every valve, the failsafe position of control valves or non-hand operated valves in the case of instrument air or power failure; steam traps; representation of insulation or heat tracing of piping, highly hazardous chemical equipment and instruments; sizes of all important equipment nozzles with location shown schematically to reflect function and elevation, such as, drains, vents, flushing connections and steam connections; references to interfacing with other diagrams describing process, service, treatment, disposal, or utility systems; data on type, size, and set pressures of every relief valve and relieving device; instruments to monitor early detection of abnormal conditions or a highly hazardous chemical release; where critical, the relative elevations between equipment and of key piping; notes or symbols on such items as slope of critical piping to avoid pockets, or, where critical symmetrical piping; notes on each item of highly hazardous chemical equipment, such as, material of construction, design temperature, design pressure, design thermal duty of heat exchangers, design capacity and dynamic head of rotating equipment, etc.

PRELIMINARY HAZARD ANALYSIS[2]

A technique that is derived from the U.S. Military Standard System Safety Program Requirements. Focuses in a general way on the hazardous materials and major process areas of a plant, and is often used as a precursor to further hazard analyses.

PROCESS CHEMISTRY[1]

The chemical reactions which are relevant to possible scenarios of highly hazardous chemical releases, including information on raw materials, intermediates, products, and waste products.

PROCESS FLOW DIAGRAM or PFD[1]

A diagram including a legend of a facility which depicts the use, generation, storage or handling of a highly hazardous chemical showing items of equipment (groups of duplicate equipment may be represented by one symbol if desired), flow of material from item to item, simplified basic control loops or major control schemes, points of discharge to the environment, and showing or cross-referencing documents which give details of material balance, flows, raw materials, products, intermediates, treatment chemicals, operating conditions of temperature, pressure and steam characteristics, operating cycles and batch sizes where applicable. A process flow diagram includes, or references, a block flow diagram that depicts the receipt, handling and storage steps at the site of shipping containers of the highly hazardous chemical.

PROCESS SAFETY MANAGEMENT[2]

The application of management systems to the identification, understanding, and control of process hazards to prevent process-related incidents and injuries.

REPLACEMENT IN KIND[1]

The replacement of existing highly hazardous chemical equipment with identical or equivalent highly hazardous chemical equipment, and installation according to criteria for design and operation.

RISK[2]

Combination of the expected frequency (events/year) and the consequence (effects/event) of a single accident or a group of accidents.

STANDARD OPERATING PROCEDURE[1]

The document setting forth the operating procedures covering all details of the operation involving highly hazardous materials that are currently in effect at the facility.

TRUTH TABLES[4]

A listing of all combinations of the states of basic events, the resulting occurrence or non-occurrence of a top event, and the corresponding probabilities for the combinations.

WHAT-IF CHECKLIST[1]

A method of hazard analysis based on a systematic study of updated piping and instrument diagrams that describe the highly hazardous chemical facility taking into consideration process chemistry, standard operating procedures, maintenance procedures, operator job descriptions, process flow diagrams, inventory tabulations, electrical one-line diagrams and other documents. The study is performed by a multidisciplinary team to identify hazards or operability problems that could result in a highly hazardous chemical accident. The study is composed of a comprehensive list of questions prepared in advance from study of documents by team members either in conference or independently usually corresponding to their individual background. The study team shall consist of trained personnel knowledgeable in the technology and operations, such as process chemistry, the design of the equipment, the procedures of operation and maintenance and the related criteria for design and operation. In addition they shall have technical expertise to answer most of the questions of the review without recourse to further expertise. The team shall include a person assigned to lead the study and a person to record the results who are technically trained and will be available for the duration of the study. Results of the study shall be reported for a unit on a table. The results are entered on the table as follows: the "what if" question and its corresponding consequence/hazard, the criticality based on the quantity or rate of the potential release and the recommended action in terms of equipment or procedure to mitigate the consequence/hazard.

1. New Jersey Toxic Catastrophe Prevention Act, N.J.A.C. 7:31, New Jersey Department of Environmental Protection and Energy, June 18, 1993.

2. Guidelines for Hazard Evaluation Procedures, 2nd. ed., Center for Chemical Process Safety of the American Institute of Chemical Engineers, 1992.

3. Process Safety Management of Highly Hazardous Chemicals, 29 CFR Part 1910.119, Occupational Safety and Health Administration, February 24, 1992.

4. Reliability Engineering and Risk Assessment, Ernest J. Henley and Hiromitsu Kumamoto, Princeton-Hall, Inc., 1981.

# TECHNICAL REFERENCES

## PRE-STARTUP SAFETY REVIEW

"American National Standard for Equipment Design and Installation of Ammonia Mechanical Refrigeration Systems," ANSI/IIAR-2-1984.

"Management Practices, Self-Assessment Process and Resource," API RP 9000.

Guidelines for Hazard Evaluation Procedures, 2nd ed., Center for Chemical Process Safety of the American Institute of Chemical Engineers, 1992.

Plant Guidelines for Technical Management of Chemical Process Safety, Center for Chemical Process Safety of the American Institute of Chemical Engineers, 1992.

WAC 296-67-033 Pre-startup Safety Review

WAC 296-67-045 Management of Change

## GENERAL REFERENCES

Ammonia Plant Safety (and related facilities), vol. 23, American Institute of Chemical Engineers, 1981.

Ammonia Plant Safety (and related facilities), vol. 24, American Institute of Chemical Engineers, 1984.

Ammonia Plant Safety (and related facilities), vol. 27, American Institute of Chemical Engineers, 1987.

Ammonia Plant Safety (and related facilities), vol. 28, American Institute of Chemical Engineers, 1988.

Ammonia Plant Safety (and related facilities), vol. 31, American Institute of Chemical Engineers, 1988.

"Guidelines for Safe Automation of Chemical Processes," American Institute of Chemical Engineers, 220p.

"Guidelines for Investigating Chemical Process Incidents," American Institute of Chemical Engineers, 347p.

"Guidelines for Auditing Process Safety Management Systems," American Institute of Chemical Engineers, 136p.

"Management of Process Hazards," American Petroleum Institute, Recommended Practice 750.

"Process Safety Management (Control of Acute Hazards)," CMA.

Chemical Manufacturers Association (CMA's Manager Guide), First Edition, September 1991.

"The Revised Field Operations Manual (FOM)," OSHA Instruction CPL 2.54B, June 15, 1989.

"State Plan Policies and Procedures Manual," OSHA Instructions STP 2.22A, Ch-2, January 29, 1990.

"Integrated Management Information Systems (IMIS) Forms Manual, Chapter V " OSHA Instruction ADM 1-1.12B, December 29, 1989.

"Systems Safety Evaluation of Operations with Catastrophic Potential," OSHA Instruction CPL 2-2.45, September 6, 1988.

"Process Safety Management Guidelines for Compliance," OSHA 3133; U.S. DOL, 1992.

"Process Safety Management," OSHA 3132; U.S. DOL, 1992.

"Safety and Health Program Management Guidelines," U.S. DOL, 1989.

"Review of Emergency Systems," June 1988; U.S. EPA, Office of Solid Waste and Emergency Response, Washington DC 20480.

"Chemical Exposure Index," Dow Chemical Co., May 1988.

"Accident Investigation * * * A New Approach," National Safety Council, 1983.

Process Safety Management Resources from the American Institute of Chemical Engineers for Use by Industrial Hygienists, James A. Gideon and Thomas W. Carmody, American Industrial Hygiene Association Journal (53), June 1992.

"Improving Construction Safety Performance," Report A-3, The Business Roundtable.

"Recommended Guidelines for Contractor Safety and Health," Texas Chemical Council.

"Loss Prevention in the Process Industries," Volumes I and II, Frank P. Lees, Butterworth, 1983.

"Guidelines for Engineering Design for Process Safety," 500p.

# APPENDIX D

## Example Programs

The following examples illustrate approaches taken by companies seeking to address the Pre-startup Safety Review requirements of 29 CFR 1910.119. These examples have not been reviewed and/or endorsed by OSHA and should not be construed as model programs. Primatech makes no claims regarding the acceptability to OSHA of the information contained herein.

The example programs provided herein were developed for specific processes, and are not generic in nature. Since the OSHA PSM regulation is performance-based, readers are strongly encouraged to develop programs tailored to their own covered processes.

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## D-1 Pre-startup Safety Review Procedures - Ammonia Refrigeration System

The following example contains a pre-startup safety review program for an ammonia refrigeration facility. The program includes typical safety review team personnel, safety review procedures and a pre-startup review report to ensure a safe startup and operation of the facility.

# PRE-STARTUP SAFETY REVIEW PROCEDURES

## Ammonia Refrigeration System

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## APPENDIX

# 1.0 SUMMARY

Pre-startup safety reviews should be conducted for the ammonia refrigeration system prior to the introduction of ammonia into the refrigeration facility. The pre-startup safety reviews are conducted for new facilities and for modifications to the existing ammonia refrigeration facility where the modifications require a change in either the equipment design basis or the technical design basis. Pre-startup safety reviews are not required for replacements in kind.

The objective of pre-startup safety reviews is to ensure that the following items have been addressed prior to the introduction of ammonia into the refrigeration system:

- Construction is in accordance with specifications;
- Appropriate testing and inspections have been performed;
- Safety, operating, maintenance, and emergency procedures are in place and adequate;
- Process hazard analysis recommendations have been addressed and actions required for startup have been completed; and
- Operating procedures are in place and training of personnel has been completed.

The site maintenance supervisor has the responsibility to ensure that the pre-startup safety reviews are conducted.

## 2.0 SAFETY REVIEW TEAM

The pre-startup safety review should be conducted by a team who by reason of knowledge, training and experience are competent for the review. Such persons typically include:

- In-house design/engineering staff such as the site maintenance supervisor or the regional engineer;
- Experienced refrigeration contractors, possibly in combination with an engineering code authority, authorized inspection agency or property insurance underwriter;
- Consulting engineers; and
- The refrigeration equipment supplier.

## 3.0 PRE-STARTUP SAFETY REVIEW PROCEDURES

Pre-startup safety reviews are conducted for new facilities and for modifications to the existing ammonia refrigeration facility where the modifications require a change in either the equipment design basis or the technical design basis. They are to be conducted prior to the introduction of ammonia into the refrigeration system.

The first step in performing a pre-startup safety review is to complete the requirements of the quality assurance program. The purpose of the quality assurance program is to ensure that the critical equipment handling ammonia is fabricated to meet design specifications and that appropriate checks and inspections are conducted to ensure the equipment is installed properly. The specific procedures involved with the quality assurance program are contained in a separate document.

The technical basis for process design and the equipment design basis should be reviewed and updated as necessary as part of the pre-startup safety review procedure. This process involves a review of the following drawings and documentation:

- Process description and chemistry;
- Process flow sheets;
- Piping and instrumentation diagrams;
- Facility site plans and equipment layout;
- Ammonia inventory;
- Operating limits for key process variables;
- Ammonia refrigeration equipment list; and
- Ammonia refrigeration safety systems list.

The pre-startup safety review also involves a review of the following policies and procedures to ensure that they are in place, adequate, and have been updated to reflect any modifications to the ammonia refrigeration system:

- Operating procedures;
- Hot work permit procedures;
- Lockout and/or tagout procedures;
- Maintenance procedures; and
- Emergency procedures.

One of the requirements involved in the startup of a new facility or modifications to the existing facility is to conduct a process hazards analysis to identify, evaluate and control the hazards associated with the process. The pre-startup safety review documents that the recommendations from the process hazard analysis have been addressed and that the actions required for startup have been completed.

Finally, the pre-startup safety review will document that all necessary personnel are informed of the modification and have been trained in accordance with any new or revised operating procedures.

Any deficiencies in the Process Safety Management (PSM) Program identified during the pre-startup safety review will be immediately documented and brought to the attention of the site maintenance supervisor. Corrective actions for these deficiencies must be completed prior to the introduction of ammonia into the refrigeration system.

## 4.0 PRE-STARTUP SAFETY REVIEW DOCUMENTATION

The report contained in Appendix A will be completed as part of the pre-startup safety review. This report includes:

- An identification of the safety review team members;
- A list of the questions addressed during the safety review; and
- A list of deficiencies in the Process Safety Management Program identified during the safety review and corrective actions taken.

Session 1 for SMITH'S

Company: Smith's Company
Location: Princeton, NJ
Facility: Ammonia Refrigeration Facility

Session Date: - -

| | Name | Phone number | Location |
|---|---|---|---|
| Leader: | | | |
| Scribe: | | | |
| Team: | | | |

Comments: Pre-startup safety review report

AUDIT-PC 1.52 Worksheet Primatech Inc.

Company: Smith's Company
Facility: Ammonia Refrigeration Facility

System: 1
Page: 1

Session: 1 - - Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Quality Assurance Program Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 1. Have the procedures associated with the quality assurance program been completed?<br><br>2. Have the action items identified during the quality assurance program been addressed? | | | | | |

Company: Smith's Company
Facility: Ammonia Refrigeration Facility

System: 1
Page: 2

Session: 1 - - Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Drawings and Documentation Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 1. Has the process description and chemistry been updated to reflect the system modifications? | | | | | |
| 2. Have the process flow sheet and/or block flow diagram been updated to reflect the system modifications? (Note: list sheet(s) and diagram(s) reviewed in the remarks column) | | | | | |
| 3. Have the piping and instrumentation diagrams been updated to reflect the system modifications? (Note: list diagram(s) reviewed in the remarks column) | | | | | |
| 4. Have walkthroughs been conducted on the updated piping and instrumentation diagrams to ensure the updated drawings reflect actual field conditions? | | | | | |
| 5. Have punch lists been generated, where appropriate? | | | | | |

Company: Smith's Company
Facility: Ammonia Refrigeration Facility

System: 1
Page: 3

Session: 1 - -
Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Drawings and Documentation
Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 6. Have the facility site plans and equipment layouts been updated to reflect the system modifications? (Note: list plan(s) and layout(s) reviewed in the remarks column) | | | | | |
| 7. Has the ammonia inventory been updated to reflect the system modifications? | | | | | |
| 8. Have the operating limits for key process variables been updated to reflect the system modifications? | | | | | |
| 9. Has the ammonia refrigeration equipment list been updated to reflect the system modifications? | | | | | |
| 10. Has the ammonia refrigeration safety systems list been updated to reflect the system modifications? | | | | | |

AUDIT-PC 1.52 Worksheet Primatech Inc.

Company: Smith's Company System: 1
Facility: Ammonia Refrigeration Facility Page: 4

Session: 1 - - Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Policies and Procedures Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 1. Are the operating procedures in place, adequate, and updated to reflect the system modifications? | | | | | |
| 2. Have newly installed local instruments been calibrated and loop/function tests conducted? | | | | | |
| 3. Have computer/hardware interfaces been tested? | | | | | |
| 4. Are the hot work procedures in place, adequate, and updated to reflect the system modifications? | | | | | |
| 5. Are the lockout and/or tagout procedures in place, adequate, and updated to reflect the system modifications? | | | | | |
| 6. Are the maintenance procedures in place, adequate, and updated to reflect the system modifications? | | | | | |
| 7. Are the emergency procedures in place, adequate, and updated to reflect the system modifications? | | | | | |

AUDIT-PC 1.52 Worksheet Primatech Inc.

Company: Smith's Company
Facility: Ammonia Refrigeration Facility

System: 1
Page: 5

Session: 1 - - Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Process Hazards Analysis Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 1. Was a process hazards analysis conducted for the modifications? | | | | | |
| 2. Have the recommendations identified during the process hazards analysis been addressed? | | | | | |
| 3. Have the action items required for startup been completed? | | | | | |

AUDIT-PC 1.52 Worksheet Primatech Inc.

Company: Smith's Company
Facility: Ammonia Refrigeration Facility

System: 1
Page: 6

Session: 1 - - Revision: 0 - -
System: 1 Pre-Startup Safety Review
Category: Training of Facility Personnel Dwg#:

| QUESTION | A | REMARKS | RECOMMENDATIONS | BY | COMMENTS |
|---|---|---|---|---|---|
| 1. Have all necessary personnel been informed of the system modifications?<br><br>2. Have the system operators be trained in accordance with any new or revised operating procedures? | | | | | |

## D-2 Pre-startup Safety Review Procedures - Petroleum Refinery

The following example contains a pre-startup safety review program for a refinery. The program includes safety review procedures, a pre-startup safety review index, a safety review findings summary report and a checklist used for new or modified facilities.

PROCESS SAFETY MANAGEMENT POLICIES & PROCEDURES

NO.

Revised November 23, 1993

## PRE-STARTUP SAFETY REVIEW

I. POLICY:

It is the policy to conduct Pre-Startup Safety Reviews of all newly constructed process units and equipment and all unit and equipment modifications where the modification is significant enough to require a change in the process safety information. These reviews will be performed to insure that new and modified equipment are ready and safe for startup.

II. SCOPE:

This policy applies to all new Processes and modifications to existing Process Equipment significant enough to require a change in the Process Safety Information.

III. PURPOSE:

The purpose of the Pre-Startup Safety Review is sevenfold:

1. To confirm that construction and equipment have been installed in accordance with design specifications and in accordance with applicable Federal, Territorial Codes and Standards and Engineering Standards and Safety Policies;

2. To confirm that Safety, Operating, Maintenance and Emergency Procedures are in place and are adequate;

3. To confirm that a Process Hazard Analysis has been done for new facilities and that recommendations from the PHA have been resolved or implemented before Startup;

4. To confirm that modified facilities meet the requirements in the Management of Change Policy;

5. To confirm that the training on operating procedures for each employee involved in operating the Process has been completed;

6. To confirm that all Maintenance and Contractor Personnel affected by the new installation or modified facilities have received the required training.

7. To insure that all warnings, markings, labels, signs and required safety equipment (i.e., fire extinguishers, flange shields, safety showers, Scott Air Paks, etc.) are installed; and

8. To insure that the equipment is safe for startup and continued operation.

IV. PROCEDURE:

1. The Pre-Startup Safety Review is mandatory on all new installations or on modifications requiring Management of Change Procedures (MOC) where there is a change in the process safety information.

2. The Equipment Owner (Operations/Terminal/Powerhouse/Area Manager) is responsible to ensure that a Pre-Startup Safety Review is conducted. The completed PSSR must be reviewed by the Area Manager and then approved prior to operation of the equipment.

3. Pre-Startup Safety Reviews should not be conducted until the new facility or modification is mechanically complete. The Pre-Startup Safety Review is not intended to be used to obtain a final punch list of items for mechanical completion of the job.

4. The review for small projects and minor modifications may be conducted by two persons, an "A" or "B" Operator and an Operations' Supervisor. For large projects the review should be conducted by a team of three or four people. The Operations/Terminal/Powerhouse Manager will determine the team members required. Normally for large projects the team will consist of the Area Manager or Superintendent, an "A" or "B" Operator who will be operating the equipment, the Maintenance/Construction Supervisor assigned to the job, and a representative from the Technical Services Department (generally the Project Engineer).

5. All Pre-Startup Safety Reviews should be conducted using the attached checklist for new or modified facilities. This checklist has been prepared to organize and simplify the review. In conducting the review, you may have to check items not on the list. In many cases there will be items on the list not pertinent to the project under review. An index page has been provided so that items which do not apply can be checked off without going through the entire review checklist.

6. The Pre-Startup Safety Review Checklist has been divided into eighteen (18) separate lists. The first three (3) lists shall be completed for all reviews. Only the lists from four to eighteen (4 - 18) marked off on the index page as applicable to this particular project need be completed.

7. All checklist items marked as "NO" shall be identified on, and have the intended or corrective action entered onto the PSSR Findings Summary Report (Attachment "C").

8. If a Pre-Startup Safety Review with incomplete or unresolved items is approved by the Safety Manager, which may be the case if the nature of the open items are such that operations can proceed, a copy of the deficiencies will remain in the Safety Department.

9. The Equipment Owner/Area manager will be responsible for any follow-up indicated by the review. Tracking will be by the PSM Automated Tracking System.

10. Monthly updates on unresolved recommendations will be completed by the Area Manager and submitted to the Safety Department.

11. The original copy of the Pre-Startup Safety Review will be maintained in the Process Safety Management Library with the project file. A Xerox copy will be maintained by the Equipment Owner.

PSSR # _____
(Assigned by Safety Dept.)

NO.
Page 4 of 27
Attachment "A"
Project # _____
November 23, 1993

TWR # _____

WORK REQUEST # _____

# PRE-STARTUP SAFETY REVIEW

UNIT: _____

TITLE: _____

BRIEF DESCRIPTION: (Include Process Description Changes) _____

_____

_____

## INSPECTION TEAM

_____
Operations/Terminal Area Superintendent or Manager

_____
Mechanical Supervisor

_____
Project Engineer

_____
Operator

DATE: _____ SUBMITTED BY: _____
(Team Leader)

DATE: _____ REVIEWED BY: _____
(Operations Mgr.)

DATE: _____ APPROVED BY: _____
(Safety Mgr.)

NOTE: Start-up of this equipment is approved prior to completion of the open items, except as noted with an * on the summary sheet.

ALL OPEN ITEMS HAVE BEEN COMPLETED:

_____ _____
Operations/Terminal Manager Date

cc: PSM Central Files (original)
Area Manager

# PRE-STARTUP SAFETY REVIEW INDEX

| | | YES | NO |
|---|---|---|---|
| 1. | Operating and Emergency Procedures and Training | X | |
| 2. | Fire Protection and Safety Equipment | X | |
| 3. | General | X | |
| 4. | Piping and Piping Supports | | |
| 5. | Vessels and Exchangers | | |
| 6. | Safety Valves | | |
| 7. | Blowdown, Flare and Pumpout Systems | | |
| 8. | Machinery - Pumps, Compressors, etc. | | |
| 9. | Electrical | | |
| 10. | Instrumentation | | |
| 11. | Structural | | |
| 12. | Access Ways | | |
| 13. | Furnaces | | |
| 14. | Tank Farms and Pump Slabs | | |
| 15. | Sewers and Separators | | |
| 16. | Cooling Towers | | |
| 17. | Materials Handling | | |
| 18. | Manlifts, Passenger and Freight Elevators | | |
| 19. | Other Safety Hazards (to be added by Team if necessary): | | |

_____

_____

_____

Project Unit #: _____
Team Leader: _____ Date: _____



## Pre-Startup Safety Review Findings Summary Report

Each item identified on the PSSR as a "No" is a deficiency item that must be listed on the table below. Please enter in all the requested information in each cell of the table. The Package and Item numbers will come from the PSSR checklist used for the review. The deficiency statements and recommendations will be numbered sequentially by the PSSR Team in the order they determine. The Team Leader is responsible to have this form completed prior to the team sign-off on the PSSR cover sheet.

| Def. # | Pkg # | Item # | Deficiency Statement | Recomm. Prior To Startup | Item OK | Item Complete (Date) | Checked By (Name) |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | | | | | | | |
| 14 | | | | | | | |

Project Unit #: _____
Team Leader: _____ Date: _____

NO.
Page 7 of 27
Attachment "C"
November 23, 1993



## Pre-Startup Safety Review Findings
## Summary Report

| Def. # | Pkg # | Item # | Deficiency Statement | Recomm. Prior To Startup | Item OK | Item Complete (Date) | Checked By (Name) |
|---|---|---|---|---|---|---|---|
| 15 | | | | | | | |
| 16 | | | | | | | |
| 17 | | | | | | | |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | | | | | | | |
| 21 | | | | | | | |
| 22 | | | | | | | |
| 23 | | | | | | | |
| 24 | | | | | | | |
| 25 | | | | | | | |
| 26 | | | | | | | |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | | | | | | | |
| 30 | | | | | | | |

Project Unit#: _____ NO.



Team Leader: _____ Date: _____

(Initials)



# PACKAGE NO. 1
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

This checklist has been prepared as a convenience for those performing safety reviews of new or modified equipment. It is not intended to be a list that will catch all possible safety hazards. Therefore, those using it should be on the alert for other safety deficiencies. It is anticipated that this checklist could be improved upon, and each user is encouraged to make recommendations for its improvement.

| PSM CHECKLIST | YES | NO | N/A |
|---|---|---|---|
| 1. Operating and Emergency Procedures and Training: | | | |
| a. Have operating procedures been developed, distributed and communicated to all affected Operations' personnel? | | | |
| b. Have all affected operators been trained on these procedures? | | | |
| c. Has appropriate training been conducted on the new equipment for all unit qualified operators? | | | |
| d. Have revisions/updates been made to the master copies of the operating manual? | | | |
| e. Do these procedures include start-up, shutdown, and emergency procedures as well as procedures for normal operations. | | | |
| f. Have criticial instruments been identified and have inspection, testing and preventive maintenance schedules been set up for said instruments? | | | |
| g. Comments: _____ | | | |
| 2. Has equipment been installed in accordance with design specifications? | | | |
| 3. Has all the required Process Hazard Analysis work been completed? | | | |
| a. Have all recommendations from the PHA been resolved? | | | |
| b. Have all the recommendations required prior to startup of the process equipment been implemented? | | | |
| 4. For modified facilities, have all actions required by Management of Change Procedure been followed? | | | |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 2
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Fire Protection and Safety Equipment | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Are an adequate number (as designated by the Fire Department) of the proper type of fire extinguishers located throughout the unit? | ☐ | ☐ | ☐ |
| b. | Are fire extinguisher stations properly noted with red paint and extinguisher identification numbers? | ☐ | ☐ | ☐ |
| c. | Are Scott Air Paks located throughout the unit in accordance with design specifications? | ☐ | ☐ | ☐ |
| d. | Are monitor nozzles strategically located throughout the unit? Do they work? | ☐ | ☐ | ☐ |
| e. | Are fire hydrants positioned strategically around the edge of the unit? | ☐ | ☐ | ☐ |
| f. | Has the Fire Chief inspected all new fire fighting equipment installations? | ☐ | ☐ | ☐ |
| g. | Have new fire water lines been hydrotested and are they currently in service? | ☐ | ☐ | ☐ |
| h. | Have start-up and shutdown utilities been provided? | ☐ | ☐ | ☐ |
| i. | Is installation complete on any utility station which is required? | ☐ | ☐ | ☐ |
| j. | Are there an adequate number of safety showers and eye wash stations located in the unit, and are they properly identified? Are safety showers and eye wash stations in good working order? Is access to all safety showers and eye wash stations unobstructed? | ☐ | ☐ | ☐ |
| k. | Are adequate warning signs posted for noise, H2S, thermal expansion, hand traps, etc.? | ☐ | ☐ | ☐ |
| l. | Have sprinkler and deluge systems been tested and found to be operational? Have these systems been approved by the Fire Chief? | ☐ | ☐ | ☐ |
| m. | Have H2S and Hydrocarbon detectors been calibrated, tested and operational? | ☐ | ☐ | ☐ |
| n. | Has all miscellaneous debris and construction material been cleaned up and removed? | ☐ | ☐ | ☐ |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 3
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| General | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Are valve boxes properly guarded, and have valves rising out of the ground been avoided? | ☐ | ☐ | ☐ |
| b. | Have sewer gratings been properly fitted in catch basins and trenches? | ☐ | ☐ | ☐ |
| c. | Have sewers been flushed and commissioned? | ☐ | ☐ | ☐ |
| d. | Is drainage adequate in all areas? | ☐ | ☐ | ☐ |
| e. | Have adequate steps been taken to avoid slipping hazards, such as water flowing across walking surfaces which could cause algae growth? | ☐ | ☐ | ☐ |
| f. | Have adequate precautions been taken to avoid stumbling hazards, such as pipelines running along the ground or slabs? | ☐ | ☐ | ☐ |
| g. | Have abandoned foundations and supports been removed to avoid stumbling hazards? | ☐ | ☐ | ☐ |
| h. | Is equipment identified by name or number? | ☐ | ☐ | ☐ |
| i. | Has equipment been properly painted to protect from corrosion and/or to identify piping? | ☐ | ☐ | ☐ |
| j. | Has the area been cleared of litter such as bottles, cans, other trash, etc.? | ☐ | ☐ | ☐ |
| k. | Have all leftover materials such as scaffolds, tools, nuts, bolts, gaskets, pipe, instruments, etc., been removed from the job site? | ☐ | ☐ | ☐ |
| l. | Have all gas cylinders either been removed or properly stored if left on-site? | ☐ | ☐ | ☐ |
| m. | Are all MSDS documents available for all chemicals, products and materials handled, stored or processed at the unit. Have all new chemicals, products and materials been approved per the Introduction of New Chemicals Procedure and Form. | ☐ | ☐ | ☐ |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 4
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Piping and Piping Supports | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Has piping been adequately protected for external corrosion (cathodic protection, wrapped, etc.)? | ☐ | ☐ | ☐ |
| b. | Is piping free of excessive wind sway? | ☐ | ☐ | ☐ |
| c. | Has insulation been properly applied for personnel protection from contact thermal burns? | ☐ | ☐ | ☐ |
| d. | Have pipe supports been securely attached with allowance for pipe movement where needed? | ☐ | ☐ | ☐ |
| e. | Have adequate provisions been made to avoid venting or draining flammable materials? | ☐ | ☐ | ☐ |
| f. | Do steam lines discharging into process equipment contain at least a check valve for back flow protection? | ☐ | ☐ | ☐ |
| g. | Are valve wheels and valve stems oriented properly to prevent obstruction and provide adequate access for operation? | ☐ | ☐ | ☐ |
| h. | Are control valve manifold drain valves adequately provided? | ☐ | ☐ | ☐ |
| i. | Are all flange bolts long enough (threads extend outside the nuts)? | ☐ | ☐ | ☐ |
| j. | Have flange ratings been checked? | ☐ | ☐ | ☐ |
| k. | Have unnecessary drains and vents been avoided? | ☐ | ☐ | ☐ |
| l. | Have all drain and vent valves been properly equipped with bull plugs or thread protection nipples or blind flanges as applicable? | ☐ | ☐ | ☐ |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 4
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Piping and Piping Supports (Cont'd.) | | YES | NO | N/A |
|---|---|---|---|---|
| m. | Has piping been hydrostatically tested? | ☐ | ☐ | ☐ |
| n. | Have alloy and stainless lines been 100% x-rayed as required? | ☐ | ☐ | ☐ |
| o. | Have alloy lines been stress relieved as required? | ☐ | ☐ | ☐ |
| p. | Are all gaskets of proper size and type? | ☐ | ☐ | ☐ |
| q. | Have all small piping connections in potential vibrating service been gusseted as required to provide adequate strength? | ☐ | ☐ | ☐ |
| r. | Are small piping connections in process service seal welded to the first block valve? | ☐ | ☐ | ☐ |
| s. | Have sample points been provided where necessary? | ☐ | ☐ | ☐ |
| t. | Is steam tracing properly "trapped" and insulated? | ☐ | ☐ | ☐ |
| u. | Have blinding lists been prepared and included with procedures for safely isolating equipment for maintenance? | ☐ | ☐ | ☐ |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 5
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Vessels and Exchangers | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Have both the exterior and interior of vessel skirts been fireproofed whenever applicable? | ☐ | ☐ | ☐ |
| b. | Has insulation for personnel protection been installed? | ☐ | ☐ | ☐ |
| c. | Are all vessel small piping connections in accordance with engineering standards? | ☐ | ☐ | ☐ |
| d. | Do vessel skirts have adequate ventilation? | ☐ | ☐ | ☐ |
| e. | Is there a high point vent to remove air and a low spot drain to remove water during start-up? Are they seal welded? | ☐ | ☐ | ☐ |
| f | Have small piping "Christmas Trees" been avoided? | ☐ | ☐ | ☐ |
| g. | Have small piping connections been properly gusseted, and are all 3/4" in size or larger? | ☐ | ☐ | ☐ |
| h. | Is there sufficient access for maintenance and removal of exchanger for heds and channels? | ☐ | ☐ | ☐ |
| i. | Is there sufficient access for maintenance and removal of exchanger for heads and channels? | ☐ | ☐ | ☐ |
| j. | Have permanent gaskets been checked on nozzles, manways, and bridles of towers, drums, and strippers? | ☐ | ☐ | ☐ |
| k. | Have permanent gaskets been checked on exchangers and fin fan nozzles? | ☐ | ☐ | ☐ |
| l. | Has all hydrotesting been completed? | ☐ | ☐ | ☐ |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 6
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Safety Valves | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Are safety valves identified with a safety valve # , set pressure, and test date? | | | |
| b. | Have existing safety valves been checked to ensure they are adequate for any changes in service or operating conditions? | | | |
| c. | Can the valve be reached without the use of a crane and personnel lift-basket for checking of tags and seals? | | | |
| d. | Can the valve be readily lowered to grade safely with either portable or permanent rigging equipment? | | | |
| e. | Does the inlet line appear adequate to avoid restricting flow to the safety valve? | | | |
| f. | Have inlet and outlet block valves of PSV's been chain locked open? (a checklist should be on hand) | | | |
| g. | Is safety valve inlet and outlet piping properly supported to avoid undue stresses on the safety valve? | | | |
| h. | When applicable, have snuffing steam lines been provided for safety valve stacks? | | | |
| i. | Are block valves oriented to prevent gates from dropping in the line? | | | |
| j. | Have drain and vent valves been installed to depressure for safety valve removal? | | | |
| k. | Do safety valve stacks have drains to remove water or liquid accumulation? | | | |
| l. | Are bellows safety valve vents piped to a location where the vent does not impinge on a flange, bolting, personnel, or pipeline? | | | |

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 6
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Safety Valves (Cont'd.) | YES | NO | N/A |
|---|---|---|---|
| m. Are all bleeders and small connections on lines to and from SVs seal welded? | ☐ | ☐ | ☐ |
| n. For safety valves in heavy oil service: Is the inlet line stream traced and insulated, and if so, is the valve body steam traced and blanketed? | ☐ | ☐ | ☐ |
| o. Have Operations PSV carlock checklists been modified or generated for this unit or equipment? | ☐ | ☐ | ☐ |

Comments: _____

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 7
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Blowdown, Flare and Pumpout Systems | YES | NO | N/A |
|---|---|---|---|
| a. Are headers free of trapped sections? | ☐ | ☐ | ☐ |
| b. Are all valves chain locked open as necessary? (Lists should be on hand) | ☐ | ☐ | ☐ |
| c. Have block valves in pressure relieving systems been installed with stems in horizontal position to guard against a dropping gate into the line, or has consideration been given to using x-rays for same? | ☐ | ☐ | ☐ |
| d. Has pumpout been designed for emergency, as well as routing shutdown conditions? | ☐ | ☐ | ☐ |

Comments: _____

Project Unit #: _____

Team Leader: _____ Date: _____
(Initials)



# PACKAGE NO. 8
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Rotating Equipment | YES | NO | N/A |
|---|---|---|---|
| a. Are small piping connections in process service seal welded and gusseted? | ☐ | ☐ | ☐ |
| b. Have "Christmas Trees" been avoided in small piping connections? | ☐ | ☐ | ☐ |
| c. Is piping adequately supported to equipment and can it be removed for maintenance without undue piping stresses being developed? | ☐ | ☐ | ☐ |
| d. Have coupling guards been installed and are they adequate for personnel protection? | ☐ | ☐ | ☐ |
| e. Have general equipment guards been provided? | ☐ | ☐ | ☐ |
| f. Are all flange bolts long enough (threads extend outside the nuts)? | ☐ | ☐ | ☐ |
| g. Has personnel protection insulation been installed as required? | ☐ | ☐ | ☐ |
| h. Have warning signs (noise, hand trap, toxic, chemicals, etc.), been properly posted? | ☐ | ☐ | ☐ |

Comments: _____

Project Unit #: _____ NO.



Team Leader: _____ Date: _____ Attachment "D"

(Initials) November 23, 1993

# PACKAGE NO. 9
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Electrical | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Is conduit properly supported? | | | |
| b. | Are guards, lighting fixtures, etc., properly supported? | | | |
| c. | Are local start-stop switches properly marked for On/Off and have been equipped with proper identification for the equipment they control? | | | |
| d. | Are local switch handles equipped with proper identification and on/off markings? | | | |
| e. | Are disconnect switches properly identified in the substation? | | | |
| f. | Is lighting adequate in all areas? | | | |
| g. | Is emergency lighting provided? Operational? | | | |
| h. | Is all electrical equipment grounded? | | | |
| i. | Are established electrical classifications complied with (conduit sealed and conduit covers installed)? | | | |
| j. | Is permanent equipment hooked up with proper electrical cable rather than cords? | | | |
| k. | Are above ground cable runs or trays and conduit fire-proofed as required? | | | |
| l. | Are automatic control and isolation valves properly identified? | | | |
| m. | Can emergency automatic isolation valves be activated without exposing personnel to hazardous atmospheres in an emergency involving the equipment they are installed to isolate? | | | |
| m. | Are automatic control and isolation valve switches properly identified? | | | |
| n. | Are aircraft warning lights operable? | | | |

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# PACKAGE NO. 10
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Instrumentation | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Is there proper access to all instruments so necessary maintenance can be performed? | ☐ | ☐ | ☐ |
| b. | Have bleeder valves been installed as required in control valve manifolds? | ☐ | ☐ | ☐ |
| c. | Are drain and depressuring valves installed on instrument installations for maintenance work? | ☐ | ☐ | ☐ |
| d. | Have control valves been properly identified? | ☐ | ☐ | ☐ |
| e. | Have switches, transmitters and instrument controls been identified? | ☐ | ☐ | ☐ |
| f. | Are the spare taps on orifice flanges plugged and seal welded? | ☐ | ☐ | ☐ |
| g. | Does each control valve have a bypass? | ☐ | ☐ | ☐ |
| h. | Are instrument air lines and process tubing properly supported? | ☐ | ☐ | ☐ |
| i. | Are instruments fireproofed as necessary? | ☐ | ☐ | ☐ |
| j. | Is steam tracing on instrument leads properly trapped? | ☐ | ☐ | ☐ |
| k. | Do all process temperature measuring devices have thermowells? | ☐ | ☐ | ☐ |
| l. | Have instruments been checked for fail-safe? | ☐ | ☐ | ☐ |
| m. | Have "critical instrument" procedures been identified, tested and placed in a preventive inspection and maintenance program? | ☐ | ☐ | ☐ |
| n. | Have DCS and PLC shutdown systems been tested and found operational? | ☐ | ☐ | ☐ |
| o. | Have all panel arms been checked? | ☐ | ☐ | ☐ |
| p. | Have all ASD's been checked? | ☐ | ☐ | ☐ |

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# PACKAGE NO. 11
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Structural | YES | NO | N/A |
|---|---|---|---|
| a. Have structural members been fireproofed as required by engineering standard? | ☐ | ☐ | ☐ |
| b. Have drain holes been drilled in floor plates as necessary to prevent corrosion and water accumulation? | ☐ | ☐ | ☐ |
| c. Are openings in floor (plate, grating or slab) for piping vessels, etc., in accordance with OSHA standards? | ☐ | ☐ | ☐ |
| d. Are ladders installed in such a manner that adequate toe clearance exists between the backside of ladder rings and the nearest objects? | ☐ | ☐ | ☐ |
| e. Have safety chains or gates been installed across the top entrances to all escape ladders? | ☐ | ☐ | ☐ |
| f. Are handrails, ladder rails, etc., free of any abrupt "finger-catchers"? | ☐ | ☐ | ☐ |
| g. Do guy wires have equal tension, and are they free from sagging? | ☐ | ☐ | ☐ |
| h. Are guys protected from corrosion with a grease coating or other suitable protection? | ☐ | ☐ | ☐ |
| i. Are guys, cables and turnbuckle rods properly marked as necessary to warn vehicular and pedestrian traffic of their presence? | ☐ | ☐ | ☐ |

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# PACKAGE NO. 12
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Access Ways | YES | NO | N/A |
|---|---|---|---|
| a. Is there more than one route of escape for any sizeable work area and/or platform? | | | |
| b. Do ladders extend not more than 30 feet in height and have a break or offset as required? | | | |
| c. Are access routes clear of piping, valves, head knockers (less than seven feet vertical clearance), or tripping hazards? | | | |
| d. Are access routes free from debris, construction material, hoses, etc.? | | | |
| e. Are ladders caged when extending over 20 feet in height, or when a person might fall more than 20 feet from a ladder to some other platform, or to the ground? | | | |
| f. Are areas directly under stairways, ladders or catwalks free of catch basins or sewer manways? | | | |

Comments: _____

# PACKAGE NO. 13
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Heaters | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Are all peepholes and access doors in good condition and capable of being closed properly? | ☐ | ☐ | ☐ |
| b. | Are purging steam connections adequate with valves located remote from the furnace? | ☐ | ☐ | ☐ |
| c. | If purging steam is controlled by an automatic control valve, is its location remote and manual block present to permit testing of the automatic control valve? | ☐ | ☐ | ☐ |
| d. | Can fuel gas be blocked from a remote location? | ☐ | ☐ | ☐ |
| e. | Have proper design standards been followed with respect to pressure letdown and control of fuel flow? | ☐ | ☐ | ☐ |
| f. | Is access to pass balancing valves satisfactory? | ☐ | ☐ | ☐ |
| g. | Is platforming adequate for servicing instrumentation, air preheater equipment, etc.? | | | |
| h. | If applicable, are noise signs posted to warn that proper hearing protection must be worn? | ☐ | ☐ | ☐ |

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# PACKAGE NO. 14
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Tank Farms and Pump Slabs | | YES | NO | N/A |
|---|---|---|---|---|
| a. | Are pumps and tanks properly numbered? | | | |
| b. | Are "remote operated" signs posted whenever appropriate? | | | |
| c. | Are fire walls in good condition? | | | |
| d. | Have ramps and steps been provided over fire walls? | | | |
| e. | Have fire wall drain valves been provided along with safe access to the drain valve? | | | |
| f. | Is the catch basin inside the fire wall properly located? | | | |
| g. | Has the surface inside the fire wall been properly graded toward the catch basin? | | | |
| h. | Does the tank water drawoff and drain extend to the catch basin? | | | |
| i. | Is the stairway firewalk access in good condition? | | | |
| j. | Are safety signs prominently displayed and legible regarding N2 blanketing or the possible presence of H2S, or other hazardous materials in the vapor space? | | | |
| k. | Are fire fighting facilities in place, tested and fully operational? Have new fire fighting facilities been approved by the Fire Chief? | | | |

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# PACKAGE NO. 15
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Sewers and Separators | YES | NO | N/A |
|---|---|---|---|
| a. Have sewers been flushed and checked for pluggage? | ☐ | ☐ | ☐ |
| b. Are manhole covers of adequate strength to support, and is its fit sufficient to prevent excessive vapor leakages? | ☐ | ☐ | ☐ |
| c. Are catch basin drain and trench covers of adequate strength without being a stumbling hazard? Are all covers in place? | ☐ | ☐ | ☐ |
| d. Are manholes vented when at the high point in a lateral? | ☐ | ☐ | ☐ |
| e. Have flame arrestors been checked for pluggage? | ☐ | ☐ | ☐ |
| f. Is the separator cover of adequate strength? | ☐ | ☐ | ☐ |
| g. Is the separator cover sealed if toxic vapors are expected to be present in the separator? | ☐ | ☐ | ☐ |
| h. Has a simplified sewer map been provided for use by operating personnel? | ☐ | ☐ | ☐ |

Comments: _____

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# PACKAGE NO. 16
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Cooling Towers | YES | NO | N/A |
|---|---|---|---|
| a. Does the casing appear to be structurally sound? | ☐ | ☐ | ☐ |
| b. Are stairways stable and free of debris? | ☐ | ☐ | ☐ |
| c. Is decking free of holes that could cause stumbling? | ☐ | ☐ | ☐ |
| d. Are fan stacks free of vibration? | ☐ | ☐ | ☐ |
| e. Can fan assemblies be safely operated and maintained? | ☐ | ☐ | ☐ |
| f. Are fire protection facilities for the cooling tower adequate? | ☐ | ☐ | ☐ |
| g. Can chemical injection equipment be safely operated and maintained? | ☐ | ☐ | ☐ |
| h. Is control of basin water level adequate, and is there an adequate warning system for impending low level? | ☐ | ☐ | ☐ |

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# PACKAGE NO. 17
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Materials Handling | YES | NO | N/A |
|---|---|---|---|
| a. Have davits been installed as required for handling manways, trays, etc.? | ☐ | ☐ | ☐ |
| b. Do chain hoists have properly posted load limit signs? | ☐ | ☐ | ☐ |
| c. Is the area clear of obstructions that prevent safe use of hoists, davits, rigging machines, etc.? | ☐ | ☐ | ☐ |
| d. Have personnel been properly instructed in the use of forklift trucks (if used in the operations)? | ☐ | ☐ | ☐ |

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# PACKAGE NO. 18
# CHECKLIST FOR NEW OR MODIFIED FACILITIES
# PRE-STARTUP SAFETY REVIEW

| Manlifts, Passenger and Freight Elevators | YES | NO | N/A |
|---|---|---|---|
| a. Have procedures been set up for routine maintenance, inspection and recordkeeping? | ☐ | ☐ | ☐ |
| b. Are warning signs and operating instructions properly posted? | ☐ | ☐ | ☐ |
| c. Are trip devices operable? | ☐ | ☐ | ☐ |

Comments: _____