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GUIDANCE FOR IMPLEMENTING PROGRAMS FOR OSHA 29 CFR 1910.119

PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS

PART THREE

OPERATING PROCEDURES

by

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GUIDANCE FOR IMPLEMENTING PROGRAMS FOR OSHA PSM

OPERATING PROCEDURES

This document contains information that may assist a company in establishing, or reviewing and updating, the operating procedures 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 acutal programs provided by industrial companies.

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
1. Do written operating procedures exist for each covered process? Do the procedures provide clear instructions for conducting activities safely?	The employer should maintain onsite written operating procedures, documenting the practices used to safely operate a covered process.	Written operating procedures exist for each covered process. The written operating procedures are prepared in a consistent fashion from one process to another. The written operating procedures are in a style, level of detail, and format readily understood by the operators intended to use them. This may include preparing operating procedures in a language other than English, where necessary. This may also include the use of simplified diagrams, flow charts, and other graphics to facilitate understanding of the procedure. The written operating procedures are consistent with other PSM elements. For example, the description of the facilities should agree with the representation of the system as provided by the piping and instrument diagrams. Interviews with a representative number of operators should indicate their understanding of: • conditions requiring emergency shutdown • the operating limits of a particular process or piece of equipment and consequences of deviating from those operating limits • steps which could be taken to avoid deviations • precautions necessary to prevent exposure to hazardous chemicals	Written operating procedures do not exist, are incomplete, or are not provided for each covered process. Operating practices follow only an 'oral history', with techniques learned solely on-the-job. Operators are unaware of the existence of written procedures and/or the contents of the procedures. Operators are not able to understand the operating procedures for any reason including the clarity of the procedure, primary language of the operator, or his ability to read. It is not clear who has the responsibility to conduct each task identified in the procedures.

PSM TRAINING MATERIAL REFERENCE MANUAL

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
2. Do the operating instructions address, as a minimum, steps for each operating phase, including: • Initial start-up? • Normal operations? • Temporary operations? • Emergency shutdowns? - conditions requiring emergency shutdowns? - assignment of shutdown responsibility to qualified operators? • Emergency operations? • Normal shutdown? • Start-ups following a turnaround or emergency shutdown?	Written operating procedures for a covered process should include the full range of expected operating conditions. These include initial start-up, normal operations, temporary operations, emergency operations, emergency shutdowns (including conditions which require emergency shutdowns and assignment of shutdown responsibility to qualified operators), normal shutdown, and start-ups following a turnaround or emergency shutdown. The procedures should be written to describe the information necessary to prevent or control accidents during each operating phase.	The written operating procedures cover at least the elements identified by this section. Written operating procedures are prepared for both continuous and batch operations. Information found in the operating instructions for each of the following operating phases may include such details as: • initial start-up - preparation of utilities, process lines, and instruments - equipment preparation and testing - dryout of process equipment - inerting/purging of equipment and lines - warmup/preheat phases - placing of unit onstream - valve positions • normal operations - procedures and process conditions for steady state conditions - means to identify conditions out of normal or acceptable range • normal shutdown (including end of batch) - proper means to shutdown unit in a controlled manner - cooldown periods - removing equipment liquid inventories - taking unit/process off-line • temporary operations - conditions requiring holding periods - special conditions where equipment or safeguards may be bypassed - operation at reduced capacities	The written operating procedures do not include, as a minimum, procedures for each of the operating phases identified herein. The procedures do not cover each operating phase in a consistent fashion or to a consistent level of detail. The written operating procedures do not cover reasonably anticipated abnormal conditions.

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
2. Do the operating instructions address, as a minimum, steps for each operating phase (contd.)	(See above)	• emergency shutdowns - conditions requiring emergency shutdowns (deviation of critical process parameters beyond established setpoints, toxic gas release, fire/explosion in or near process area, hurricane, etc.) - assignment of shutdown responsibility to qualified operators • emergency operations - operating procedures to control/mitigate an emergency condition - steps taken when maximum allowable operating limits are exceeded • start-ups following an abnormal or emergency shutdown (may be similar to initial startup procedures) - preparation of utilities, process lines, and instruments - equipment preparation and testing - procedures for safely placing unit back onstream	(See above)
3. Do the operating procedures include operating limits that outline consequences of process deviation and steps required to correct or avoid deviations?	The written procedures should contain a listing of the normal and maximum allowable upper and lower operating limits of critical process parameters. The procedure should describe the consequences of exceeding these limits and the steps to be taken in order to correct or avoid exceeding these limits. The procedures should recognize that the normal or acceptable ranges for some parameters will change depending upon the operating phase (e.g. start-up, normal operations, etc.) being discussed.	Procedures should identify the maximum and minimum allowable values for critical process parameters (pressure, temperature, flowrate, liquid levels, etc.), either through a table listing the values for such parameters or otherwise. Normal operating conditions may solely indicate the range of values of the process parameters necessary to keep a product within specification. Separate maximum and minimum ranges may describe the limits beyond which the integrity of a vessel may be compromised and/or stable operation may not be possible. The consequences of deviating beyond the parameter ranges identified should be described. The consequences identified should be consistent with the results of a process hazard analysis of the process operating phase.	The operating procedures do not identify the critical operating parameters. The operating procedures do not establish normal and/or allowable ranges for critical operating parameters. The operating procedures do not identify the potential consequences of deviating beyond the established ranges. The range of values of parameters and/or the consequences of deviating beyond the established ranges do not agree with data in other elements of the PSM program.

PSM TRAINING MATERIAL REFERENCE MANUAL

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
4. Have safety and health considerations been included in the operating procedures? Do they include at a minimum: • Properties of, and hazards presented by, chemicals used in the process? • Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment? • Control measures to be taken if physical contact or airborne exposure occurs? • Quality control for raw materials and control of hazardous chemical inventory levels? • Any special or unique hazards?	The operating procedures should include a description of the safety and health considerations of the highly hazardous chemicals, including a discussion of the properties of the chemicals, the hazards of, recommended precautions for storage and handling, measures to be taken for exposure, quality control, and any special properties of the highly hazardous chemicals.	The operating procedures should include a summary of the pertinent data from, or a copy of, the MSDS for the highly hazardous chemicals, toxics and reactives of the covered process. The procedures recognize where the MSDSs do not address the potential hazards realized in the use of the hazardous materials at operating conditions. Where the MSDSs do not include this information, it is developed from available operational data and health/safety information.	The operating procedures do not include a discussion or listing of safety and health considerations for the highly hazardous chemicals. The operating procedures do not address where the operating conditions may create hazards different than those identified by the MSDS. The information regarding the safety and health considerations is not consistent with information provided elsewhere, including the findings of the PHA.

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
5. Are safety systems and their functions included in the operating procedures?	Operating procedures should include a description of the applicable safety systems and their functions for the covered process.	Operating procedures contain a table or listing of all the safety systems for a process such as: • pressure control systems and alarms • temperature control systems and alarms • level control systems and alarms • *flow control systems and alarms* • pressure relief systems, including pressure safety valves, rupture disks, and disposal of the relieved *material* • process interlocks and emergency shutdown systems • flammable and toxic gas detection systems • *fire* protection systems The operating procedures contain a description of the purpose and operation of the safety systems, including relevant setpoints. Where appropriate, the procedures describe the periodic testing and maintenance of the system.	*The operating procedures do not include* a description of safety systems and their functions.
6. Are the operating *instructions consistent with* the process safety information?	The operating procedures should be based on the *information and hazards of the materials*, as identified in the process safety information, and should accurately reflect their content.	A procedure exists to ensure that the written operating procedures are updated as necessary to reflect any revision to the process safety information. For example, a replacement in kind would result in a change to the process safety information, but not necessarily the operating procedure. The installation of new equipment would require a change to the process safety information and a change in the operating procedures.	Inconsistencies exist between the operating procedures and the process safety information. One document may not have been revised after a change to the other.

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
7. Are operating procedures readily accessible to employees who work in or maintain a process?	Written operating procedures should be readily accessible to employees who work in or maintain a process, such as: operators and maintenance personnel, contract employees, engineering personnel, and safety/environmental personnel.	Observation of a representative sample of process units and interviews with a representative number of employees who work in or maintain a process should indicate that the written operating procedures are readily accessible to the employees who work in or maintain the process. Operating procedures manuals are located in key locations, such as, but not necessarily limited to: • the process control room • the operations manager's office • the maintenance manager's office • the emergency command center • the safety/environmental manager's office Copies of key procedures, including emergency shutdown and safety procedures may also be kept in field locations.	Operating procedures are not readily accessible to employees who work in or maintain a process. Employees who work in or maintain a process are unaware of the existence or location of operating procedures.

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
8. Are operating procedures reviewed as often as necessary to assure that they reflect current operating practice? Are they certified annually by the employer that they are current and accurate? Do they reflect current operating practice that have resulted from changes in: • Process chemicals? • Technology? • Equipment? • Facilities?	Operating procedures should be reviewed as often as necessary, but at least annually, in order to maintain the accuracy and completeness of the procedures. Operating procedures should be certified annually.	A procedure exists to ensure that the operating procedures are updated as often as necessary, but at least annually, to reflect the current operating practices and conditions. The frequency of review of the operating procedures should reflect how often changes are made to the process. Review and updates of operating procedures should be certified by noting date(s) of review, purpose of review, significant changes and authorization signature(s). Observation of a representative sample of process units and interviews with a representative number of operators and maintenance employees should indicate that operating procedures reflect current practices, including changes that may result from changes in the process chemicals, technology, equipment, and/or facilities. Specific task observation may be used to see if actual procedures match the written operating procedures. A review of process safety information and management of change documentation may be used to verify that any changes made to the process are also included in the operating procedures. Operating procedures should include a cover signoff sheet showing the date the procedure was written and by whom, an expiration date, and an authorization signature by the operations manager or appropriate authority.	Operating procedures do not reflect current operating practice, are not certified annually by the employer, or are not complete. Where multiple copies of the procedures manual exist, there are discrepancies between the various copies.

ABD00102753

OPERATING PROCEDURES [29 CFR 1910.119 (f)]

PQV Question	Explanation	Positive Program Indicators	Negative Program Indicators
9. Have safe work practices been developed and implemented for employees and contractors to control hazards during operations such as: • Lockout/tagout? • Confined space entry? • Opening process equipment or piping? • Control over entrance into a facility by maintenance, contractor, laboratory or other support personnel?	Written safe work practices should be implemented on the site for use by employees and contractors.	Written safe work practices exist. Procedures exist to ensure that all personnel necessary are trained in the use of the safe work practices. The safe work practices procedures should include provisions to ensure that persons responsible for operating the process are aware of non-routine operations occurring in the process. The safe work practices should also include provisions to ensure that persons responsible for conducting non-routine work activities are informed of existing hazards, appropriate precautions, and emergency procedures. Safe work practices exist, at a minimum, for the following operations: • lockout/tagout • confined space entry • opening process equipment/piping • hot work • facility access control Observation of a representative number of operations should indicate that safe work practices are implemented for both company and contract employees. Safe work practices may also include hot work permits, smoking policy and other recommended industry practices from organizations such as: National Fire Protection Association (NFPA), American Petroleum Institute (API), International Institute of Ammonia Refrigeration (IIAR) and Synthetic Organic Chemical Manufacturers Association (SOCMA).	Safe work practices are either not developed or are not implemented. Safe work practices are not equally communicated to, and enforced for, contractors and employees. Inadequate communication exists between those responsible for conducting non-routine operations, such as maintenance, construction, etc., and those responsible for safely operating the process. Written safe work practices do not meet the minimum requirements of OSHA standards where they exist (e.g., hot work, confined space entry).

APPENDIX A

List of Acronyms

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 inter-facing 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.

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APPENDIX C

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APPENDIX D

Example Programs

The following examples illustrate approaches taken by companies seeking to address the Operating Procedures 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.

CONTENTS

D-1 Operating Procedures - Amine Unit (Shut-down)

The following is an example of operating procedures used in a petroleum refinery. The procedures outline the specific steps to be taken for the shut-down of an amine unit. It includes safety requirements, special tools or equipment required and special considerations for the safe shutdown of the unit.

REFINERY

NAME OF PROCEDURE: SHUT-DOWN OF THE NORTH AMINE UNIT

A. PURPOSE: TO PROVIDE PROCEDURES FOR A SAFE SHUT DOWN OF THE NORTH AMINE UNIT.

B. REFERENCES:

P&ID'S	# 4874-5-10-011-1
	# 4874-5-10-011-2
	# 4874-5-10-011-3
	# 4874-5-10-011-4
	# 4874-5-10-011-5
	# 4874-5-10-011-6
PROCESS FLOW DIAGRAM	# E-11838-60-0101

C. APPROVALS:

COMPLEX SHIFT SUPERVISOR
A-CREW

COMPLEX SHIFT SUPERVISOR
B-CREW

COMPLEX SHIFT SUPERVISOR
C-CREW

COMPLEX SHIFT SUPERVISOR
D-CREW

COMPLEX SUPERVISOR

D. SAFETY REQUIREMENTS:

1. Follow all refinery safety policies and procedures during shut down of the North Amine Unit.

2. All personal protective equipment must be worn, where applicable.

3. Ascertain that H_2S alarm system is operable and SCBA breathing apparatus units are available and ready to use.

4. Check that all fire fighting equipment is in the correct location and ready for service.

5. Scaffolding must be installed at predetermined locations and a portable scaffold available for unit technicians to safely gain access to valves and equipment.

6. Full Body Harness must be worn when Scaffolding or Platforms are not available above 4 feet.

E. SPECIAL TOOLS OR EQUIPMENT REQUIRED:

1. 18, Chemical drain hoses for draining Amine & condensate

2. 5, 3/4" check valves and 5, pressure regulators set at 10 psig.

3. 5, green N_2 hoses.

4. 1, stripping pump and 4, 3" x 20" lengths of reinforced vacuum hose.

5. 1, PortaScaffold.

F. PRE-SHUTDOWN PROCEDURES AND SPECIAL CONSIDERATIONS:

____ 1. Work list on specific items that involve entry, draining, etc., should have been gone over thoroughly, (on site), with the Unit Supervisor, Console Shift Supervisor, and the Maintenance Supervisor in charge to review any item that may need clarification.

____ 2. A current blind list that applies to the North Amine Unit must be issued to the Maintenance department.

____ 3. A master blind list will be kept available and up to date by the Sulfur Recovery Unit Senior Technician in charge of the North Amine Unit shut down.

____ 4. Maintain level in Lean DEA Surge Tank, 10-F-20, at 4 feet.

____ 5. Check that all the Lean Amine from the Lean Amine Pumps 10-G-21ABC is going through the Lean Amine Coolers, 10-E-23A/B, and 8" bypass is closed.

____ 6. Assure that level in Amine Sump, 10-F-21, is pumped down, line up 10-

G-24 to pump back to 10-F-20 and block in discharge back to Rich Amine line D/S of H.I.C-250.

____ 7. Have filter elements available on hand to do complete filter change out for Lean Amine Filter, 10-J-20 & Amine Sump Filter, 10-J-22.

____ 8. Review Toxic Gas Procedure and hazards of H_2S with all unit personnel.

____ 9. With the North Amine Unit shutting down it will be necessary to have the Unsaturate Gas Plant line up the Amine system to the East and West Amine Trains.

____ 10. North Sulfur Unit will no longer have acid gas supply from the North Amine Unit. However, acid gas can be routed from the east or west Amine units to keep the North SRU operating if desired.

____ 11. North Amine Unit will be circulated until unit is cool.

____ 12. Drain all Amine to closed amine sewer. (Do not drain Amine to the OWS. Utilities cannot treat amine at the Waste Water Treatment Plant.)

____ 13. Unit will be depressured, steamed out to gas free and water washed to remove sludge deposits from equipment.

____ 14. Personnel will be familiar with physical locations of shutdown lines, drains and vents in order that the unit will be shut down safely and efficiently.

____ 15. Run chemical drain hoses to the specific locations as described in section G, sub-section 3. Do not hook up hoses at this time.

16. PREPARE UNIT FOR SHUTDOWN:

a. Rich DEA Flash Drum, 10-D-20.

From the Master Blind List remove drain spec blinds per the following:

____ (1) 3, 2" and 1, 4" blinds at gate valves on bottom drains to Closed DEA Sewer for Rich DEA Flash Drum, 10-D-20.

____ (2) 1, 2" blind at gate valve on bottom drain to the Closed DEA Sewer for the Entrained Amine Separator, 10-D-49.

(3) Install 0-100 psig pressure gauge on D/S ball valve for PIC-250B control loop.

b. Lean/Rich Amine Exchangers, 10-E-20A/D.

From the Master Blind List remove drain blinds per the following:

____ (1) 2, 2" blinds at gate valves for tube side drains to Closed DEA Sewer for Lean/Rich Amine Exchangers, 10-E-20A/D.

____ (2) 2, 2" blinds at gate valves for shell side drains to

Closed DEA Sewer for Lean/Rich Amine Exchangers, 10-E-20A/D.

c. Regenerator Reboilers, 10-E-22A/B.

From the Master Blind List remove drain spec blinds per the following:

____ (1) 3" blind at gate valve for shell side common inlet drain to the Close DEA Sewer for Regenerator Reboilers, 10-E-22A/B.

____ (2) 2" blind at gate valve for reboiler common outlet drain to the Closed DEA Sewer for Regenerator Reboilers, 10-E-22A/B.

d. Regenerator Ovhd Accumulator, 10-D-22.

From the Master Blind List remove drain spec blinds per the following:

____ (1) 2" blind at gate valve for bottom drain to Closed DEA Sewer for Regenerator Ovhd Accumulator, 10-D-22.

____ (2) 1 1/2" blind at gate valve for drain to OWS for LT-261 & LG-558 level bridle on 10-D-22.

e. Regenerator Reflux Pumps, 10-G-20A/B and Regenerator Ovhd Hydrocarbon Pump, 10-G-22A.

From the Master Blind List remove drain spec blinds per the following:

____ (1) 3/4" blinds at gate valves for drains to OWS for 10-G-20A/B.

____ (2) 1 1/2" blind at gate valve for drain to OWS for 10-G-22A.

17. Install N_2 hoses with check valves and regulators set at <u>15 psig</u> at following locations:

____ a. 3/4" bleeder at U/S of PIC-250A control valve.

____ b. 3/4" U/S bleeder for PIC-253A control loop off of 10-D-22.

____ c. 3/4" bleeder U/S of FIC-258 control valve for Lean Amine spill back to 10-F-20.

____ d. 3/4" high point vent on suction line for 10-G-26A, Lean Amine Filter Pump.

G. <u>NORTH AMINE UNIT SHUTDOWN:</u>

1. Reduce Rates And Amine Circulation:

___ a. Notify the Utilities section of the reduction in 40# steam usage and condensate production.

___ b. Notify the Console Shift Supervisor for the FCC and the Night Supervisor of the planned Amine Unit shutdown.

___ c. Have the Saturate Gas Plant, Unsaturate Gas Plant, Merox and C.H.D Unit slowly reduce the total Lean Amine charge rate to 45 M B/D to their respective contactors and absorbers. This will lower the amine circulation on the East and West Amine Units to accommodate the Unsaturate Gas Plant Amine Absorber, 5-D-6 when they switch to the amine headers from the East and West Amine units. As circulation is adjusted the Amine Surge & Mix Tank, 10-F-1, level will fluctuate.

___ d. Close console monitoring of the North Amine unit and the East and West Amine unit must be done during the bypass of the North Amine Lean to Rich piping.

___ e. When the total amine circulation is reduced to 45 M B/D to the East & West Amine Units, have the FCC Console Supervisor direct the Sr. Tech and Process Technicians to switch 5-D-6 from the North Amine Unit to the East and West Amine Units per procedure.

___ f. When the switch is complete and circulation is being maintained through the 6" bypass, start reducing the circulation with HIC-250 and F.V-251 at a rate of 10 M B/D per hour down to 13-15 M B/D.

___ g. When the Rich Amine Flow FIC-251 to the DEA Regenerator has dropped to 20 M B/D shut down one Lean Amine Pump, 10-G-21ABC.

___ h. Insure that FIC-258 is spilling back more Lean Amine to 10-F-20 as amine circulation is lowered.

___ i. When amine circulation has been reduced to 13 M B/D, the North Amine Unit will be at minimum circulation.

___ j. Put steam/feed controllers on ratio control for the Regenerator Reboilers. 10-E-22A/B and set it at 1.0. This will reduce steam automatically as rate is reduced with FV-251

___ k. Continue to circulate the amine unit in this manner until PIC-253A is closed and Accumulator pressure starts to fall. This will indicate that Acid Gas production has stopped.

___ l. Close the acid gas butterfly valve D/S of P.V-253A control loop on acid gas piping to the North Sulfur at battery limits.

___ m. Set PV-253B at 11-15 psig to vent excess pressure to the LP flare for Regenerator Ovhd Accumulator, 10-D-22.

___ n. Close 2" gate valve D/S of LV-250 for Hydrocarbon from Regenerator Ovhd Accumulator. Put 10-G-22A in the off position.

___ o. Lower level to 0%, on LT-250 block in the 3" battery limits valve for hydrocarbon line to F.C.C unit (or Coker) from 10-D-20, when hydrocarbon has been displaced from the level glass.

___ p. Maintain PIC-250 at 60 psig by allowing fuel gas to control 10-D-20 pressure from P.V-250B.

___ q. Leave LT-251 for the Rich DEA Flash Drum, 10-D-20 set on cascade mode with FV-251 on the control console, this will control the level in the Rich DEA Flash Drum and maintain a somewhat stable Rich Amine Feed to the DEA Regenerator, 10-D-21. If LT-251 level starts to become erratic HIC-250 can be closed down to reduce the amount of rich amine to 10-D-20.

2. Reduce Temperature to Cool Down the Unit:

___ a. When 35 psig steam flow is at 10-15 M LB/HR for each FT-252 & FT-259 to 10-E-22A/B, take steam

control valves off ratio control and slowly reduce the steam flow in manual to both reboilers.

___ b. Lower level slowly to 10% in 10-E-22A/B Regenerator reboilers, LT-252A & LT-252B making sure that process gases do not blow through to the Lean DEA Surge Tank, 10-F-20.

___ c. Adjust variable speed fans for 10-E-21A/B as necessary to keep ovhd temp at 115°F per TI-258.

___ d. Close 1 1/2" reflux bleed line to 11-G-30, D/S of discharge lines for the Regenerator Reflux Pump, 10-G-20A/B.

___ e. Block in condensate supply line to 10-M-20 desuperheater,close 1 1/2" gate valve for 150# velocity steam to 10-M-20 desuperheater.

___ f. At this time close off all steam to 10-D-22A/B Regenerator Reboilers. Block in FIC-252 & FIC-259 steam control valves and LIC-265 level control loop for 10-D-23 condensate pot, crack open 3" condensate valve to OWS U/S of LIC-265 level control valve.

___ g. When no more reflux is being produced, pump the level LIC-253 from the Regenerator Ovhd Accumulator, 10-D-22 to the regenerator and shut down the Regenerator Reflux Pumps 10-G-20A/B when pumps lose suction.

___ h. With N_2 injection hoses installed at low point bleeder U/S of PIC-253A control valve, slowly start to pressure up the entire Amine system to 10 psig.

___ i. Circulate the amine through the system until rebolier outlet temperatures fall below 125°F per TI-256.

___ j. When reboiler outlet temperatures have fallen below 125°F shut down 10-G-21 ABC Lean Amine Pumps.

____ k. When LT-251 level for 10-D-20 reaches 0%, and level glass indicates 0%. Line up 10-D-20 to displace the remainder of amine by opening the top 2" drain valves from the stilling well, main compartment to the rich amine outlet section of 10-D-20. Keep drain line closed to the Closed DEA Sewer.

____ l. Crack open 2" drain valves for tube side inlets on 10-E-20A/D if drain valves are gassing through then close the 1 1/2" ball valve at battery limits for fuel gas make up to Rich DEA Flash Drum, 10-D-20. Open PIC-250B to 100% and depressure the fuel gas line from battery limits into the Rich DEA Flash Drum, 10-D-20.

____ m. Monitor the local 0-100 psig gauge installed on the 3/4" D/S ball valve on PIC-250B control loop, when the local pressure gauge has equalized with PT-250 transmitter for the Rich DEA Flash Drum close the 1 1/2" gate valve D/S of PIC-250B control loop for Fuel Gas make-up to 10-D-20.

____ n. Close 12" butterfly valve for Lean DEA inlet to Lean DEA Surge Tank 10-F-20 after the Regenerator Reboilers, 10-D-22A/B have stopped gaining level.

____ o. Open the 6" gate valve for the Filtered Lean Amine jumpover to the spill back line to the Lean DEA Surge Tank, 10-F-20.

____ p. Close the 3, 6" gate valves for Filtered Lean Amine to the suction lines to the Lean Amine Pumps, 10-G-21ABC.

____ q. Close 3, 10" suction butterfly valves at 10-F-20 for the Lean Amine Pumps, 10-G-21ABC.

____ r. Close 10" D/S butterfly valve and 6" bypass valve at FIC-258 Lean Amine Spill Back control loop.

____ s. Close 10" butterfly valve at battery limits for Lean Amine To Units.

____ t. Close 10" butterfly valve at battery limits for Rich Amine to 10-D-20 Rich DEA Flash drum.

____ u. Close 3" gate valve at battery limits for Amine Flash gas to F.C.C unit (or Coker) from 10-D-20.

____ v. Continue filtering amine through the Lean Amine Filter system during the unit draining process.

3. Prepare To Drain Down Unit:

a. There are no provisions for pumping out the amine unit. It must be drained through the closed DEA sewer system to the Amine Sump, 10-F-21 and pumped to the Lean DEA Surge Tank, 10-F-20.

b. Proceed to the following steps .to prepare equipment for draining.

(1) Rich DEA Flash Drum, 10-D-20.

Install chemical drain hoses on low point bleeders and route to Amine Sump, 10-F-21 per the following:

(a) 3/4" bleeder D/S of HIC-250 control loop Rich DEA to 10-D-20.

(b) 3/4" bleeder at battery limits U/S of 3" isolation valve for liquid hydrocarbon to FCC/Coker.

(c) Install chemical drain hose to 3/4" ball valve U/S of fuel gas makeup PIC-250B and route to 3/4" bleeder D/S of PSV-10067 to the LP Flare.

(d) 3/4" bleeder at battery limits D/S of 14" butterfly valve for Rich DEA to 10-D-20.

(e) 3/4" bleeder at battery limits U/S of battery limits isolation valve for PIC-250 Amine Flash Gas to the FCC/Coker unit.

(2) Regenerator Ovhd Accumulator, 10-D-22.

Install chemical drain hoses on low point bleeders and route to Amine Sump, 10-F-21 per the following:

(a) 3/4" bleeder D/S of LIC-254, Regenerator Reflux to DEA Regenerator, 10-D-21.

(b) 3/4" bleeder D/S of PIC-253A and 14" check valve on acid gas line at battery limits.

(c) 3/4" bleeder D/S of PIC-253B control valve on acid gas line at battery limits.

(3) Lean DEA Coolers, 10-E-23A/B.

Install chemical drain hoses on low point bleeders and route to Amine Sump, 10-F-21 per the following:

(a) 3/4" low point bleeder on shell side of Lean DEA cooler, 10-E-23A/B.

(b) 3/4" bleeder for Lean Amine to units at battery limits U/S of 10" butterfly valve for Lean Amine to units.

(c) 3/4" bleeder D/S of FIC-258 for Lean Amine spill back to 10-F-20, Lean DEA Surge Tank.

(4) Lean/Rich Exchangers: 10-E-20A/D.

Install chemical drain hoses on low point bleeders and route to Amine Sump, 10-F-21 per the following:

(a) 3/4" bleeder D/S of FV-251 DEA Regen Feed control valve.

(b) 3/4" bleeder U/S of LIC-252 Regen Reboiler level control valve.

(c) 3/4" high point vent U/S of 12" butterfly valve for Lean Amine to 10-F-20 Lean DEA Surge Tank.

(5) Amine Sump Pump, 10-G-24 discharge line.

Install chemical drain hoses on 3/4" bleeder and route to the Amine Sump, 10-F-21 per the following:

(a) 3/4" bleeder on filter outlet piping at the Rich Amine line D/S of HIC-250.

(6) Install Chemical drain hoses on the vent and drain manifold to the LP Flare per the following:

(a) Rich DEA Flash Drum, 10-D-20.

1) 3/4" ball valve U/S of fuel gas make-up PIC-250B and route to the 3/4" bleeder D/S of PSV-10067 to the LP Flare.

2) 3/4" bleeder at battery limits U/S of battery limits isolation valve for PIC-250A Amine Flash Gas to the FCC/Coker.

3) 3/4" bleeder at battery limits U/S of 3" isolation valve for liquid hydrocarbon to the FCC/Coker.

4) 3/4" bleeder on common 2" drain piping to the Closed DEA Sewer for the Entrained Amine Separator, 10-D-49.

b. Regenerator Overhead Accumulator, 10-D-22.

1) 2, 3/4" bleeders on discharge line of 10-G-22A back to D/S side of LIC-250 control loop and HIC-250 control loop.

2) Remove 1 1/2" drain detail D/S of 1 1/2" gate valve on drain piping to the OWS for LT-282 & LG-558 level bridle assy. Install 3/4" chemical hose to drain Hydrocarbon side of

10-D-22 to the LP Flare.

3) Remove the 1 1/2" drain detail D/S of the 1 1/2" gate valve on drain piping to the OWS for the Regenerator Ovhd Hydrocarbon pump, 10-G-22A. Install 3/4" chemical hose to drain the Hydrocarbon side of 10-D-22 to the LP Flare.

4. Draining Down Of Unit:

a. Special Consideration prior to Draining down the unit.

(1) Verify that all battery limit isolation valves have been closed as outlined in section G.

(2) Flag off area around the North Amine Unit - USE THE BUDDY SYSTEM DURING ALL DRAINING. Note: Have extra SCBA air packs available at the unit.

(3) With N_2 injection hoses installed at low point bleeder U/S of PIC-250A control valve, slowly start to pressure up the entire Amine system to 15 psig.

(4) When N_2 pressure has been established and is maintaining 15 psig on PT-250 for 10-D-20, Rich DEA Flash Drum, PI-251 for 10-D-21, DEA Regenerator, PT-253 for 10-D-22, Regenerator Ovhd Accumulator. Check valve position for PIC-253B on the control console, if valve is open set PIC-253B up to 20 psig to stop excess flaring.

Note: (5) Unit draining must be monitored so 10-F-20, Lean DEA Surge Tank & 10-F-21, Amine Sump, does not over fill. Adjust unit draining to Closed DEA sewer to keep level below 80%. Assure that 10-G-24 DEA Sump Pump is working properly.

b. Draining Equipment Per The Following:

Note: Do not overfill the Amine Sump, 10-F-21 and the Lean DEA Surge Tank, 10-F-20.

(1) Rich DEA Flash Drum, 10-D-20.

(a) Crack open 3, 2" bottom gate valves and 1, 4" bottom gate valve and the 4" common drain valve to start draining the Rich DEA Flash Drum, 10-D-20 to the Closed DEA sewer.

(b) Crack open and drain level bridles for LT-251, LT-250, and LG-562 for Rich DEA Flash Drum to the Closed DEA Sewer.

(c) Open HIC-250 control valve to 100% on the console and crack open 8" bypass valve. Open 3/4" low point bleeder D/S of HIC-250 control loop to start draining down Rich Amine line through attached chemical hose to Amine Sump. Note: Check drain hose at Amine Sump if hose is blowing gas block in 3/4" bleeder at HIC-250.

___ (d) Open 3/4" ball valve on D/S side of PIC-250B control loop, and the 3/4" gate valve D/S of PSV-10067. Depressure remainder of fuel gas line from battery limits through the attached hose to the LP flare. When PIC-250B fuel gas line is depressured close 1 1/2" U/S and D/S ball valves and 1 1/2" bypass valve on the control loop to isolate fuel gas line.

___ (e) Open 3/4" bleeder at battery limits D/S of 14" butterfly valve for Rich DEA to 10-D-20 and drain down through attached chemical hose to the Amine Sump.

___ (f) Open 3/4 bleeder at battery limits U/S of 3" gate valve for liquid hydrocarbon to the FCC/Coker from 10-D-20 and DRAIN DOWN THROUGH ATTACHED CHEMICAL HOSE TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Note: Check drain hose at vent and drain manifold if hose is blowing gas block in 3/4" bleeder at battery limits.

___ (g) Crack open 3/4" bleeder at battery limits U/S of 3" isolation valve for Amine Flash Gas to FCC/Coker unit and DRAIN DOWN THROUGH ATTACHED CHEMICAL HOSE TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Note: Check drain hose at vent and drain manifold if hose is blowing gas block in 3/4" bleeder at battery limits.

(2) Entrained Amine Separator, 10-D-49.

___ (a) Crack open 2" gate valve on bottom of Entrained Amine Separator, 10-D-49. Drain the Amine Interface to the Closed DEA Sewer until the level sight glass shows only hydrocarbon is present. CLOSE OFF THE COMMON DRAIN LINE TO THE CLOSED DEA SEWER AND FINISH DRAINING THE HYDROCARBON THROUGH THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Note: If drain sounds like gas is blowing through block in 2" bottom drain to LP Flare.

___ (b) Crack open and drain LT-259 LEVEL BRIDLES FOR 10-D-49 TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE.

___ (c) Monitor Amine Sump, 10-F-21 level LI-254 on the console and in the field. Verify that 10-G-24 is running in automatic and is able to maintain a constant level. Note: Do not overfill the Amine Sump.

(3) Lean/Rich Exchangers, 10-E-20A/D.

___ (a) Crack open 2, 2" gate valves to drain tube side of Lean/Rich Exchangers, 10-E-20A/D to the Closed DEA Sewer.

___ (b) Open Regenerator feed control valve FIC-251 to 100%, and crack open 8" bypass valve. Crack open 3/4" D/S bleeder on FIC-251 control valve and drain through attached chemical hose to the Amine Sump, 10-F-21. Note: Check drain hose at Amine Sump if hose is blowing gas block in 3/4" bleeder.

___ (c) Crack open 2, 2" gate valves to drain shell side of Lean/Rich Exchangers, 10-E-20A/C to the Closed DEA Sewer.

___ (d) Open LIC-252 control valve from the console to 100%, crack open 10" bypass. Crack open 3/4" bleeder U/S of LIC-252 control valve, drain through attached chemical hose to the Amine Sump. Note: Check drain hose at Amine Sump if hose is blowing gas block in 3/4" bleeder.

___ (e) Open 3/4" high point vent U/S of 12" butterfly valve for Lean Amine to 10-F-20, drain through attached chemical hose to the Amine Sump. Note: Check drain hose at Amine Sump, if hose is blowing gas block in 3/4" bleeder.

(4) DEA Regenerator, 10-D-21.

___ (a) Crack open and drain LT-258 & LG-556 level bridles to the Closed DEA Sewer.

Note: (b) Unit draining must be monitored so 10-F-20, Lean DEA Surge Tank & 10-F-21, Amine Sump, do not overfill. Adjust unit draining to Closed DEA Sewer to keep level below 80%.

(5) Regenerator Reboilers, 10-E-22A/B

___ (a) Crack open 3" gate valve to drain common shell side inlet of the Regenerator Reboilers, 10-E-22A/B and DEA Regenerator, 10-D-21 to the Closed DEA Sewer.

___ (b) Crack open 2" gate valve to drain common shell side outlet of the Regenerator Reboilers, 10-E-22A/B to the Amine Sump.

___ (c) Open the 2" start-up equalizing line between the shell inlet and the shell outlet of the Regenerator Reboilers, 10-E-22A/B.

___ (d) Crack open and drain LT-252A/B level bridles for Regenerator Reboilers, 10-E-22A/B to the Closed DEA Sewer.

(6) Regenerator Ovhd Accumulator, 10-D-22.

___ (a) Crack open 2" bottom gate valve to drain Regenerator Ovhd Accumulator, 10-D-22 to the Closed DEA Sewer. Note: If gas is blowing through to DEA Sewer, block in drain.

___ (b) Crack open 3/4" gate valve to drain acid gas line at battery limits D/S of PIC-253A control loop, drain through attached chemical hose to the Amine Sump, 10-F-21. Block in when draining is complete.

___ (c) Open 1 1/2" gate valve to drain level column assy. for LIC-262 on hydrocarbon side of 10-D-22 to the VENT AND DRAIN MANIFOLD TO THE LP FLARE. Block in when drain is blowing gas.

___ (d) Open 3/4" gate valves to drain LT-253 & LG-557 level bridle assy, to the Closed DEA Sewer.

___ (e) Open 3/4" gate valves to drain LT-263 & LG-567 level bridle assy, to the Closed DEA Sewer. Block in when draining is complete.

___ (f) Crack open 2, 3/4" bleeders for case drains to Regenerator Reflux Pumps, 10-G-20A/B and drain down to the Oily Water Sewer. Note: If gas is blowing through to the Oily Water Sewer block in case drains.

___ (g) Open 2, 3/4" gate valves for warm up bypasses around check valves for 10-G-20A/B, drain discharge piping to the OWS Sewer. Note: If gas is blowing through to the Oily Water Sewer block in case drains.

___ (h) Open 1, 3/4" gate valve on hydrocarbon piping from 10-G-22A back to D/S side of LIC-250 for hydrocarbon withdrawal to the FCC/Coker unit, DRAIN THROUGH THE ATTACHED CHEMICAL HOSE TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Block in when draining is complete

___ (i) Open 1, 3/4" gate valve on hydrocarbon piping from 10-G-22A back to D/S side of HIC-250 for Rich DEA to 10-D-20. DRAIN THROUGH ATTACHED CHEMICAL HOSE

TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Block in when draining is complete.

(j) Crack open 3/4" case drain bleeder and 1 1/2" gate valve on suction line to Regenerator Ovhd Hydrocarbon Pump, 10-G-22A and DRAIN THROUGH THE VENT AND DRAIN MANIFOLD TO THE LP FLARE. Note: If gas is blowing through to the Oily Water Sewer block in case drains.

(k) Open 1, 3/4" gate valves for warm up bypasses around check valves for 10-G-22A, DRAIN DISCHARGE PIPING TO THE VENT AND DRAIN MANIFOLD TO THE LP FLARE.

(l) Crack open 3/4" bleeder U/S of FIC-254 control valve for Regenerator Reflux to 10-D-21 and drain through attached chemical hose to the Amine Sump. Crack open 2" bypass for FIC-254 control loop.

Note: (m) Monitor the Differential Pressure across the Filters 10-J-22, 10-J-20 & 10-J-21, when the DP exceeds 25 psig remove the filter from service and replace the filter elements per the procedure.

(n) Continue draining the unit. When N_2 appears at each sight glass bulls eye, close each drain valve on equipment to maintain N_2 pressure on the unit at 15 psig. Do not allow excess N_2 to blow to the Amine Sump or LP FLare.

(o) When amine has been drained from the unit, go through once more and check every piece of equipment to verify that unit is drained. Leave drains closed after checking drains.

(p) After unit has been assured to be liquid free, stop N_2 injection at PIC-250A control valve, PIC-253A control loop off of 10-D-22, slowly reduce the set point of PIC-253B down to 5 psig on the console to depressure the unit. **Note: Do not depressure the unit through open bleeders to the atmosphere, high concentrations of H_2S are still present in all the equipment.**

(7) <u>Shut Down Lean DEA Filter System, 10-J-20 & 10-J-21:</u>

Note: The Lean Amine Filter System has been used to help filter out any solids that may have been drained to the Closed DEA Sewer or the surge tank during the draining sequence of the Amine shutdown. Note: The Lean Amine Filter system can be taken out of service prior to shut down, or can be left circulating if no repair work is to be done.

(a) Slowly reduce FIC-255 flow on the control console to '2 M B/D through the Lean Amine Filter System, then shut down 10-G-26A, Lean Amine Filter Pump.

(b) Close the 8" butterfly valve at 10-F-20 for the suction line to 10-G-26A.

(c) Close the 8" return butterfly valve for the Spill Back line to the Lean DEA Surge Tank, 10-F-20.

(a) Draining Down 10-J-20 & 10-J-21 Filter System:

(1) Start N_2 injection to high point vent at 10-G-26A Lean Amine Filter Pump. Verify that pressure gauge on inlet to 10-J-20 is good, replace if necessary. Monitor local pressure gauge on inlet to 10-J-20, maintain under 10 psig by adjusting pressure regulator on the N_2 hose.

(2) Crack open 3/4" gate valve to drain 10-G-26A, Lean Amine Filter Pumpto the Closed DEA Sewer.

(3) Crack open 3/4" bleeder U/S of FIC-255 control valve for Lean Amine to 10-J-20 and drain through attached chemical hose to the Amine Sump.

(4) Open FIC-255 control valve on the console to 100%, and open the 4" bypass for FIC-255.

(5) Open the 1 1/2" bottom gate valve to drain 10-J-20 Lean Amine Filter to the Closed DEA Sewer. (When N_2 is blowing through to the Closed DEA Sewer, close the 1 1/2" drain valve.)

(6) Open the 1 1/2" bottom gate valve to drain 10-J-21 Lean Amine Carbon Filter to the Closed DEA Sewer. (When N_2 is blowing through to the Closed DEA Sewer, close the 1 1/2" drain valve.

(7) Start N_2 injection to 3/4" bleeder D/S of line strainer on 10-J-21.

(8) Open the 3, 6" gate valves for carbon filtered lean amine from 10-J-21. Drain through to suction lines for the Lean Amine Pump-, 10-G-21ABC to the Closed DEA Sewer.

b. **Lean Amine Pumps, 10-G-21ABC.**

(1) Open 3, 3/4" gate valves to drain pump cases for 10-G-21ABC to the Closed DEA Sewer. Insure that the 3, 10" pump suction butterfly valves are open.

(2) Open 3, 3/4" gate valves for warm up bypasses around check valves for 10-G-21ABC, drain discharge piping to the Closed DEA Sewer.

(3) Open 3, 3/4" gate valves to drain suction lines U/S of 10-G-21ABC to the Closed DEA Sewer.

(4) When N_2 is blowing through to case drains and suction drains for 10-G-21ABC, close off 3, 3/4" gate valves for case drains and suction drains to the Closed DEA Sewer, this will help and force N_2 to sweep amine liquid from the 10-E-23A/B, Lean Amine Exchangers.

(5) Verify that 8" butterfly valve is closed next to 10-F-20, Lean DEA Surge Tank. Open 3/4" gate valve to drain FIC-258 Spill Back control loop through the attached chemical hose to the Amine Sump.

(6) Open FIC-258 Spill Back control valve on the console to 100%, crack open the 6" bypass for FIC-258 control loop.

c. Lean DEA Coolers, 10-E-23A/B.

(1) Open 3/4" gate valve to drain shell side outlet, through attached chemical hose to the Amine Sump.

(2) Open 3/4" gate valve U/S of 10" butterfly valve at battery limits to drain Lean Amine piping through attached chemical hose to the Amine Sump.

(3) Crack open 8" bypass on Lean Amine around 10-E-23A/B, Lean Amine Coolers.

(4) When N_2 appears at low point drain for 10-E-23A/B, Lean Amine Coolers and at battery limits bleeder, close off drains until valves are just open slightly to keep N_2 purge on Lean Amine piping and coolers.

(5) Once the Lean Amine section of the unit is drained, go through once more and check every piece of equipment to verify that unit is drained.

(6) Open the 1 1/2" bottom gate valve to drain 10-J-21 Lean Amine Carbon Filter to the Closed DEA Sewer. (When N_2 is blowing through to the Closed DEA Sewer, close the 1 1/2" drain valve.

(7) Start N_2 injection to 3/4" bleeder D/S of line strainer on 10-J-21.

(8) Open the 3, 6" gate valves for carbon filtered lean

amine from 10-J-21. Drain through to suction lines for the Lean Amine Pumps, 10-G-21ABC to the Closed DEA Sewer.

d. Drain 10-F-21 Sump Filter System Discharge Line.

____ (1) Pump the level in the Amine Sump, 10-F-21 until a low level of 10"/, is reached on LI-254 then shut down 10-G-24, Amine Sump Pump. Close the 2" inlet and the 2" outlet valve for the Amine sump Filter, 10-J-22.

____ (2) Close the 2" gate valve D/S of the check valve for filtered amine from 10-F-21 to the Lean DEA Surge Tank, 10-F-20.

____ (3) Open the 2" jumpover around 10-G-24 discharge check valve. With the 2" gate valve closed for the filtered amine to the D/S side of HIC-250, drain down the amine piping back into the Amine Sump, 10-F-21. Drain until the local pressure gauge on 10-G-24 reads 0 psig.

____ (4) Crack open the 3/4" bleeder D/S of the 2" check valve on the filtered amine from the Amine Sump to the Rich Amine Line D/S of HIC-250. Drain to the Closed DEA Sewer. When the discharge line is drained, line the discharge line back up to 10-F-20.

H. INSTALL ISOLATION BLINDS:

To isolate the unit from the rest of the refinery the following Blinds will be installed from the Master Blind List at battery limits.

____ 1. Liquid Hydrocarbon to the FCC/Coker.

____ 2. Flash Gas to the FCC/Coker units.

____ 3. Rich Amine.

____ 4. Lean Amine.

____ 5. Acid Gas D/S of PIC-253A control loop.

____ 6. Make-up Fuel Gas PIC-250B double block and bleed.

____ 7. Regenerator Ovhd Accumulator Bleed Line to the Amine Acid Gas KO Drum ,11-D-30.

I. PREPARE UNIT FOR STEAM OUT:

1. From the Master Blind List remove tower blinds Per The Following:

a. Rich DEA Flash Drum, 10-D-20.

(1) 2" blind for 40 psig steam to bottom of vessel.

(2) 3" blind for vent on top of vessel.

b. Entrained Amine Separator, 10-D-49.

(1) 2" blind for 40 psig steam to bottom of vessel.

c. DEA Regenerator, 10-D-21.

(1) 3" blind for 150 psig steam to bottom of tower.

(2) 3" blind for top vent on tower.

d. Regenerator Ovhd Accumulator, 10-D-22.

(1) 2" blind for 40 psig steam to bottom of vessel.

(2) 2" blind flange for top vent of vessel.

2. Have a 150 psig steam supply connected to piping per the following:

a. Rich DEA Flash Drum, 10-D-20.

(1) 3/4" bleeder U/S of PIC-250A control loop.

b. Regenerator Ovhd Hydrocarbon Pump, 10-G-22A.

(1) 3/4" suction bleeder U/S of pump, install 150 psig steam hose.

c. Regenerator Ovhd Reflux Pumps, 10-G-20A/B.

(1) 2, 3/4" suction bleeders U/S of pumps, install 2, 150 psig steam hose.

d. Lean Amine Pumps, 10-G-21ABC.

(1) 3, 3/4" suction bleeders U/S of pumps, install 3, 150 psig steam hose.

e. Amine Sump Pump, 10-G-24.

(1) 3/4" bleeder on 2" jumpover D/S of 10-G-24, install 1, 150 psig steam hose.

3. <u>Condensate Wash of Rich DEA Flash Drum, 10-D-20.</u>

a. The Rich DEA Flash Drum, 10-D-20, will be condensate washed prior to the Steam Out Procedure, to dilute any sludge deposits that remain on the bottom of the vessel. To do this it will be necessary to install condensate hoses from discharge side of 10-G-23A/B, Condensate Pumps to the following locations:

(1) 3/4" battery limits bleeder D/S of 10" butterfly valve for Rich DEA to 10-D-20.

(2) Close 2, 8" Rich DEA inlets to tube side of 10-E-20A/D.

b. When condensate hoses have been installed and drains have been verified as being closed, start condensate wash to Rich DEA Flash Drum, 10-D-20.

(1) Start condensate to Rich DEA line at battery limits, fill from battery limits through HIC-250 control loop and into 10-D-20.

(2) Open 3/4" cold condensate to LG-562, LT-250, LG-550, LT-251, LG-551 level bridle assy, flush into vessel side of 10-D-20.

(3) When all condensate connection have been turned on to 10-D-20, fill for 2 hours.

(4) After 2 hour fill, stop condensate flush to Rich DEA line, and LG-562 level glasses drain 10-D-20 and 10-D-49 through bottom drains, slowly to the Amine Sump, 10-F-21.

(5) Open 2, 8" butterfly valves to inlet of tube side of the Lean/Rich Exchangers, 10-E-20A/D, drain down inlet piping to the Closed DEA Sewer.

(6) With the Rich DEA Flash Drum, 10-D-20 draining down diluted sludge deposits to the closed DEA Sewer, monitor the differential pressure across the Amine Sump Filter, 10-J-22. When the DP is 25 psig across the filter, stop draining down 10-D-20 and take 10-J-22 out of service and replace filter elements per the procedure.

(7) When 10-D-20 is drained, remove condensate hoses from Rich DEA piping at battery limits, reinstall chemical hose at battery limits that was used during the unit draining process. Drain down the Rich DEA piping control loop to the Amine Sump, 10-F-21.

J. STEAM OUT OF UNIT:

1. Steam Out Of Hydrocarbon Flash Drum, 10-D-20.

Note: When the steam out sequence starts, all steaming out of vessels, lines, pumps, etc. will be steaming to the Amine Sump, 10-F-21, and condensate will be pumped to the Lean DEA Surge Tank. Do not overfill the Amine Sump or the Lean DEA Surge Tank, watch levels closely.

The sump pressure will need to be monitored closely by the local pressure gauge installed on inlet line to the Amine Sump Carbon Filter, 10-J-25, adjust
drains and bleeders on equipment to prevent over pressuring as

needed to keep PSV-10055 from relieving to the atmosphere.

____ a. Start steam purge to 10-D-20, open 2" steam at bottom of vessel and at steam hose connected to PIC-250A control loop.

____ b. Start steam purge to 10-D-49, open 2" drain slightly to steam out and drain condensate.

____ c. Crack open and steam out level bridles for LT-259 & LG-565 for 10-D-49 to the Closed DEA Sewer.

____ d. Open HIC-251 on top of 10-D-20 steam to LP flare for 2 hrs.

____ e. Open 2" and 4" drains on 10-D-20 as needed to drain condensate from vessel. Do not leave drains open unattended.

____ f. As 10-D-20 starts to heat up and build pressure, steam out to battery limits to Rich DEA piping, Flash Gas to FCC/Coker and Liquid Hydrocarbon to FCC/Coker.

____ g. Crack open and steam out level bridles for LT-251, LT-250 and LG-562 for Rich DEA Flash Drum to the Closed DEA Sewer.

2. <u>Steam Out Of 10-E-20A/D Lean/Rich Exchangers And 10-D-21 DEA Regenerator:</u>

____ a. After 10-D-20 has been steaming for 2 hours, open 2, 8" butterfly valves on tube side inlets for 10-E-20A/D Lean/Rich exchangers.

____ b. Close 4" gate valve D/S of HIC-251 to the LP flare and start steaming from 10-D-20 through exchangers and Rich Amine feed line to 10-D-21, open 2" drain lines U/S of 10-E-20A/D to Closed DEA Sewer as needed to drain condensate out.

____ c. Open 3" 150 psig steam to DEA Regenerator, 10-D-21, steam through 10-E-22A/B reboilers to shell side inlets to 10-E-20A/D Lean/Rich exchangers.

____ d. Open 2, 2" shell side outlet drains on 10-E-20A/D and steam through to the Closed DEA Sewer. Open 3/4" low point bleeder U/S of LIC-252 control valve.(Leave 10" D/S butterfly valve closed for LV.252 until overhead circuit is steam purged.)

____ e. Open and steam through the 2" equalizing line for start-up between the inlet and outlet amine lines to and from 10-E-22A/B.

____ f. Crack open and steam out level bridles for LT-258 & LG 556 for 10-D-21 to the Closed DEA Sewer.

____ g. Drain condensate through low point drains until dry steam is present at 2" drain D/S of 10-E-22A/B, and at 3" bottom drain U/S of 10-E-22A/B.

h. Crack open steam to the Regenerator Reboilers, 10-D-22A/B through FIC-252 & FIC-259 control valves to keep reboilers warm, drain out the condensate through the 3" drain to the OWS U/S of LIC-265.

3. <u>Steam Out Of 10-E-21A/B Overhead Condensers And 10-D-22 Regenerator Overhead Accumulator:</u>

a. Steam from 10-D-21 will start to heat up the 10-E-21 Overhead Condensers. Leave fans off during steam purge and louvers closed. Steam coils can be put in service to help in preventing condensation through the condensers during steam purge.

b. Open the 2" gate valve for the 40 psig steam out to the Regenerator Ovhd Accumulator, 10-D-22. steam and condensate should start to appear at 10-D-22. crack open case drains on 10-G-20A/B and 10-G-22A as needed to drain condensate out. Set PIC-253B control valve on the console down to 2 psig.

c. Start steam purge to suctions of 10-G-20A/B Regenerator Reflux Pumps. Partially close off 4" suction plug valves for both pumps. This will force steam through FIC-254 control loop for Regenerator Reflux to the DEA Regenerator, 10-D-21.

d. Start Steam purge to suction of 10-G-22A Regenerator Ovhd Hydrocarbon Pump. Partially close off 3" suction gate valve. Open the 1 1/2" gate valve for hydrocarbon to the D/S side of LIC-250 control loop. Purge through discharge of 10-G-22A to the battery limits D/S of LIC-250 Hydrocarbon to the FCC/Coker. VERIFY THAT THE VENT AND DRAIN HOSE IS CRACKED OPEN TO THE LP FLARE. When the steam is dry or chemical drain hose is hot going to the LP Flare at battery limits, close down on the 1 1/2" gate valve until the valve is just cracked open on the alternate hydrocarbon piping to the D/S side of LIC-250 control loop.

e. Open 1 1/2" gate valve to purge hydrocarbon piping from discharge of 10-G-22A back to Rich DEA piping. Leave the 1 1/2" gate valve for the alternate hydrocarbon piping cracked open to steam out both sections of discharge piping.

f. Open 3/4" gate valves to steam out LT-253 & LG-557 level bridle assy and drain to the Closed DEA Sewer.

g. Open 3/4" gate valves to steam out LT-263 & LG-567 level bridle assy and drain to the Closed DEA Sewer.

h. When Regenerator Ovhd Condensers, 10-E-21A/B and Regenerator Ovhd Accumulator, 10-D-22 are hot and pressure is building on the system, set PIC-253B at 5 psig to vent to the LP flare as needed to hold pressure on unit. Steam to the LP Flare for 2 hours.

i. After unit has been steaming to the LP flare for 2-3 hours. Close the steam sources for unit steaming until the unit has depressured down to under 1 PSIG, then install isolation blinds as they appear in order in Section K below.

j. Prior to opening vessel top vents, close isolation valves per the following:

(1) Rich DEA Flash Drum, 10-D-20.

(a) 2, 8" butterfly valves U/S and D/S of PSV-10067.

(b) 2, 8" butterfly valves U/S and D/S of PSV-10068.

(c) 4" gate valve on U/S side of HIC-251.

(2) DEA Regenerator, 10-D-21.

(a) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053A.

(b) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053B.

(3) Regenerator Ovhd Accumulator, 10-D-22.

(a) 10" U/S & D/S butterfly valves and 8" bypass valve on PIC-253B to the LP flare.

(b) 14" U/S & D/S butterfly valves and 14" bypass valve for PIC-253A.

k. Prior to opening vents, install flare blinds from the Master Blind List per the Following:

(1) Rich DEA Flash Drum, 10-D-20.

(a) 8" blind U/S of PSV-10067.

(b) 8" blind U/S of PSV-10068.

(c) 4" blind U/S of HIC-251 control valve.

(2) DEA Regenerator, 10-D-21.

(a) 6" blind U/S of PSV-10053A.

(b) 6" blind U/S of PSV-10053B.

(3) Regenerator Ovhd Accumulator, 10-D-22.

(a) 10" blind D/S of PIC-253B control valve. Install blind on U/S side of D/S 10" butterfly valve.

(b) 8" blind on U/S side of bypass to the LP Flare for PIC-253B.

l. When isolation valves have been closed and LP Flare blinds have been installed, the vessel top vents can be opened and the unit steam out to the atmosphere can proceed. Unit technician and stand by person will use SCBA to open vessel top vents per the following:

(1) 3" gate valve on top of Rich DEA Flash Drum, 10-D-20.

(2) 3" gate valve on top of DEA Regenerator, 10-D-21.

(3) 2" gate valve on top of Regenerator Ovhd Accumulator, 10-D-22.

(4) Crack open 1 1/2" gate valve to steam out level column assy for LIC-262 on hydrocarbon side of 10-D-22 to the OWS.

m. When vessel vents have been opened on 10-D-20, 10-D-21 and 10-D-22. Open 3/4" bleeder D/S of PIC-253B control valve to steam to the atmosphere.

n. Open LV.252 control loop and start steam purge to high point vent on Lean Amine inlet piping to 10-F-20, Lean Amine Surge Tank.

4. <u>Steam Out Of 10-G-21ABC Lean Amine Pumps & 10-E-23A/B, Lean Amine Cooler.</u>

a. Verify that 10-F-20 Lean Amine Surge Tank is isolated as described in section G of the Unit Shutdown and N_2 is holding positive pressure on 10-F-20.

b. Close cooling water inlet and cooling water outlet on 10-E-23A/B Lean Amine Coolers and drain down.

c. Open 150 psig steam to suction of 10-G-21ABC and purge through suction piping out warm-up jumpover to the Closed DEA Sewer. Open discharge butterfly valves and purge through discharge piping to 10-E-23A/B, Lean Amine Coolers. Leave 8" bypass piping around coolers cracked open to battery limits bleeder.

d. Open F.V.258 control valve for Lean Amine spill back to 10-F-20, steam purge out to D/S bleeder on control loop.

e. Alternate discharge location of the Amine Sump Pump, 10-G-24 back to the 3/4" bleeder at the Rich Amine Line and to the Lean DEA Surge Tank.

f. Continue steaming the Amine Unit to the atmosphere for 4-6 hours until it has been determined that all systems have been steamed.

5. <u>To verify that the unit has been thoroughly steamed out an H_2S check will be done by a Fire & Safety inspector wearing Fresh Air on the following:</u>

a. Top vent on 10-D-20.

b. Top vent on 10-D-21.

c. Top vent on 10-D-22.

d. When it has been determined through testing that the unit is virtually H_2S free, the unit steam out sequence is considered complete. Note: If H_2S testing indicates that H_2S content is not at safe level continue to steam unit until it is at a acceptable level.

e. After testing on unit vessels indicate that H_2S is at a safe level shut off all steam sources that were used for steaming, open all low point bleeders to drain down and depressure the unit.

6. <u>Drain Down Amine Sump Filter System:</u>

a. Manually start DEA Sump Pump, 10-G-24 run until sump is empty. When 10-G-24 looses suction shut down the pump. Close the 2" gate valve D/S of check valve at 10-F-20 for filtered amine from 10-F-21.

b. Open 1 1/2" gate valve to drain 10-J-22, Amine Sump Filter.

c. Open 3/4" low point bleeder D/S of 2" filter bypass to drain down filter outlet piping.

d. Open 2" jumpover around discharge check valve on 10-G-24, DEA Sump Pump to drain discharge piping back to Amine Sump.

e. Open 3/4" bleeder to drain 10-J-21 filter outlet piping at Rich Amine Line at South end of Unit. Drain through the attached chemical hose to the Amine Sump.

f. When the pressure drops to 0 psig on the local pressure gauge for 10-G-24 close the 2" jumpover around the check valve for 10-G-24.

g. When the Amine Sump Filter System is drained proceed with the N_2 purge sequence.

7. <u>Steam Purge Of The Amine Sump Filter System:</u>

a. The Amine Sump Filter, 10-J-22 will not be steam purged the fiter elements cannot tolerate the high steam temperature. To protect filter elements from damage, close the 2" inlet and the 2" outlet valve to 10-J-22, Amine Sump Filter and then open the 2" filter bypass valve.

b. Start steam injection to 3/4" bleeder on 2" jumpover D/S of 10-G-24, steam from discharge of 10-G-24 through the bypass around the Amine Sump Filter, 10-J-22 out to the 3/4" low point bleeder

U/S of 2" gate valve for discharge to 10-F-20.

____ c. Verify that the 2" gate valve is closed for 10-G-24 pump discharge to the Rich DEA piping D/S of HIC-250. Steam through 10-J-22 outlet piping to 3/4" low point bleeder D/S of 2" filter bypass and the 3/4" bleeder for 10-G-24 discharge back to the Rich DEA piping at the south end of the unit. Drain condensate through attached chemical hoses to the Oily Water Sewer.

____ d. When 10-J-22 is hot and steam is blowing through to Amine Sump from low point bleeder D/S of 2" filter bypass. and at discharge piping back to Rich DEA line. crack open the 2" bypass to purge bypass line.

____ e. After all the liquid has drained and steam is present at low point bleeders stop steam injection at 10-G-24 DEA Sump Pump and remove steam hose on 10-G-24 discharge line.

____ f. Open 2" jumpover around 10-G-24 discharge check valve and drain piping back into the Amine Sump.

____ g. Filter is now ready to be isolated and filter elements can be removed for change out.

K. <u>DEA REGENERATOR, 10-D-21, CONDENSATE WASH:</u>

Close isolation valves per the following:

____ 1. Regenerator Reboilers. 10-E-22A/B.

a. 18" butterfly valve on 40 psig steam to PIC-255 and depressure the steam system to the Regenerator Reboilers. 10-E-22A/B.

____ 2. All other isolation valves have been closed as described in section G of the unit shutdown.

____ a. 10" butterfly valve at battery limits for Rich Amine to the Rich DEA Flash Drum, 10-D-20. (Isolation blind was installed in section H.)

____ b. 10" butterfly valve at battery limits for Lean Amine to units. (Isolation blind was installed in section H.)

____ c. 14" butterfly valve D/S of PIC-253A control loop on acid gas piping to the North Sulfur at battery limits.

____ d. 12" butterfly valve for Lean DEA inlet to the Lean DEA Surge Tank, 10-F-20.

____ e. 1 1/2" ball valve at battery limits for fuel gas make-up to 10-D-20.

____ f. 3" gate valve at battery limits for Amine Flash gas to the FCC/Coker from 10-D-20. (Isolation blind was installed in section H.)

____ g. 3" gate valve for Liquid Hydrocarbon to the FCC/Coker units from 10-D-20. (Isolation blind was installed in section H.)

____ 3. All other isolation valves have been closed and blinds have been installed as described in section J of the unit shutdown.

____ a. Rich DEA Flash Drum, 10-D-20.

(1) 2, 8" butterfly valves U/S and D/S of PSV-10067.

(2) 2, 8" butterfly valves U/S and D/S of PSV-10068.

(3) 4" gate valve on U/S side of HIC-251.

____ b. DEA Regenerator, 10-D-21.

(1) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053A.

(2) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053B.

____ c. Regenerator Ovhd Accumulator, 10-D-22.

(1) 10" U/S & D/S butterfly valves and 8" bypass valve on PIC-253B to the LP flare.

(2) 1 1/2" Regenerator Ovhd Accumulator Bleed Line to the Amine Acid Gas KO Drum, 11-D-30.

4. Condensate Wash of the DEA Regenerator, 10-D-21

____ a. The DEA Regenerator, 10-D-21 will be condensate washed to remove any amine deposits that may exist on the trays that were not removed during the steaming sequence.

____ b. A stripping pump will be installed to pump from the bottom of the DEA Regenerator back to The Regenerator Ovhd Accumulator, 10-D-22. Regenerator Reflux Pumps, 10-G-20A/B will be used to pump condensate back to the DEA Regenerator.

5. Prepare Unit For Condensate Wash Per The Following:

____ a. Have Maintenance install tower isolation blinds per the Master Blind List.

____ b. Have Maintenance install condensate wash tie-ins as shown on Master Blind List.

____ c. Check to insure all bleeders are closed on 10-D-22, 10-G-20A/B, 10-G-22A, and 10-D-21 after tower isolation blinds and wash connections are installed.

6. Prepare For Condensate Fill:

___ a. Install 3" suction hose from stripping pump to 3" drain from DEA Regenerator bottoms.

___ b. Install 3" discharge hose from stripping pump to top 2" vent on the Regenerator Ovhd Accumulator, 10-D-22.

7. Condensate Fill For Wash:

___ a. Open 2" gate valve for cold condensate make-up on 10-E-21, Ovhd condenser outlet line to Regenerator Ovhd Accumulator, 10-D-22.

___ b. Start filling the accumulator with condensate, when 50% level has been established on LIC-253, start 10-G-20A/B Regenerator Reflux Pumps and pump condensate back to the regenerator. Continue to fill the Regenerator until a 50% level in the Regenerator bottoms has been established on LI-258.

___ c. When 50% level has been maintained in the accumulator and regenerator, close 2" cold condensate make-up to 10-D-22, start circulation through the stripping pump and back to the accumulator. Add condensate as necessary to stabilize levels after circulation has been started.

___ d. Maintain condensate circulation for 2 hours before sampling.

___ e. Take a sample of the wash to the Water Lab to check the ph, sulfides, and CODs.

If the PH is between 5-12, and

If the sulfides are less than 100 mg/l, and

If the CODs are less than 2000 mg/l,

then the wash can be drained to the oily sewer. If the sample fails any of these criteria, continue to circulate and add condensate for dilution.

___ f. When samples results meet the above criteria, shutdown circulation and notify utilities that the DEA Regenerator will be drained to the Oily Water Sewer.

___ g. Once the DEA Regenerator is drained, the unit is ready for Maintenance.

L. <u>ENVIRONMENTAL, SAFETY AND HEALTH CONSIDERATIONS:</u>

1. Rich Amine TRN# 360917-00.

2. Lean Amine TRN# 341925-00.

4. Sulfur Unit Feed Gas TRN# 360024-00.

3. Amine liquid solutions must be drained to the Closed DEA Sewer. **NEVER ALLOW AMINE TO ENTER THE OILY WATER SEWER.**

D-2 Operating Procedures - Amine Unit (Start-up)

The following is a petroleum refinery operating procedure for initial start-up of an amine unit. It includes safety requirements, special tools or equipment required, normal and critical operating parameters, and special considerations for the safe start-up of the unit.

REFINERY

NAME OF PROCEDURE: INITIAL START-UP OF THE NORTH AMINE UNIT

A. PURPOSE: TO PROVIDE PROCEDURES FOR A SAFE START-UP AND OPERATION OF THE NORTH AMINE UNIT.

B. REFERENCES:

	P&ID'S	# 4874-5-10-011-1
		# 4874-5-10-011-2
		# 4874-5-10-011-3
		# 4874-5-10-011-4
		# 4874-5-10-011-5
		# 4874-5-10-011-6
PROCESS FLOW DIAGRAM		# E-11838-60-0101

C. APPROVALS:

____
COMPLEX SHIFT SUPERVISOR
A-CREW

____
COMPLEX SHIFT SUPERVISOR
B-CREW

____
COMPLEX SHIFT SUPERVISOR
D-CREW

____
COMPLEX SHIFT SUPERVISOR
C-CREW

____
COMPLEX SUPERVISOR

D. SAFETY REQUIREMENTS:

1. Follow all refinery safety policies and procedures during start-up and operation of the North Amine Unit.

2. All personal protective equipment must be worn, where applicable.

3. Ascertain that H_2S alarm system is operable and SCBA Breathing Apparatus Units are available and ready for use.

4. Check that all fire fighting equipment is in the correct location and ready for service.

5. Scaffolding must be installed at predetermined locations and a portable scaffold available for unit technicians to safely gain access to valves and equipment.

6. Full Body Harness must be worn when Scaffolding or Platforms are not available above 4 feet.

E. SPECIAL TOOLS OR EQUIPMENT REQUIRED:

1. 4, 3/4" check valves.

2. 4, control regulators set at 25 psig.

3. 4, N_2 hoses.

4. 7, Chemical handling hoses.

5. Portascaffold.

F. PRE-START-UP PROCEDURE & SPECIAL CONSIDERATIONS FOR INITIAL START-UP:

____ 1. All utility line commissioning has been completed, and in service per procedure.

____ 2. Water wash all process lines to remove foreign material.

____ 3. Chemically clean and then flush with condensate the entire Amine System.

____ 4. Unit is under N_2 blanket at 5 psig to eliminate oxidation.

____ 5. All pumps, drivers and fans have been checked off on Equipment List for correct rotation and lubrication.

____ 6. Assure that all Start-Up Filters and Strainers are in place.

____ 7. All control valves have been checked off on Instrument Equipment List for free travel and calibration from control console.

____ 8. Instrument loops, alarms, and interlocks are in working order, and have been checked off on Instrument Equipment List.

____ 9. Cooling water exchangers have been passivated and cooling water circulation has been established through all cooling water exchangers per Exchanger List.

____ 10. Personnel will be familiar with physical locations of start-up lines, drains & vents in order that the unit can be brought on stream safely and efficiently.

____ 11. Master blind list and lock out/tag out list are to be reviewed by Unit Supervisor, Console Shift Supervisor and Sr. Process Tech.

____ 12. The Console Shift Supervisor and Sr. Process Technician will assure that all flows are lined up correctly and that all blinds have been removed or installed as required by the blind list in this Procedure Manual.

____ 13. The Lean DEA Surge Tank, 10-F-20, and Fresh Dea Storage Tank, 10-F-22, will be under a N_2 blanket following the initial wash and chemical cleaning operation.

____ 14. Verify that unit is lined up to feed the Unsat Gas Plant. Verify that Rich and Lean Amine header block valves to the CHD/SGP located in the ICP at the Unsat Gas Plant battery limits are closed.

____ 15. NOTE: The North Amine Unit will not require steam out for initial Start-Up since the unit was chemically cleaned, purged, pressure tested, and N_2 blanketed to prevent oxidation. However, during subsequent start-ups, steam will be used to prepare the unit for start-up, air freeing, and pressure testing the unit prior to start-up. To accomplish this, use the steam out procedure as directed below.

____ 16. For Initial Start-Up, proceed to section J.

G. ISOLATION BLINDS:

Note: To isolate the unit from the rest of the refinery the following Blinds should have been installed from the Master Blind List at battery limits.

____ 1. Liquid Hydrocarbon to the FCC/Coker.

____ 2. Flash Gas to the FCC/Coker units.

____ 3. Rich Amine.

____ 4. Lean Amine.

____ 5. Acid Gas D/S of PIC-253A control loop.

____ 6. Make-up Fuel Gas PIC-250B double block and bleed.

____ 7. Regenerator Ovhd Accumulator Bleed Line to the Amine Acid Gas KO Drum, 11-D-30.

a. Prior to steaming the unit, close isolation valves per the following:

(1) Rich DEA Flash Drum, 10-D-20.

____ (a) 2, 8" butterfly valves U/S and D/S of PSV-10067.

____ (b) 2, 8" butterfly valves U/S and D/S of PSV-10068.

____ (c) 4" gate valve on U/S side of HIC-251.

(2) DEA Regenerator, 10-D-21.

___ (a) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053A.

___ (b) 1, 6" U/S gate valve and 1, 8" butterfly valve D/S of PSV-10053B.

(3) Regenerator Ovhd Accumulator, 10-D-22.

___ (a) 10" U/S & D/S butterfly valves and 8" bypass valve on PIC-253B to the LP flare.

___ (b) 14" U/S & D/S butterfly valves and 14" bypass valve for PIC-253A.

b. Prior to steaming the unit, install flare blinds from the Master Blind List per the Following:

(1) Rich DEA Flash Drum, 10-D-20.

___ (a) 8" blind U/S of PSV-10067.

___ (b) 8" blind U/S of PSV-10068.

___ (c) 4" blind U/S of HIC-251 control valve.

(2) DEA Regenerator, 10-D-21.

___ (a) 6" blind U/S of PSV-10053A.

___ (b) 6" blind U/S of PSV-10053B.

(3) Regenerator Ovhd Accumulator, 10-D-22.

___ (a) 10" blind D/S of PIC-253B control valve. Install blind on U/S side of D/S 10" butterfly valve.

___ (b) 8" blind on D/S side of bypass to the LP Flare for PIC-253B.

H. <u>PREPARE UNIT FOR STEAM OUT:</u>

1. From the Master Blind List remove blinds per the following:

a. Rich DEA Flash Drum, 10-D-20.

___ (1) 2" blind for 40 psig steam to bottom of vessel.

___ (2) 3" blind for vent on top of vessel.

___ (3) 3, 2" and 1, 4" spec blind at gate valves on bottom drains to the closed DEA Sewer.

b. Entrained Amine Separator, 10-D-49.

___ (1) 2" blind for 40 psig steam to bottom of vessel.

___ (2) 1, 2" blind at gate valve on bottom drain to the closed DEA Sewer.

c. Lean/Rich Amine Exchangers, 10-E-20A/D.

___ (1) 2, 2" blinds at gate valves for tube side drains to closed DEA Sewer Lean/Rich Amine Exchangers, 10-E-20A/D.

___ (2) 2, 2" blinds at gate valves for shell side drains to closed DEA Sewer for Lean/Rich Amine Exchangers, 10-E-20A/D.

d. DEA Regenerator, 10-D-21.

___ (1) 3" blind for 150 psig steam to bottom of tower.

___ (2) 3" blind for top vent on tower.

e. Regenerator Reboilers, 10-E-22A/B.

___ (1) 3" blind at gate valve for shell side common inlet drain to the closed DEA Sewer for Regenerator Reboilers, 10-E-22A/B.

___ (2) 2" blind at gate valve for reboiler common outlet drain to the closed DEA Sewer for Regenerator Reboilers, 10-E-22A/B.

f. Regenerator Ovhd Accumulator, 10-D-22.

___ (1) 2" blind for 40 psig steam to bottom of vessel.

___ (2) 2" blind flange for top vent of vessel.

___ (3) 2" blind at gate valve for bottom drain to Closed DEA Sewer for Regenerato Ovhd Accumulator, 10-D-22.

___ (4) 1 1/2" blind at gate valve for drain to OWS for LT-261 & LG-558 level bridle on 10-D-22.

g. Regenerator Reflux Pumps, 10-G-20A/B and Regenerator Ovhd Hydrocarbon Pump, 10-G-22A.

___ (1) 3/4" blinds at gate valves for drains to OWS for 10-G-20A/B.

___ (2) 1 1/2" blind at gate valve for drain to OWS for 10-G-22A.

h. Lean Amine Filter, 10-J-20.

___ (1) 1 1/2 blind at gate valve for bottom drain to the Closed DEA Sewer.

___ (2) 2" blind at gate valve for 40 psig steam to 10-J-20.

i. Lean Amine Carbon Filter, 10-J-21.

___ (1) 1 1/2" blind at gate valve for bottom drain to the Closed Dea sewer.

___ (2) 2" blind at gate valve for 40 psig steam to 10-J-21.

j. Amine Sump Filter, 10-J-22.

___ (1) 1 1/2" blind at gate valve for bottom drain to the Closed DEA Sewer.

___ (2) 1" blind at gate valve for 40 psig steam to 10-J-22.

2. Install chemical drain hoses and route to the Oily Water Sewer per the following:

a. Rich DEA Flash Drum, 10-D-20.

___ (1) 3/4" bleeder at battery limits U/S of 3" isolation valve for liquid hydrocarbon to the FCC/Coker.

___ (2) 3/4" bleeder at battery limits D/S of 14" butterfly valve for Rich DEA to 10-D-20.

___ (3) 3/4" bleeder at battery limits U/S of isolation valve for PIC-250A Amine Flash Gas to the FCC/Coker.

___ (4) 3/4" bleeder U/S of 2" gate valve for Amine Sump Pump, 10-G-24 discharge back to the Rich DEA piping D/S of HIC-250 control valve.

b. Regenerator Ovhd Accumulator, 10-D-22.

___ (1) 3/4" bleeder D/S of PIC-253A and 14" check valve on acid gas line at battery limits.

___ (2) 3/4" bleeder D/S of PIC-253B control valve on acid gas vent line to the LP Flare.

c. Lean DEA Coolers, 10-E-23A/B.

___ (1) 3/4" bleeder for Lean Amine to units at battery limits U/S of 10" butterfly valve.

3. Have a 150 psig steam supply connected to piping per the following:

a. Regenerator Ovhd Hydrocarbon Pump, 10-G-22A.

___ (1) 3/4" bleeder on discharge side of pump, install 150 psig steam hose.

b. Regenerator Ovhd Reflux Pumps, 10-G-20A/B.

___ (1) 2, 3/4" bleeders on discharge side of pump, install 2, 150 psig steam hose.

c. Lean Amine Pumps, 10-G-21ABC.

___ (1) 3, 3/4" bleeders on discharge side of pump, install 2, 150 psig steam hoses.

d. Amine Sump Pump, 10-G-24.

___ (1) 3/4" bleeder on 2" jumpover on discharge side of pump, install 40 psig steam hose.

I. STEAM OUT OF UNIT:

1. Steam Out Of 10-G-24 Amine Sump Pump, 10-F-24 Amine Sump:

Note: When the steam out sequence starts, all steaming out of vessels, lines, pumps, etc. will be steaming to the Amine Sump, 10-F-21, and condensate will be pumped to the Lean DEA Surge Tank. Do not overfill the Amine Sump or the Lean DEA Surge Tank, watch levels closely. The sump pressure will need to be monitored closely by the local pressure gauge installed on inlet line to the Amine Sump Carbon Filter, 10-J-25. adjust drains and bleeders on equipment to prevent over pressuring as needed to keep PSV-10055 from relieving to the atmosphere.

____ a. The Amine Sump Filter, 10-J-22 will not be steam purged. The filter elements cannot tolerate the high steam temperature. To protect filter elements from damage, close the 2" inlet and the 2" outlet valve to 10-J-22, Amine Sump Filter.

____ b. Start steam injection to 3/4" bleeder on 2" jumpover D/S of 10-G-24, steam from discharge of 10-G-24 through the bypass around the Amine Sump Filter, 10-J-22 out to the 3/4" low point bleeder U/S of 2" gate valve for discharge to 10-F-20.

____ c. Verify that the 2" gate valve is closed for 10-G-24 pump discharge to the Rich DEA piping D/S of HIC-250. Steam through 10-J-22 outlet piping to 3/4" low point bleeder D/S of 2" filter bypass and the 3/4" bleeder for 10-G-24 discharge back to the Rich DEA piping at the south end of the unit. Drain condensate through attached chemical hoses to the Oily Water Sewer.

____ d. When 10-G-24 discharge piping is hot and steam is blowing through to Amine Sump from low point bleeder D/S of 2" filter bypass, and at discharge piping back to Ri DEA line, close off all bleeders and vents and pressure system to 10 psig using loca pressure gauge on inlet to 10-J-22 Amine Sump Filter. Check system over for leaks.

____ e. If no leaks are found depressure filter system to 5 psig and remove steam hose on discharge line.

____ f. Filter is now ready to be N_2 purged and put in service per procedure.

2. Steam Out of the Rich DEA Flash Drum, 10-D-20.

____ a. Start steam purge to 10-D-20, open 2" steam at bottom of vessel.

____ b. Start steam purge to 10-D-49, open 2" drain slightly to steam out and drain condensate.

____ c. Crack open and steam out level bridles for LT-259 & LG-565 for 10-D-49 to the Closed DEA Sewer.

____ d. Crack open top vent on 10-D-20 to steam to the atmosphere.

____ e. Open 2" and 4" drains on 10-D-20 as needed to drain condensate from vessel. Do not leave drains open unattended.

____ f. As 10-D-20 starts to heat up and build pressure, steam out to battery limits to Ric' DEA piping, Flash Gas to FCC/Coker, and Liquid Hydrocarbon to FCC/Coker.

g. Crack open and steam out level bridles for LT-251, LT-250 and LG-562 for Rich DEA Flash Drum to the Closed DEA Sewer.

3. Steam Out Of 10-E-20A/D Lean/Rich Exchangers And 10-D-21 DEA Regenerator:

a. After 10-D-20 has been steaming for 2 hours, open 2, 8" butterfly valves on tube side inlets for 10-E-20A/D Lean/Rich exchangers.

b. Close 3" top vent on the Rich DEA Flash Drum, 10-D-20. Start steaming from 10-D-20 through exchangers and Rich Amine feed line to 10-D-21, open 2" drain lines U/S of 10-E-20A/D to Closed DEA Sewer as needed to drain condensate out.

c. Open 3" 150 psig steam to DEA Regenerator, 10-D-21, and crack open the 3" top vent, steam through 10-E-22A/B reboilers to shell side inlets to 10-E-20A/D Lean/Rich exchangers.

d. Open 2, 2" shell side outlet drains on 10-E-20A/D and steam through to the Closed DEA Sewer. Open 3/4" low point bleeder U/S of LIC-252 control valve. (Leave 10" D/S butterfly valve closed for LV.252 until overhead circuit is steam purged.)

e. Open and steam through the 2" equalizing line for start-up between the inlet and outlet amine lines to and from 10-E-22A/B.

f. Crack open and steam out level bridles for LT-258 & LG 556 for 10-D-21 to the Closed DEA Sewer.

g. Drain condensate through low point drains until dry steam is present at 2" drain D/S of 10-E-22A/B, and at 3" bottom drain U/S of 10-E-22A/B.

h. Crack open steam to the Regenerator Reboilers, 10-D-22A/B through FIC-252 & FIC-259 control valves to keep reboilers warm, drain out the condensate through the 3" drain to the OWS U/S of LIC-265.

4. Steam Out Of 10-E-21A/B Overhead Condensers And 10-D-22 Regenerator Overhead Accumulator:

a. Close the 3" top vent on 10-D-21. Steam from 10-D-21 will start to heat up the 10-E-21 Overhead Condensers. Leave fans off during steam purge and louvers closed. Steam coils can be put in service to help in preventing condensation through the condensers during steam purge.

b. Open the 2" gate valve for the 40 psig steam out to the Regenerator Ovhd Accumulator, 10-D-22, steam and condensate should start to appear at 10-D-22, crack open case drains on 10-G-20A/B and 10-G-22A as needed to drain condensate out.

c. Open the top vent on 10-D-22 and steam to the atmosphere adjust 40 psig steam as necessary to 10-D-22 to keep pressure under 25 psig on PT-253 transmitter.

d. Purge through the 3/4" bleeder on acid gas piping D/S of PIC-253A control loop to the Oily Water Sewer. Steam purge through to the 3/4" bleeder D/S of PIC-253B control valve to the Oily Water Sewer.

e. Start steam purge to suctions of 10-G-20A/B Regenerator Reflux Pumps. Partially close off 4" suction plug valves for both pumps. This will force steam through FIC-254 control loop for Regenerator Reflux to the DEA Regenerator, 10-D-21.

f. Start Steam purge to suction of 10-G-22A Regenerator Ovhd Hydrocarbon Pump. Partially close off 3" suction gate valve. Open the 1 1/2" gate valve for hydrocarbon to the D/S side of LIC-250 control loop. Purge through discharge of 10-G-22A to 3/4" battery limits bleeder D/S of LIC-250 Hydrocarbon to the FCC/Coker. When the steam is dry at battery limits close down on the 1 1/2" gate valve until the valve is just cracked open on the alternate hydrocarbon piping to the D/S side of LIC-250 control loop.

g. Open 1 1/2" gate valve to purge hydrocarbon piping from discharge of 10-G-22A back to Rich DEA piping. Leave the 1 1/2" gate valve for the alternate hydrocarbon piping cracked open to steam out both sections of discharge piping.

5. <u>Steam Out Of Lean Amine Section:</u>

a. Verify that 10-F-20 Lean Amine Surge Tank and 10-F-22 Pure Amine Tank are blocked in and N_2 is holding positive pressure on both.

b. Open LV-252 control loop and start steam purge to high point vent on Lean Amine inlet piping to 10-F-20, Lean Amine Surge Tank.

c. Close cooling water inlet and cooling water outlet on 10-E-23A/B Lean Amine Coolers and drain down.

d. Open 150 psig steam to suction of 10-G-21ABC and purge through suction piping out warm-up jumpover to the Closed DEA Sewer. Open discharge butterfly valves and purge through discharge piping to 10-E-23A/B, Lean Amine Coolers. Leave 8" bypass piping around coolers cracked open to battery limits bleeder.

e. Open FV-258 control valve for Lean Amine spill back to 10-F-20, steam purge out to D/S bleeder on control loop.

f. Open suction gate valve and start 40 psig steam to 10-G-26 steam through suction piping out warm-up jumpover to the Closed DEA Sewer. Open discharge gate valve and FV-255 control loop and steam out to 3/4" high point vent on the Lean Amine Filter, 10-J-20.

g. Start 40 psig steam to 10-J-20 filter. Open the 1 1/2" drain valve to the Closed DEA Sewer as necessary to drain out condensate.

h. Purge from 10-J-20 to high point vent on 10-J-21, Lean Amine Carbon Filter. Start 40 psig steam to bottom of 10-J-21, Lean Amine Filter. Open the 1 1/2" drain on 10-J-21 to the Closed DEA Sewer as necessary to drain out condensate. Steam purge through 10-J-21 to filter outlet piping to the suction of the Lean Amine Pumps, 10-G-21ABC.

i. Continue to steam purge unit to the atmosphere until it has been determined that all systems have been steamed and air freed. Close all bleeders, drains and vents on equipment. Open HV-251 off 10-D-20, Rich DEA Flash drum and PV-253B off 10-D-22, Regenerator Overhead Accumulator. When purging is complete block in HV-251 off 10-D-20 and PV-253B and pressure up system to 25 psig. Go over the whole unit carefully checking for obvious leaks. <u>Note:</u> May need to connect N_2 to 10-D-22, Regenerator Ovhd Accumulator, to get the pressure up to 25psig on unit

J. PREPARE UNIT FOR N_2 PRESSURE TEST:

____ 1. The unit will be pressurized by installing N_2 hoses with control regulators set at 25 psig at 4 different locations. Pressure will be monitored by PT-250, PT-251, and PT-253. In the event of over pressuring, unit pressure will be lined up to vent excess pressure through PIC-250, PIC-253A out open bleeders D/S of the control loops to the atmosphere inside unit battery limits.

____ 2. Proceed to following steps to prepare equipment for N_2 pressure test.

a. 10-D-20 Rich DEA Flash Drum.

____ (1) Open all vessel trim per the following:

2, 2" gate valves on level bridles for LT-251, LG-551, LT-250, and LG-550 assy.

2, 2" gate valves on sight glass bridles for LG-562, LG-566, and PT-250.

1 1/2" gate valve for PT-250 transmitter.

____ (2) Close all vessel trim per the following:

3, 2" and 1, 4" bottom drain valves to amine sump, 3/4" gate valves for cold condensate flush to level bridles LT-250 & LT-251.

3/4" gate valves for cold condensate flush to LG-562, LG-566 to closed DEA sewer.

3" gate valve for top vent.

2" 40psig steam valve to steam coil and 2" condensate return from steam coil.

2" 40psig steam valve for purge to bottom of 10-D-20.

____ (3) Open all process lines per the following:

10" butterfly valves for HIC-250 and crack open bypass.

2" and 3" gate valves on PIC-250A off gas to FCC/Coker and crack open bypass.

2" and 3" gate valve on LIC-250 liquid H.C. to the FCC/Coker unit and crack open bypass.

2, 8" butterfly valves for PSV 10067 & PSV 10068.

4" gate valve for HIC 251 to the LP flare.

6" gate valve from bottom of 10-D-20 to inlet of 10-D-49.

1/2" hex valves for FT-251 Rich DEA flow transmitter.

(4) Close all process valves per the following:

1 1/2" gate valve D/S of PIC-250B control loop for fuel gas to 10-D-20.

2" gate valve from 10-J-22 to D/S side of HIC-250 Rich DEA control loop.

1 1/2" gate valve D/S of LIC-250 form 10-D-22.

b. 10-D-49 Entrained Amine Separator.

(1) Open All Vessel trim per the following:

2, 2" gate valves on level bridle LT-259 & LG-565.

(2) Close all vessel trim per the following:

2" bottom drain valve to closed amine sewer.

3/4" gate valve for cold condensate flush to LT-259 & LG-565 bridle assy to closed DEA sewer.

2" 40 psig steam purge line.

c. 10-D-21 DEA Regenerator.

(1) Open all vessel trim per the following:

2, 2" gate valves for LT-258 & LG-556 on bottom of tower.

2, 2" gate valves for PT-2501 & PDT-252 pressure transmitters.

(2) Close all vessel trim per the following:

3" isolation gate valve for 150 psig steam purge to bottom of tower.

3" gate valve for top vent on tower.

3/4" gate valve for cold condensate to flush LT-258 level bridle to closed DEA sewer.

3" gate valve for drain piping to closed DEA sewer on tower drain on common inlet line to 10-E-22A/B, Regenerator Reboilers.

(3) Open all process lines per the following:

2, 10" isolation gate valves for FV-251 and 8" bypass valve.

2, 6" isolation gate valves for PSV 10053A & PSV 10053B.

d. 10-D-22 Regenerator Ovhd Accumulator.

(1) Open all vessel trim per the following:

2, 2" isolation gate valves on level bridle for LT-253 and LG-557.

2" isolation gate valves for level bridle LT-262 and LG-558.

2, 2" isolation gate valves for level bridle LT-263.

2, 2" isolation gate valves for level bridle LG-567.

Isolation gate valve for PT 253 pressure transmitter and P.I-555 local pressure indicator.

(2) **Close all vessel trim per the following:**

2" drain to closed DEA sewer.

2" drain from bottom of vessel and install blind flange.

1" gate valves for Cold Condensate flush header to flush level bridles for LT-262, LT-263, LT-253 and LG-567.

1 1/2" gate valve for drain to oily water sewer from LT-262 level bridle.

2" 40psig steam valve for steam purge to bottom of vessel.

3/4" drains from 10-G-20A/B and 10-G-22A to oily water sewer.

2" gate valve for cold condensate make-up to 10-D-22.

(3) **Open all process lines per the following:**

2, 14" butterfly valves for PV-253A acid gas line to the SRU, and 14" bypass butterfly valve.

Flow taps for FT-253 transmitter.

1, 14" U/S butterfly valve for PV-253B vent to the LP flare. Note: Leave 8" bypass closed during pressure test.

2, 4" suction plug valves to 10-G-20A/B Regenerator Reflux Pumps.

2, 3" discharge plug valves for 10-G-20A/B.

1/2" hex valves for flow tap for FT-254 transmitter.

2, 3" valves for FV-254 control loop and 2" crack open bypass valve for Regenerator Reflux to 10-D-21.

3" suction valve to 10-G-22A Regenerator Ovhd Hydrocarbon Pump.

1 1/2" discharge gate valves for 10-G-22A.

(4) **Close all process lines per the following:**

1 1/2" gate valve on bleed line from 10-G-22 Reflux piping to 11-G-30A/B Amine Sour Water pumps.

2, 10" butterfly valves for PIC-253B control loop and 8" bypass butterfly valve.

e. 10-E-22A Regenerator reboilers.

(1) Open all vessel trim per the following:

2, 2" gate valves for level bridle LT-252A and LG-554.

(2) Close all vessel trim per the following:

1" gate valve for cold condensate flush to LT-252A and LG-554.

2" gate valve for draining shell side of 10-E-22A/B Reboilers to the closed DEA sewer.

f. 10-E-22B Regenerator reboilers.

(1) Open all vessel trim per the following:

2, 2" gate valves for level bridle LT-252B and LG-555.

(2) Close all vessel trim per the following:

1" gate valve for cold condensate flush to LT-252B and LG-555.

g. 10-E-20A/B Lean/Rich Exchangers.

(1) Open all process valves per the following:

2, 8" Rich DEA tube side inlet butterfly valves and 2, 8" Rich DEA tube side outlet gate valves on 10-E-20A/D.
2, 10" Lean DEA shell side inlet butterfly valves and 2, 10" Lean DEA shell side outlet butterfly valves on 10-E-20A/D.

2, 12" butterfly valves for LV-252 control loop and crack open 10" bypass butterfly valve.

2, 1 1/2" gate valves for PSV-10069 and PSV-10070 on tube side of 10-E-20A/C.

(2) Close all process drain valves per the following:

2" drain to closed DEA sewer on Rich DEA inlet to tube side of 10-E-22B.

2" drain to closed DEA sewer on Lean DEA outlet side of 10-E-22B.

2" drain to closed DEA sewer on Rich DEA inlet to tube side of 10-E-22D.

2" drain to closed DEA sewer on Lean DEA outlet side of 10-E-22D.

h. 10-E-21A/B Regenerator Ovhd Condensers.

(1) Open all process valves per the following:

6, 8" butterfly valves on inlet side of Ovhd Condensers.

4, 8" gate valves on outlet side of Ovhd Condensers.

____ (2) Close all process drain valves per the following:

6, 3/4" bleeder valves on inlet lines to condensers D/S of blind locations.

4, 3/4" bleeder valves on outlet lines from condensers U/S of blind locations.

i. 10-E-23A/B Lean DEA Cooler.

____ (1) Open all process valves per the following:

2, 1/2" hex valves to FT-258 flow transmitter.

1, 12" butterfly valve for Lean DEA inlet from shell side of 10-E-23A.

1, 12" butterfly valve for Lean DEA outlet from shell side of 10-E-23B.

2, 1/2" hex valves for FT-256 flow transmitter.

1/2" hex valve for PT-256 and PI-599 local pressure indicator.

2, 8" butterfly valves for FV-258 control loop, and crack open 6" bypass butterfly valve.

j. 10-F-20 Lean DEA Surge Tank.

____ (1) Verify that all vessel trim is closed per the following:

12" Tank inlet butterfly valve from 10-E-20A/D Lean/Rich exchangers.

2" gate valve for filtered DEA from 10-F-21 Amine sump.

3" drain to closed DEA sewer.

8" butterfly valve for Lean DEA spill back.

3" gate valve for Fresh amine from 10-F-22 and 3" gate valve for pumped low pressure condensate to 10-F-20.

8" tank outlet butterfly valve for suction line to 10-G-26, Lean DEA Filter Pump.

3, 10" tank outlet butterfly valves for suctions lines to 10-G-21ABC, Lean Amine Pumps.

____ (2) Open all process valves per the following:

3, 10" suction butterfly valves at Lean Amine Pumps, 10-G-21ABC.

3, 10" discharge butterfly valves for 10-G-21ABC, Lean Amine Pumps.

____ (3) Close all process valves per the following:

3/4" high point vents and case drains to closed DEA sewer for 10-G-21ABC Lean Amine Pumps.

6" gate valve for carbon filtered Lean Amine to 10-G-21 spill back to 10-F-20 Lean DEA Surge tank.

(3) Close all process drains and utility systems per the following:

2, 1 1/2" gate valves for high point vent and vessel drain to closed DEA Sewer.

2" gate valve for 40psig purge steam to 10-J-21.

2" gate valve for cold condensate flush to 10-J-21.

m. Condition of Battery Limits Isolation valves.

(1) Verify that battery limits valves are properly positioned per the following:

3" gate valve for liquid hydrocarbon to FCC/Coker from 10-D-20 Rich DEA Flash Drum. (Closed)

3" gate valve for off gas to FCC/Coker from 10-D-20 Rich DEA Flash Drum. (Closed)

10" butterfly valve for Rich DEA to 10-D-20 Rich DEA Flash Drum. The blind at battery limits will be removed and the 10" butterfly valve will be opened to include new Rich DEA piping for N_2 pressure test.

14" butterfly valve D/S of PIC-253A at battery limits for acid gas to North Sulfur Recovery unit and acid gas to and from East & West Sulfur Recovery Units. (Closed)

10" butterfly valve for Lean Amine to units. The blind at battery limits will be removed and the 10" butterfly valve will be opened to include the New Lean Amine piping for N_2 pressure test.

3" gate valve for Fresh Amine from 10-F-22 Fresh Amine Tank to 10-F-20 Lean DEA Surge Tank. (Closed)

n. Install N_2 hoses with check valves and control regulators at the following locations.

(1) On low point bleeder at HIC-250 amine control valve to 10-D-20.

(2) On low point bleeder at FIC-251 control valve to DEA Regenerator.

(3) High point vent on 10-G-20A Regenerator Reflux Pump.

(4) High point vents on 10-G-21ABC Lean Amine Pumps.

(5) High point vent on 10-G-26, Lean Amine Filter Pump.

o. The following valves can be opened to avoid over pressuring during the N_2 pressure test.

(1) The 3/4" high point vent at battery limits D/S of PIC-250A on off gas line to FCC/Coker.

____ (2) The 3/4" high point vent D/S of check valve from PIC-253A control loop.

____ (3) Install 0-60psig pressure gauge in 3/4" battery limits bleeder for Lean Ar to units.(Gauge will be used only for the N_2 pressure test and will be removed prior to Amine fill.)

K. N. PURGE OF LEAN AMINE FILTER SYSTEM:

Note: The Lean Amine Filter System will not be steam purged, because the filter elements for 10-J-20 cannot tolerate the high temperature.

____ 1. Open suction gate valve and start N_2 to 10-G-26 purge through suction piping out warm-up jumpover to the Closed DEA Sewer. Open discharge gate valve and FV-255 control loop and purge out to 3/4" high point vent on the Lean Amine Filter, 10-J-20.

____ 2. N_2 purge through to 10-J-20 filter. Crack open the 1 1/2" drain valve to the Closed DEA Sewer as necessary to displace air from the system.

____ 3. Purge from 10-J-20 to high point vent on 10-J-21, Lean Amine Carbon Filter. Open the 1 1/2" drain on 10-J-21 to the Closed DEA Sewer as necessary to displace air from the system.

____ 4. Purge through 10-J-21 to the 3/4" bleeder D/S of the line strainer on the filter outlet piping to the suction of the Lean Amine Pumps, 10-G-21ABC.

____ 5. Crack open the 3, 6" gate valves for filtered Lean Amine on the suction lines for the Lean Amine Pumps, 10-G-21ABC.

L. NITROGEN PRESSURE TEST:

____ 1. Verify that all vents, drains and low bleeders are closed on all equipment.

____ 2. Make sure FIC-258 spillback is blocked in at Lean DEA Surge Tank,10-F-20.

____ 3. With N_2 injection hoses installed at the following; HIC-250 low point bleeder, 10-G-20 Regenerator Reflux Pump high point vent, low point bleeder on FIC-251 control loop, 10-G-26, and 10-G-21ABC high point vents, slowly start to pressure up entire Amine system up to 25 psig. (Do not open and N_2 pressure test 10-F-20.)

____ 4. Close off N_2 injection hoses when N_2 pressure has been established and is maintaining 25 psig on the following; PIC 250 for 10-D-20, H.C. Flash Drum, PI-251 for 10-D-21 DEA Regenerator, PIC-253 for 10-D-22, Regenerator Ovhd Accumulator, and D/S of 10-E-23A/B at battery limits.

____ 5. Check unit carefully with snoop. If no leaks are found, depressure unit and leave a slight positive N_2 pressure on the unit while unit isolation blinds are removed per unit blind list.

____ 6. Once Blinds are removed, N_2 pressure the unit to 5 psig.

M. 10-F-20, LEAN DEA SURGE TANK FILL:

____ 1. Refer To Fresh DEA Unloading Procedure for 10-F-22 and N_2 purge procedure for 10-F-22 prior to filling. Fresh DEA will be unloaded from a tank truck into the Fresh DEA Tank, 10-F-22, located in the East Amine Unit and will be pumped into the Lean DEA Surge Tank 10-F-20 by 10-G-25 transfer pump.

2. Steam coils should be activated in the Fresh DEA Tank, 10-F-22, to hold the DEA temperature at approximately 110°F. Condensate will be added to 10-F-20 to mix and produce a strength of 25 weight % per procedure.

3. Steam coils should be placed in service in the Lean Amine Surge Tank 10-F-20 to hold the 25 Weight % temperature at approximately 110°F per TI-265.

4. Vessel Preparation & Line Up For Circulation:

a. Check the entire unit to ascertain that all vent and drain valves are closed and that bull plugs are installed at all locations. Confirm that all control valves operate properly per Instrument Check List.

b. Line Up The Unit Per The Following:

(1) Check that the 6" Rich Amine header to Lean Amine header bypass line is open at the Unsat Gas Plant battery limits.

(2) Check that Liquid Hydrocarbon line from Flash Drum 10-D-20 is blocked in at LV-250 control loop. PV-250A in the off gas line from 10-D-20 should be placed in service at 60 psig. Notify the FCC to line up to take 10-D-20, Amine Flash, open battery limit valves when FCC is ready to take Amine Flash Gas. (Note Leave PV-250B control loop blocked in.)

(3) Check that battery limits block valves are open on both the Rich and Lean Amine to the units.

(4) Set PV-253B in regenerator accumulator 10-D-22 off gas line at 2 psig to the LP flare. Leave PV-253A to the sulfur unit closed.

(5) Verify that FV-258 Lean Amine spill back control loop is closed going back to 10-F-20 Lean DEA Surge Tank.

(6) Close Bypass valve on 10-E-23A/B Lean DEA Cooler.

5. North Amine Unit Filling:

a. Line up 10-F-20 Lean Amine Surge Tank to the suction of the Lean Amine pumps 10-G-21ABC. Verify that the 3, 6" gate valves D/S of the Lean Amine Filter System to the suctions are closed. Start 10-G-21C turbine pump on slow roll (per turbine start up procedure) crack open the discharge valve. This will start to fill the Lean Amine header to the battery limit gate valves at the USGP through the bypass valve at battery limits and return to the Hydrocarbon Flash Drum, 10-D-20, through HIC-250 control valve for the Rich Amine line. Block in tube and shell sides of 10-E-20A/D Lean/Rich exchangers.

b. Maintain Hydrocarbon Flash Drum pressure at 60 psig, using HIC-251 to vent off excess N_2 to the LP flare.

c. The Lean Amine Filter System may now be filled and placed in service. Refer to procedure for 10-J-20 & 10-J-21 prior to start-up.

(1) Open the 8" butterfly valve at the Lean DEA Surge Tank, 10-F-20 for the suction to 10-G-26.

(2) Open FIC-255 Control valve on the control console to 20%. Start 10-G-26, Lean Amine Filter Pump slowly open the discharge valve to start filling the Lean Amine Filter, 10-J-20, open the 3/4" bleeder to displace the N_2 to the Closed DEA Sewer.

(3) When 10-J-20 is full close the high point vent and continue filling the Lean Amine Carbon Filter, 10-J-21, open the 1 1/2" high point vent valve to displace the N_2 to the Closed DEA Sewer.

(4) Once the Lean Amine Carbon Filter, 10-J-21 is full, close the 1 1/2" top vent valve to the Closed DEA Sewer.

(5) Open the 8" butterfly valve for the 10-G-21ABC spill back line at the Lean DEA Surge Tank, 10-F-20.

(6) Open the 6" gate valve for the filtered amine to the spill back line to the Lean DEA Surge Tank, 10-F-20.

(7) When the Lean Amine Filter piping is lined up to the spill back line to 10-F-20, open the discharge valve for 10-G-26 the rest of the way and raise FIC-255 on the console to 2 M B/D.

(8) Monitor the differential pressure across both filters during the unit start-up phase.

d. When a normal level (50%) is established in the Hydrocarbon Flash Drum, 10-D-20, shut down the Lean Amine pump 10-G-21C, and check the liquid level in the Lean Amine Surge Tank, 10-F-20. If level is below a half tank,make up some additional 25% solution to bring the level up back to 50%.

e. Commission PV-250B fuel gas control valve to 10-D-20 and set PIC-250B at 60 psig.

f. When the preceding steps have been taken to establish an Amine level and Flash Drum pressure, the Lean Amine pump 10-G-21C may again be started to fill the remainder of the unit.

g. With 10-G-21C running, open tube side inlet and outlet butterfly valves on 10-E-20A/D and start filling 10-E-20A/D Lean Rich Amine exchangers on tube side. N_2 will vent out PIC-253B to the LP Flare.

h. When 10-E-20A/D Lean Rich Amine exchangers are full amine will appear at FIC-251. Periodically check open low point bleeder at control loop for amine use container to catch sample to verify amine is present at control loop.

i. With Amine at FIC-251, start closing down control valve from console. This will help to maintain LT-251 for 10-D-20 Hydrocarbon Flash Drum.

j. If level in 10-D-20 Hydrocarbon Flash Drum starts to drop, close down on FIC-251 to keep level constant. Monitor level in 10-F-20 Lean DEA Surge Tank, and shut down 10-G-21C when low level alarm is activated.

k. The Amine Solution will now be entering the DEA Regenerator 10-D-21, at Tray 23. Amine will flow down the tower to the bottom of the regenerator and to the Regenerator Reboilers,10-E-22A/B. LT-252A/B will indicate when amine is present in reboilers. Continue to fill DEA Regenerator, 10-D-21, and Regenerator Reboilers, 10-E-22A/B, until 80% level is reached on LT-252A/B.

____ l. When regenerator reboilers 10-E-22A/B are full, open inlet butterfly valve for Lean DEA Surge Tank, 10-F-20. Verify that 10-F-20 N_2 Blanketing system is venting properly. Open 10-E-20 A/D shell side inlet and outlet valves to start to fill the Lean Amine side of 10-E-20A/D Lean Rich exchangers. When 10-E-20A/D are full amine solution will appear at LV-252. Periodically check low point bleeder on control loop for amine, use container to catch sample to confirm amine is present at control loop.

____ m. As amine starts to enter 10-F-20, Lean DEA Surge Tank, the level will start to stabilize, verifying that amine is returning from the regenerator. The system is full when the level in 10-F-20 remains constant.

N. <u>NORTH AMINE UNIT START-UP:</u>

____ 1. With the Lean Amine Pump 10-G-21C turbine running at slow speed, open the discharge valve fully and start adjusting steam to turbine to increase speed and Amine circulation. When 10-G-21C is running at full RPM, set FV-258 at 5 M B/D to spill back to 10-F-20, Lean Amine Surge Tank.

____ 2. Set H.C. Flash Drum, LT-251, on cascade control with FV-251 in the feed line to 10-D-21 Regenerator at 15 M B/D. Adjust H.V.250 manually to keep constant flow of amine to 10-D-20, Rich DEA Flash Drum.

____ 3. Set LV-252 D/S of 10-E-20A/D from 10-E-22A/B reboilers on automatic control. (Set level at 50%.)

____ 4. Check the entire North Amine Unit and systems for leaks and proper operation of equipment.

____ 5. With circulation established and all systems functioning properly, the next step will be to activate the reboilers 10-E-22A/B and heat up the unit. This must be done very slowly to eliminate any condensate buildup and accompanying water knock. Steam and condensate lines must be checked during the heat up for expansion clearance. Note: Commission the North SRU condensate system per the start-up procedure.

____ 6. On condensate Pot 10-D-23, open the 1" equalizing line between 10-E-22A/B. Open 2, 6" gate valves on bottom of tube side outlets for steam side of 10-E-22A/B Reboilers. Activate auto vent valves for non-condensibles for equalization lines for 10-E-22A/B. Open the 3" gate valve to the OWS U/S of LV-265 control loop. (Leave D/S gate valve closed going to condensate system during heat up phase of steam system.)

____ 7. Check that TV-252 in the pumped low pressure condensate line to desuperheater 10-M-20 is blocked in, PV-255 control valve in the 40 psig steam line to desuperheater 10-M-20 is set at 20-30% open and FV-252 and FV-259 in the steam supply lines to reboilers 10-E-22A/B are on manual control in the closed position.

____ 8. With one Technician stationed at the main block valve in the 40 psig steam line to this system, very slowly crack open valve enough to start a small flow of steam. Leave the block valve in this position until system begins to heat up.

____ 9. As the steam lines to the reboilers heat up and condensate draining to the OWS through the trap out lines U/S of FV-252 & FV-259 control loops reaches a minimum, the block valve in the main steam supply may be slowly opened.

____ 10. At this time FV-252 and FV-259 in the reboilers supply lines can be slowly opened to start a steam flow through 10-E-22A&B. Activate PV-255 control valve, and set steam pressure at 35psig.

____ 11. When PV-255 control valve is in service, set the minimum steam flow at 5 M LB/HR to the reboilers with FV-252 and FV-259. Open the pumped low pressure condensate to TV-2[illegible] and place in service. Open 150psig velocity steam to 10-M-20 desuperheater (Set TV-2 to control at approximately 280°F.)

____ 12. The condensate from 10-D-23 will continue to drain to the sewer until the system is completely hot. At that time slowly open LV-265 control loop, to send condensate from the reboilers to the condensate system and close the 3" gate valve U/S of LV-265 to the OWS. Place LV-265 on automatic control on the console when the condensate is flowing to the Condensate System.

____ 13. With the steam pressure and temperature on control, slowly increase the steam flow on manual control to 10-E-22A and 10-E-22B to raise regenerator's bottom temperature over 2-3 hr. period to approximately 260°F.

____ 14. Control the Lean Amine Temperature from Coolers 10-E-23A/B at 115-120°F by adjusting the 8" bypass valve.

____ 15. As the regenerator's overhead temperature reaches 200°F, the louvers on the overhead condensers 10-E-21A/B should be opened. Fans can be started to maintain condenser outlet temperature at 115°F. Place TIC-272 and TIC-274 in automatic to control variable speed of 10-E-21 A/B fans.

____ 16. When a liquid level builds in the Regenerator Overhead Accumulator, 10-D-22, reflux pump 10-G-20A/B may be started and LIC-253 and FV-254 placed in service to control the level in 10-D-22 at 50%.

____ 17. With the North Amine Unit circulating 15 M B/D and the unit is up to temperature, start 2nd Lean Amine Pump, 10-G-21ABC. Slowly start to raise the amine circulation rate to 35-40 M B/D over a 2 hr. period to the North Amine Unit.

____ 18. The North Amine Unit will be lined up to supply lean amine to the USGP and send rich amine from the USGP back to the North Amine Unit. This will reduce the amine circulation to the East and West Amine Units. Close monitoring on the console for all three amine trains will be needed during the USGP switch to the North Amine Unit.

____ 19. As the amine becomes rich with H_2S, the overhead system pressure will increase due to the unit stripping H_2S out of the Rich Amine. The overhead accumulator 10-D-22, has been venting to the LP flare through PV-253B since the amine unit was started and circulation was established. H_2S will be venting to the LP flare, so venting should be eliminated as soon as possible due to the environmental concern.

____ 20. When a level builds in H.C. side of 10-D-20, notify the FCC to line up to take hydrocarbon from 10-D-20. When FCC is ready to take hydrocarbon, open battery limits valves and put LT-250 on cascade with LV-250. Set level at 50% and line up to pressure to the FCC/Coker.

____ 21. The North Amine Unit will normally feed the North Sulfur Unit. However for Initial Start-up, Acid Gas from the North Amine Unit will be sent to the East and West Sulfur trains. To do this it will be necessary to open the acid gas "jumpover" from the North Amine Unit and North Sulfur Unit to the "crossover" line between the East and West Amine Units. Slowly open the acid gas to the East or West Sulfur Furnace, it will take a short amount of time for the Sulfur Furnaces to adjust for the increase in acid gas. Avoid sending a surge of acid gas to the East or West Sulfur Units by opening the acid gas valves from the North Amine too quickly.

22. When acid gas is lined up from the North Amine Unit to the North Sulfur or the East or West Sulfur units, the acid gas venting will be eliminated. Set PV-253 at 18psig on 10-D-22 to keep flare valve closed so all the acid gas produced from the North Amine Unit will go to the sulfur units.

O. NORMAL OPERATING PARAMETERS:

NORTH AMINE UNIT

1.	35psig Steam Temperature To 10-E-22A/B Reboilers.	280°F
2.	Rich Amine Temperature From 10-D-20 H.C. Flash Drum.	125°F
3.	Regenerator Bottoms Temp. From 10-D-21.	260°F
4.	Rich Amine Feed Temp. To 10-D-21 Regenerator.	212°F
5.	Lean Amine Tower Bottoms To 10-F-20 Surge Tank.	170°F
6.	Regenerator Tower 10-D-21 Overhead Temp.	237°F
7.	Overhead Condensers 10-E-21A/B Outlet Temp.	115°F
8.	Lean Amine Temperature To Units.	115°F
9.	H.C. Flash Drum Pressure 10-D-20.	60 psig
10.	Amine Regenerator 10-D-21 Top Pressure.	15 psig
11.	Amine Regenerator 10-D-21 Bottom Pressure.	19 psig
12.	Overhead Accumulator Pressure 10-D-22.	13 psig
13.	40psig Steam Let Down Pressure, To 10-E-22A/B Reboilers.	35 psig
14.	Lean Amine Pressure Before 10-E-23A/B coolers.	270 psig
15.	Lean Amine Pressure After 10-E-23A/B coolers.	260 psig

16. Refer to Process Flow Diagram E-11838-60-0101 for further process flow information.

P. EMERGENCY OPERATING/ SITUATIONS:

1. Loss of Instrument Air: In the event of a complete instrument air failure all control valves will fail in the safe position, so that the charge to and the flow from all vessels will stop. Steam to the reboilers 10-E-22A/B will be shut off and pressure control valves will open on 10-D-20 and 10-D-22 to the LP flare.

2. Loss of Power: An automatic reacceleration program has been designed to automatically restart the North Amine Unit pumps when power is restored within 5 seconds, after a power failure.

3. Flange Leak: Large or small amine leaks can not be tolerated. These leaks contain H_2S and must be repaired quickly to keep the amine from reaching the oily water sewer. All precautions must be taken to prevent the escape of H_2S into the atmosphere. H_2S is a personnel safety hazard and an environmental problem.

Q. CRITICAL OPERATING LIMITS:

1. Maximum steam temperature to 10-E-22A/B___284°F.
2. Low level in 10-F-20 Lean Amine Surge Tank___3 feet.
3. High concentration of hydrocarbon in Rich Amine.
4. Sudden changes in amine circulation rate.

DEVIATION	CONSEQUENCES	STEP TO CORRECTIONS/AVOID
1. High steam temp. to 10-E-22A/B.	1. Amine degrades at temp. above 284°F, causing the amine to decompose and form a corrosive product.	1. Ascertain that condensate is lined up to 10-M-20 desuperheater, and that TV-252 control valve is working properly. Adjust TV-252 set point to 280°F on control console.
2. Low level in 10-F-20 Lean Amine Surge Tank.	1. Loss or erratic Lean Amine flow to units. Damage to Lean Amine pumps 10-G-21ABC from cavitation.	1. Verify LT-252A/B for 10-E-22A/B reboilers are controlling properly and not holding Amine in reboilers. 2. Start adding condensate to 10-F-20 to increase level. 3. Check with amine users possible trouble with amine levels in contactors or absorbers pulling to hard on lean amine to try and satisfy their needs.
3. High concentration of hydrocarbon in Rich Amine.	1. Amine unit upset from tower carryover and high pressure and temperature. 2. High amounts of hydrocarbon in the acid gas from the Amine Unit will effect the Sulfur Recovery Units performance.	1. Contact Amine users immediately to have levels checked in contactors and absorbers to find where hydro-carbon is coming from. 2. Bypass the Ta Gas Unit if problem cannot be resolved quickly. 3. Vent Acid Gas to the LP Flare through PV-253B off the top of 10-D-22 Overhead Accumulator or HIC-251 on the Rich DEA Flash Drum, 10-D-20. 4. Shut down the Sulfur Recovery Unit.

DEVIATION	CONSEQUENCES	STEP TO CORRECTIONS/AVC
4. Sudden changes in Amine circulation rate.	1. Flow increase to above design rates. 2. H_2S stripping from amine reduced due to erratic flows to the DEA Regenerator tower. 3. Higher than design acid gas rates to the Sulfur Recovery Units.	1. Contact amine users to chec that vessels are being blown down, and levels are being controlled properly. 2. Take FV-252 and FV-259 steam control valves off steam/feed ratio control and set steam rate to control in auto to keep a constant stea flow to the Amine Reboilers. 1. Monitor Sulfur Units carefully by: a. Watching for acid gas knockout drum for carryover. b. Monitoring air demand so t proper amount of air is fed the sulfur furnaces.

- SAFETY RELIEF SYSTEMS AND THEIR FUNCTIONS:

(1) There are two safety relief valves on 10-D-20 H.C. Flash Drum. Both are set to relieve to the Low pressure flare at 95 psig. HV-251 on 10-D-20 can be manually opened at the control console to control drum pressure.

(2) 10-D-21 Amine Regenerator has two safety relief valves that protect the tower from over pressuring, both are set to relieve at 50 psig.

(3) On 10-D-22 Overhead Accumulator, PV-253 is set for 18 psig and will automatically start venting Acid Gas to the flare to control the pressure on the North Amine Unit.

(4) N_2 is supplied to the Pure Amine Tank, 10-F-22, and to the Lean Amine Surge Tank, 10-F-20. Both are under local pressure control from the refinery N_2 system. This N_2 blanket is provided to prevent oxidation of the amine solution. 10-F-20 is equipped with a safety relief that is set to 10" WC, it will relieve if PCV-568 fails to open to the 10-J-23A/B carbon filter system.

- ENVIRONMENTAL SAFETY AND HEALTH CONSIDERATIONS:

(1) Pure Amine TRN# 812958-00
(2) Rich Amine TRN# 360917-00
(3) Lean Amine TRN# 341925-00
(4) Sulfur Unit Feed Gas (Acid Gas) TRN# 360024-00

D-3 Operating Procedures - Crude Unit (Start-up)

The following is a normal operating procedure for a crude unit start-up, generally found in a petroleum refinery. The procedures outline the necessary steps needed for the safe start-up and continuous operation of the unit, including safety requirements, special tools or equipment required, normal and critical operating parameters and emergency conditions or situations.

REFINERY

NORMAL OPERATING PROCEDURE FOR CRUDE UNIT START-UP

A. PURPOSE

To establish a standard with this procedure, considered necessary for the safe start-up and continuous operation of the Crude Unit.

B. REFERENCES

1. P & ID drawings: 4350-R-1-010, R-1-011A, R-1-011B, R-1-012
R-13-013, R-13-014, R-13-015.
2. Unit Description Manual
3. Emergency Procedure Manual
4. Unit Procedure Manual

C. APPROVALS

Complex Shift Supervisor
A-Shift

Complex Shift Supervisor
B-Shift

Complex Shift Supervisor
C-Shift

Complex Shift Supervisor
D-Shift

Complex Supervisor

D. SAFETY REQUIREMENTS

1. Wear required personal protective equipment (PPE).

2. Follow Lock Out/Tag out procedures (LOTO).

3. Follow established refinery safety practices, take all personal safety precautions during unit start-up.

E. SPECIAL TOOLS OR EQUIPMENT REQUIRED

1. Valve wrenches.

2. Temporary scaffolding.

3. Safety harness for working above 4 feet.

4. Air, steam & chemical hoses.

5. N2 hoses with Dixlox connections.

6. Copper tubing and compression fittings.

F. PRESTART-UP PROCEDURE

1. Remove Blinds.

2. Open required valving.

3. Steam air free and gas purge.

4. Pressure test equipment.

5. Commission Utility Systems.

6. Check Power equipment and Control instrumentation.

G. START-UP PROCEDURE

After initial checks are complete and the unit is sectionally divided, there are certain required steps which must be acted on in sequence to each section. It is not intended that each unit section be placed in service as it is listed. It's possible that several steps may be on-going at the same time.

Start-up consists of the following major steps;

- Steam Out - Crude Line and product to Crude Exchangers.
- Steam Out - Desalter.
- Steam Out - Crude Heaters and Atmospheric Tower.
- Pressure Test - Atmospheric Section.

- Fuel Gas Purge - Atmospheric Section.
- Crude Flow - Exchangers, Desalter, Heaters, and Atmospheric Tower.
- Fuel Fire - Atmospheric Heaters (System dry out and heat up).
- Steam Out - Vacuum Heater, Vacuum Tower and Flow circuits.
- Pressure Test - Vacuum Section.
- Fuel Gas Purge - Vacuum Section.
- Gas Oil Circulate - Vacuum Tower, Heater, and Flow circuits.
- Fuel Fire - Vacuum Heater (System dry out and heat up).
- Reduced Crude Flow - Raise Heater outlet temperatures, and establish a normal vacuum to bring Vacuum side on stream.
- Products/Rundown - Increase charge rates and temperatures to bring products on specification. Change product rundowns to storage.

<u>ATMOSPHERIC AND VACUUM TOWER STEAMOUT</u>

1. Make certain that all required blinds are swung open or removed.

2. Block in each atmospheric heater control valve and bypass. Open 150# tube steam into the outlets of 13-E-10A & C, and steam backwards through the hot oil preheat exchangers, desalter, and the desalter preheat exchangers.

☞ <u>Steam through all preheat train exchangers and desalter first</u>.

3. When a good flow of steam is showing from the exchanger drains and desalter vent, close off on the backflow and begin to direct steam flow into each atmospheric heater pass. Steam initially from east to west, starting with F01020 C/V and bypass.

☞ <u>Check each heater outlet bleeder for dry steam from the bottom north deck</u>.

4. At this same time, light two burners in each atmospheric heater box to begin dryout and assist with heatup.

5. Start boot steam into Atmospheric Tower and allow steam to blow from tower top vent.

6. Steam through all control loops (including bypasses), pump circuits, exchangers, and side strippers.

7. Steam flow should carry through the 1-E-21 overhead bundles into the accumulator.

☞ A large amount of condensate will form in the accumulator across the 1-E-21's. When a water level forms in the 1-D-7 boot, line-up and pumpout to the SW rundown.

8. Begin a direct flow of 150# tube steam into the Vacuum heater charge line. Steam each vacuum heater pass. Steam initially from south to north, starting with F13058 C/V and bypass.

☞ Check each heater outlet bleeder for dry steam from the bottom east deck

9. At this same time, light two burners in each Vacuum Heater box to begin dryout and assist with heatup.

10. Steam through all control loops (including bypasses), pump circuits, and exchangers. Allow steam to blow from tower top vent.

11. Steam flow should carry through overhead system (ejector condensers) into seal drum.

☞ While the unit is steaming, check flanges for leaks, and finish opening all remaining block valves for operating equipment or at relief valves.

12. When dry steam is showing at nearly all locations, close all bleeders, vents, and allow steam pressure to reach 20# PSIG on both Atmospheric and Vacuum towers.

☞ Check all flanges for leaks.

13. Use N_2 to air-free purge 1-G-1A/B compressor system, 1-E-14 Discharg Coolers, and the 1-D-9 Discharge Separator.

14. When unit steam purge and pressure testing is complete, open fuel gas into 1-D-7 Accumulator and maintain 5# Psig pressure on the atmospheric overhead. Likewise, open fuel gas into 13-D-11 Seal Drum and maintain 5# Psig on vacuum system. (Fuel gas blowdown line from 1-D-16 may provide enough gas volume to maintain the pressure on 1-D-7).

☞ Bleed H_2O from all low point bleeders, pump cases, and equipment drains, except the Desalter. Leave a slight water level in 1-D-6 between LC-01501 and 1" trycock tap.

START RAW CRUDE INTO PREHEAT TRAIN

15. Contact Oil Movements to start one crude pump lined up through P01001. Fill entire preheat preheat train and both atmospheric heaters with inlet to Atmospheric Tower. (Include; desalter, crude booster pumps, exchanger bypass loops, and each individual pass flow control loop and bypass.)

☞ Crude charge pump(s) should provide the necessary volume and pressure for the initial fill. Do not exceed 50-60m B/D of cold crude flow. A higher rate may flood the atmospheric tower.

16. Open 1-B-1A/B pass flow controllers (F01005 thru 20) separately. Make certain that each Pass shows a positive flow, and pressure at the loop.

☞ It will be necessary to start a crude booster pump at the desalter to assist the filling process. Commission P01001 and re-adjust heater pass flows after starting 1-G-2.

17. When a bottoms level is established in 1-D-1, start 1-G-12A/B and pump L01007 to Virgin Slop. Set L01007 instrumentation to control F01015 (Resid to storage). (Slop return: 1-G-12 -> 13-E-10's, 13-E-5's, F01015, resid line to B/L jumpover).

☞ With this circulation in progress, continue draining excess water from all low points, alternate spare pumps, open and fully flush all by-pass lines, leaving valves slightly open.

18. Begin raising transfer line temperatures of the Atmospheric Heaters about 100°F per hour. Make sure a good steam flow is showing from the exhaust mufflers to the super heater coils of each heater.

19. Start injection of Stripped sour water into the preheat train (F01002), and at the Desalter (F01039). Energize the electrodes to the Desalter grids and also start pumping demulsifying chemical. Establish a 50% water level in 1-D-6.

TOWER HEAT-UP, CIRCUIT FLOWS AND REFLUX ESTABLISHED

As heater outlet temperatures increase along with atmospheric tower overhead, fans will be started on 1-E-21 condensers to provide temperature and pressure control. Begin overhead chemical injection when top temperature exceeds 250°F.

20. When gasoline and water levels are establish in the Overhead Accumulator and Boot, line-up 1-G-3 reflux pump and 1-G-15 sour water pump. Commission LC-01503 to displace sour water to the sour water rundown. Start 1-G-3 and reflux Atmospheric Tower to maintain a top temperature of 150°F. Commission F01031 to control reflux rate. Line-up and start 1-G-4 S.R. Gasoline pump to control L01001. Commission F01030 to control flow off-spec product to slop.

☞ Continue draining free water from P/A circuit low points. Use caution to avoid drawing a flow of hot liquid into a line packed with water when starting a P/A or product pump.

21. As tower temperatures increase on tower, start P/A circuits.

22. As levels establish in side strippers, start product pumps to draw small accumulations to Virgin slop.

23. Start-up the overhead compressor(s) as P01009 spillback closeure will dictate the need.

☞ Crude feed rate should be at this time around 100m B/D.

VACUUM TOV...R OIL FILL AND HEAT-UP

24. Line-up 650 product wash oil into the discharge of 13-G-18B turbine and direc. the flow to F01068 as Top P/A through 13-E-23 cooler and back to Vacuum Tower. Allow wash oil to overflow internal tower trays and cascade through the tower.

25. When wash oil fills L01011 at Tray 7, drain all free water from Vacuum Mid P/A pumps.

26. When 13-G-19A/B pumps are water free, line-up and start flow through Mid P/A circuit. If pump starts to cavitate, shut it down until Tray 7 level is re-established.

☞ Continue draining free water from Vacuum heater pass control loops, pass outlets, and all tower flow circuits.

27. When wash oil appears at Tray 5 (L01013), line-up and start 13-G-21. Circulate flow through F01076 and back to Tray 5. Make certain that 4" block valve at Atmospheric Tower is closed downstream of L01013.

28. When an oil level is indicated by L01014/15 as Vacuum Tower bottoms and the drain lines from 13-G-22A/B are water free, line-up and begin circulating oil through the Vacuum Heater. (Stop the in-coming flow of 650 wash oil when bottoms circulation is satisfied.)

☞ Open a small flow of atmospheric bottoms into the Vacuum Tower through the bottoms quench line (F01079). This should heavy up the bottoms and help stabilize temperature and flow through the heater.

29. Open 13-B-2 pass flow controllers (F01047 thru 58) separately in manual control. Make certain that each Pass shows a positive flow, and pressure at the loop.

30. Raise heater outlet temperature at 100°F per hour. Stabilize in 250-300°F range for two hours to allow excess water to boil out. This period will also help establish good levels on upper tower trays for pumparound circulation.

31. Be careful not to flood the tower excessively during the wash oil fill. Once the bottoms show indication, pinch back or completely stop the in-coming flow. Maintain level indications whenever possible. (A 3" pumpout line off the common discharge of 13-G-22A/B is available to remove the excess bottoms level to CGO or slop).

32. Continue heat-up and total systems control of both Atmospheric and Vacuum Sections. Color check Atmospheric product taps often and line-up storage rundowns with Oil Movements as soon as cuts are ready.

33. Marry the Atmospheric and Vacuum Sections when both towers are running within 50°F of each other at 500-550°F on bottoms temperature. Secure bot' tower levels within reliable control range. Target the Crude charge at a 110r. B/D prior to the mate.

☞ The bottom level controls for each tower, (L01007) 1-D-1, (L01015) 13-D-10, may act sluggish immediately following the valving change. Make certain that all instrument changes are inserted at the console to correspond with the new control scheme. Communication must be accurate and direct from unit personnel to the control console at the time of the switch.

34. Do not proceed to raise tower temperatures or unit rates further until the tower mating is complete and good level control is established. Line out the unit at 120m B/D.

35. When Unit is lined out with all operating parameters normal, prepare line-up of Hot Resid for Coker feed and 550 Hvy Kero for Coker purge oil.

H. NORMAL OPERATING PARAMETERS

The following are approximate operating conditions which will serve as a guide in lining out the unit after the Atmospheric and Vacuum Towers have been married.

CRUDE, DESALTER, PREHEAT

Crude Flow (40-G-1)	F01001	30m B/D
Desalter Psig (40-G-2A/C)	P01001	155# PSIG
Desalter Inlet	T01012	270°F
Stripped Sour H_2O	F01002	3.5m B/D
Stripped Sour H_2O	F01039	3m B/D
1-B-1A Charge Rate	F01003	90m B/D
1-B-1B Charge Rate	F01004	90m B/D
Cooling H_2O Psig	P01018	55-60# PSIG

ATMOSPHERIC SECTION

Tower Top Psig	P01009	20# PSIG
Top Temperature	T01057	300°F
Top Reflux	F01031	20m B/D
Transfer Temperature	T01055	680°F
1-B-1A/B Pass Temperature	T01018-40	675-680°F
Bottoms Level	L01007	50-55%
Top P/A	F01032	60m B/D
Mid P/A	F01037	80m B/D
Btm P/A	F01041	110m B/D
Tower Boot Steam	F01045	30m
Condenser Outlet	T01081	165°F
Accumulator Psig	P01011	10-12# PSIG

VACUUM SECTION

Tower Top Psig	P01017	11mm Hg
Top Relux Temperature	T01166	175°F
Transfer Temperature	T01144	760°F
13-B-2 Pass Temperature	T01118-135	775-780°F
Bottoms Level	L01015	50%
Top P/A	F01068	18m B/D
Mid P/A	F01072	110m B/D
Mid P/A Temp Return	T01170	340°F
Btm Grid Wash	F01071	20m B/D
Btm Tower Psig	P01020	20mm Hg
Btms Temperature	T01162	690°F
Resid to Storage	F01080	10-15m B/D
Hot Resid to Coker	F06061	20-22m B/D

I. EMERGENCY CONDITIONS/SITUATIONS

1. Flange leaks.

2. Pump seals.

3. Instrument problems

4. Valve failure.

5. Refer to the following Emergency Procedures in the UEI&P Manual.

   (a) Steam failure.

   (b) Electric failure.

   (c) Instrument air failure.

   (d) Cooling water failure.

   (e) Fire/explosion.

   (f) Toxic gas release.

   (g) TDC-3000 Distributive Control Failure.

J. CRITICAL OPERATING LIMITS

Pressure, levels, and temperatures.

DEVIATIONS	CONSEQUENCES	STEPS TO CORRECT/AVOID
High Desalter Pressure (P01001)	1. PSV's relieve to 1-D-1	1. Reduce Crude Rate and Temperature accordingly
High Desalter Temperature (T01012)	1. Crude vaporization; suction loss to Booster Pumps 2. Overpressure, PSV's relieve	1. Reduce Crude Inlet Temperature to 1-D-6 below 270°F
High Heater Pass Outlet Temperature 1-B-1/13-B-2	1. Heater tube coking	1. Stroke C/V manually 2. Increase Flow with Control Valve Bypass 3. Bias Pass Flows 4. Reduce Heater Firing
High Tower Pressure 1-D-1 (P01009)	1. PSV's relieve to atmosphere	1. Reduce Boot Steam 2. Reduce Heater Transfer Temperature (T01055) 3. Reduce Crude Charge
High Bottoms Level 1-D-1 (L01007)	1. Tower Flooding Closes Boot Steam C/V 2. Permits Lighter Feed into Vacuum Tower	1. Reduce Crude Charge 2. Control L01007 in Manual 3. Switch to spare 1-G-12 if F01046 is down or lost
Low Bottoms Level 1-D-1 (L01007)	1. 1-G-12 cavitation; pump damage 2. Low Flow to 13-B-2 Interlock Shutdown	1. Reduce Boot Steam Rate 2. Reduce Heater Transfer Temperature (T01055) 3. Increase F01077 (Recycle)
High Tower Pressure 13-D-10 (P01017)	1. Ejector steam is lost 2. PSV's relieve to atmosphere 3. Seal Drum gas to flare 4. Upper tray levels diminish as Tower top overheats	1. Remove Stripping Steam 2. Reduce Crude Charge 3. Reduce 13-B-2 Temperatures 4. Maintain cooling from reflux circuits
Low Bottoms Level 13-D-10 (L01015/14)	1. 13-G-22 cavitation; pump damage 2. Loss of crude pre-heat 3. Hot Resid to Coker is lost	1. Remove Stripping Steam 2. Reduce 13-B-2 Temperatures 3. Increase tower quench 4. Reduce Vacuum (Hg mm)
Low Fuel Pressure (Fuel gas) (Fuel oil)	1. Fuel Gas Chopper closes; Interlock Shutdown 2. Fuel Oil Chopper closes; may overload gas firing 3. L01007 - High Level	1. Reduce crude rate to 90m 2. Steam Purge Heater boxes 3. Isolate gas burners, Reset Chopper, Re-light 4. Isolate oil burners, Reset Chopper, Re-light
Loss of Compressor(s) (1-G-1A/B)	1. P01011 opens to flare 2. PSV's relieve if P01011 does not open (manual set clsd?)	1. Reduce Unit Charge 2. Verify Interlock system.

Loss of Crude Flow	1. High Heater Pass outlet temperatures 2. Possible coking of tubes @ 800°F 3. Overheating crude exchangers 4. Eventual loss of reduced crude to Vacuum Tower	1. Check for Flame out: Manual set TRC valves and Reset 2. Inject steam in heater tubes 3. Unmarry Atmospheric and Vacuum towers 4. Reduce 13-B-2 firing 5. Stop H_2O and all chemical injection streams 6. Stop product draws: reduce reflux circuit flows
Loss of Coolant System (Equipment Leak)	1. Exchanger overheating 2. Exchanger plugging 3. External leakage to OWS will upset the WWT system 4. Environmental Incident	1. Reduce unit rates. 2. Bypass exchangers to prevent overheating and damage to tubes 3. Allow enough flow through exchangers to avoid plugging 4. Isolate equipment if external leakage is not preventable
Loss of Cooling Water	1. Compressed gas and Condensing systems overheat 2. Compressor(s) shutdown: gas is flared 3. Possible Unit Shutdown	1. Reduce Crude Charge 2. Reduce Heater Temperatures 3. Reduce 150# Ejector Steam

K. SAFETY SYSTEMS AND THEIR FUNCTIONS

1. Unit Pressure Safety Valves

	PSV #	Size	Relief PSIG
1-D-6 Desalter	PSV-01015	6" x 10"	set @ 203#
1-D-6 Desalter	01016	8" x 10"	set @ 168.5#
1-B-1A 150# Steam	01019	4" x 6"	set @ 175#
1-B-1B 150# Steam	01029	4" x 6"	set @ 175#
1-D-1 Tower	01030	8" x 10"	set @ 32.5#
1-D-1 Tower	01031	8" x 10"	set @ 32.5#
1-D-1 Tower	01032	8" x 10"	set @ 32.5#
1-D-1 Tower	01033	8" x 10"	set @ 32.5#
1-D-1 Tower	01034	8" x 10"	set @ 32.5#
1-D-1 Tower	01035	8" x 10"	set @ 31#
1-D-1 Tower	01036	8" x 10"	set @ 31#

1-D-1 Tower	01037	4" x 6"	set @ 32.5#
1-D-7 Accumulator	01044	4" x 6"	set @ 23#
1-D-7 Accumulator	01045	4" x 6"	set @ 23#
1-E-21 Outlet	01078	8" x 10"	set @ 25#
1-E-21 Outlet	01079	8" x 10"	set @ 25#
13-D-10 Tower	13056	4" x 6"	set @ 26#
13-D-10 Tower	13057	4" x 6"	set @ 25#
13-D-11 Seal Drum	13059	6" x 8"	set @ 25#
13-D-10 Seal Drum	13060	6" x 8"	set @ 26#
13-D-10	13080	6" x 8"	set @ 26#
13-D-23	13084	$1^1/_2$" x 2"	set @ 15#
13-D-12	13064	4" x 6"	set @ 85#

2. Unit HIC (depressuring) valves.

   a. P01011

   b. P13549

3. Interlock systems.

   a. Low Crude Flow to 1-B-1A/B Heaters; <u>TRC's - Minimum Fire</u>

      Low Feed Flow to 13-B-2 Heater; <u>TRC's - Minimum Fire</u>

   b. Low Fuel Gas Pressure to 1-B-1A/B; <u>Interlock Shutdown</u>

      Low Fuel Gas Pressure to 13-B-2; <u>Interlock Shutdown</u>

   c. Low Lube Oil Pressure to 1-G-1A/B; <u>Compressor Shutdown</u>

      Hi KO Drum Level (1-D-8); <u>Compressor Shutdown</u>

   d. Low Discharge Pressure; <u>Spare Pump Acceleration</u>

      (1) 1-G-4B Reflux Turbine

      (2) 13-G-18A Top P/A Turbine

   e. High Tower Btms Level; <u>Closes Stripping Steam C/V</u>

   f. High Current on 1-D-6; <u>Shuts down Transformer Power</u>

L. ENVIRONMENTAL, SAFETY AND HEALTH CONSIDERATIONS

1. Environmental Practices

The successful operation of the entire Refinery will be dependent upon the environmental control practices in the refinery. It is vital that all employees work as a team to achieve good environmental control within the refinery. Our ability to comply with both air, noise, and water criteria and objectionable odors will be reflected in large part by the housekeeping practices of the refinery. It is important that all refinery employees be aware of bad housekeeping situations which will contribute to either air or water pollution.

a. Water

Listed on the following page are situations which may be both a housekeeping and an environmental problem for water treating effluent streams:

(1) Large unit area oil spills which are not promptly cleaned up in an efficient manner.

(a) Fuel oil from 1-B-1A/B Atmospheric Heaters.

(b) Open vent or drain valve on hydrocarbon lines.

(c) Leaking flanges of hydrocarbon exchangers.

(d) Hydrocarbon line ruptures.

(2) Haphazard draining of chemicals to oily water sewer system.

(a) Leaking seals or packing glands of chemical injection pumps.

(b) Cleaning chemical injection pumps and piping for repairs.

(3) Draining large quantities of hydrocarbons to oily water sewers.

(a) Line clearing and draing for repairs, or for turnaround periods.

(b) Leaking mechanical seals on pumps.

(c) Clearing pumps for repairs, blind installation.

(4) Draining of sulfide contaminated water to oily water sewers.

(a) Sour water from Accumulators 1-D-7, 1-D-9, and 13-D-11. Normally all potential oily water sewer contaminant vessels have blinds installed to the oily water sewer at drain points to eliminate the possibility of accidental draining.

(5) *Disposal of solids to oily water sewers.*

(a) Sludge and scale deposits from vessels and lines during turnaround.

(6) A standard operating procedure will be to <u>inform</u> the utilities section and water effluent treating section <u>quickly</u> when any of the previously listed contaminants are accidently spilled to oily water sewer system.

(7) Employees should be alert to their role in environmental control. For example, they should know of the consequences when treating facilities are overloaded or large quantities of contaminants are dumped into sewers. Biological systems adapt reasonably well to some variability in waste water characteristics. However, the bacteria and micro-organisms in our activated sludge process can be destroyed, or their efficiency reduced, by sudden, sharp changes in environmental conditions. Problems with microbial activity can be caused by:

(a) Sudden temperature rise. Optimum range is 65° F. min., 100° maximum.

(b) Sulfides in concentrations greater than 10 mg/l.

(c) Phenolics in concentrations greater than 50 mg/l.

(d) Low pH caused by acid contamination or high pH from caustic contamination. Optimum pH range for biological activity is 6.5-8.5.

b. <u>Air Criteria and Monitoring</u>

(1) During normal day to day operation of the Crude Unit, the possibility of exhausting sulfur dioxide (SO_2) from either Air Preheater, Heater (1-B-1A/B or 13-B-2) stacks is always present.

(a) 1-B-1A/B will often be base loaded with fuel oil firing.

(b) Incomplete combustion of the fuels or poor efficiency of the heaters can cause stack emissions.

(c) Operation of heater soot blowers will cause some particulate emissions.

(d) Lighting off and removing fuel oil burners may result in some smoke emissions.

(2) Fuel gas is continually monitored to analyze for H_2S. Any H_2S level exceeding .015 vol% in the fuel gas must be reported per the New Source Performance Standards.

(3) To eliminate or lessen the possibilities of heater stack emissions without controls, analyzers have been provided at each heater to give notice of some abnormal condition.

(4) During heater steam, air decoking operations, special care must be taken to prevent excess air and noise pollution.

(a) A decoking drum and water quench system has been provided to minimize these emissions.

c. Noise

Noise exposure limits have been set by the Walsh-Healy Act and are presently under the jurisdiction of the U.S. Department of Labor. The limits are generally defined in decibels. The decibel is a unit used to measure sound intensity. On the decibel scale, zero decibel is the threshold of hearing and 120 decibels is the threshold of pain. Instruments commonly used for sound measurement are sound level meters and octave band analyzers. A passenger car at 30 MPH emits a noise level of 60 to 78 decibels and rises to 72-90 decibels at 70 miles per hour. Our refinery site prior to construction ranged from 38-54 decibels with most of the noise emanating from traffic on I-55. Refinery equipment has been selected so that sound pressure levels will meet limits at worker exposure locations. Auxiliary noise reduction devices have been specified where needed. Periodic noise surveys will be made in all refinery areas.

(1) A normal source of noise in day to day operation will be from heaters burner air intake even though some muffling designs have been incorporated in the heater construction.

(2) The motors and fans rotating on the overhead cooler fans will produce a certain amount of noise because of their rotation and height.

(3) Each piece of equipment has been measured for noise emission and noted on conspicuously posted signs that will advise of the noise emission levels. These signs also advise personnel of ear protection required in the work area.

(4) All employees will be issued ear covers or plug inserts

d. Odor

(1) There is presently no definitive regulation on odor. Nevertheless, we must be diligent in minimizing release of objectionable odors to the atmosphere in the refinery. It is a form of pollution that is readily detectable and of considerable concern to the general public.

(a) There should be no odor emission from any normal operating equipment within the Crude Unit. Only during an abnormal operation condition would there be a particular odor emission.

(b) During unit shutdowns, hydrocarbon freeing or steaming out of vessels and lines will be a possibilit[illegible] an unusual odor or smell.

(c) A strong odor present during normal operation, day to day, would be certain indication of machinery or equipment failures; leaking flanges, valve packing, mechanical seals of pumps or line ruptures.

2. Safety

a. Fire Equipment

The Crude Unit is equipped with dry chemical portable hand extinguishers, along with (2) 350# wheeled units. Line hose reels and fixed stationary monitors are also provided. A fixed fire water spray system is manifolded from the unit B/L Interconnecting pipeway to provide water blanketing of all unit product and hot oil pumps. Safety showers and fire blankets are also available in the unit. Instructions for care and use of this system is contained in the Refinery Emergency Response Manual. Every Technician should become familiar with the location and use of this equipment.

b. Self-contained Breathing Apparatus

Self-contained breathing apparatus is available on or near the Unit. Refer to the Refinery Emergency Response Manul for instructions for the use of this apparatus.

3. Health

Refer to the following facility inventory report to obtain MSDB TRN numbers and MSDBs through CD-MACSIN. In order to get safe handling and health information on chemicals used in the Crude.

D-4 Operating Procedures - Crude Unit (Emergency Procedures)

The following is an emergency operating procedure used for a crude unit, generally found in a petroleum refinery. The procedure outlines the necessary steps to be taken during emergency situations such as; power loss, steam outage, plant air failure, instrument air failure or heater tube rupture.

X. EMERGENCY PROCEDURES

An operator's best preparation for an emergency is a thorough knowledge of the equipment and normal shutdown procedures. The operator in charge is expected to use his own judgment in each situation. Thorough knowledge allows safe methods to be improvised to handle emergencies. Good practice is to follow normal shutdown procedures as soon as safely possible.

Every type emergency that could occur cannot be covered or anticipated. Some operating conditions which require emergency action are mentioned in this section.

A. Power Interruption: Loss

An Automatic Reacceleration Program has been designed to automatically restart selected electric motors when power is restored within five (5) seconds after a power failure. When power failure is longer than five (5) seconds all electric driven equipment on the reacceleration schedule must be manually restarted.

A list of motors restarted and the time (in seconds) that they are restarted following a power loss of less than five (5) seconds follows:

1.0	10 Seconds	Units Started
1-G2B	Crude Booster Pump	1
13-G 19 A & B	Vacuum Mid. P/A and Product	1
2.0	25 Seconds	
1-G5	Atmospheric Top P/A	1
1-G6A	Atmospheric Mid. P/A	1
1-G6B	Spare for 1-G5 and 1-G6A	1
1-G7	Atmospheric Bottom P/A	1

	25 Seconds	Units Started
1-G13 A&B	Compressor Suction K.O. Drum	1
13-G24 A&B	Coolant Pumps (Methanol)	1
13-E24 A,D,E,H	Coolant Cooler Fans	4
13-E 23B	Vacuum Top P/A Cooler Fan	1
1-E 21,A,E,I,M,Q, D,H,L,P,T	Atmospheric Overhead Condenser Fans	10

3.0 40 Seconds

1-G4A	Straight Run Gasoline	1
1-G14 A&B	Light Gasoline	1
1-G8	450 E.P. Product	1
1-G9A	550 E.P. Product	1
1-G9B	Spare for 1-G8 and 1-G9A	1
1-G15	Sour Water From 1-D7	1
1-G10A	650 E.P. Gas Oil Product	1
1-G11	Atmos. Heavy Gas Oil Product	1
1-G10B	Spare for 1-G10A and 1-G11	1
13-G23 A&B	Ejector Condensate	1
13-G 20	Vacuum Bottom P/A	1
1-E 22B	650 E.P. Gas Oil Cooler	1

Acceleration is completed generally 6 to 15 seconds after starting times shown.

4.0 Auto Start

Motors that are started by a (Instrument Interlock) FSL, PSL, LSH, etc. will automatically restart 10 seconds after power restoration when switch is set in the automatic position.

All electric driven equipment must be checked when power is restored within five (5) seconds after a power failure to ascertain reacceleration is complete and to restart manually that equipment not on the automatic restart list. Unit conditions, temperatures, levels, flows, etc., must be checked closely and returned to normal operation.

Atmospheric and vacuum tower top temperature control is protected by steam driven spare pumps. Atmospheric tower overhead Reflux Pump, 1-G3, is spared by a steam turbine driven pump 1-G4B, that will start on low discharge pressure of 1-G3. Vacuum tower top reflux pump 13-G18A is spared by a steam turbine driven pump 13-G8B, that will start on low discharge pressure of 13-G18A.

Action will depend on the duration of the power failure, steps should be taken to steam through all heaters. Change all product lines to slop, and bring in wash oil from off sites, to wash out heavy oil systems and prepare for unit restart. Unit pressures must be monitored closely and vented as needed. Cooling water pumps include one turbine drive so cooling water will be available at reduced rates.

5.0 Desalter Transformer

The Crude Desalter transformers will fall out on voltage drop. They must be re-energized when power is restored. If the desalter water pumps (18-G-9 & 13-G-23) were started some time ahead of the transformers, some water carryover in crude could occur.

B. Steam Outage: Loss

There are three (3) separate steam systems in the Crude Unit area, a list of their pressures and normal usage is listed below:

1.0 600 PSIG System

1.1 Soot Blowers on atmospheric heaters, 1-B1 A&B

1.2 Soot Blowers on vacuum heater 13-B2

2.0 <u>150 PSIG System:</u>

2.1 To atmospheric heaters 1-B1 A&B for superheating then for stripping steam to towers:

a. Atmospheric Tower 1-D1

b. 450 E.P. Stripper 1-D2

c. 550 E.P. Stripper 1-D3

d. 650 E.P. Stripper 1-D4

e. Atmospheric Heavy Gas Oil Stripper 1-D5

f. Vacuum Tower 13-D 10

g. Purge Steam to Desalter Relief Valves

2.2 Vacuum Tower Ejectors - 13-G 25 A&B and 13-G 27 A&B.

2.3 Atomizing steam for Oil Burners in Heaters 1-B1 A&B and 13-B2

2.4 Steam out connections to Heaters 1-B1 A&B and 13-B2

2.5 Snuffing steam to firebox and header box of Heaters 1-B1 A&B and 13-B2.

2.6 Snuffing steam to all Relief Valves from Atmospheric Tower 1-D1 and Vacuum Tower 13-D10.

2.7 Supply Steam to:

a. S.R. Gasoline and Atmosphere Top Reflux Turbine Driven Spare Pump 1-G 4B.

b. Vacuum Tower Top Reflux and Product Turbine Driven Spare Pump 13-G 18B.

2.8 For steam air decoking all Heaters.

3.0 <u>40 PSIG System:</u>

3.1 To fuel gas plate heaters.

3.2 For atomizing steam to waste gas burners in Heaters 1-B1 A&B.

3.3 For heating coil of Vacuum Tower Top Pump Around Cooler 13-E 23.

3.4 For vaporizer in ammonia system at Storage Drum 1-D 13.

3.5 To heating coils in Caustic Tank 1-F5, and other enclosures.

3.6 To all Utility Stations.

3.7 As Quench Steam to Resid Pumps 13-G 22 A&B.

4.0 <u>Steam Shortage</u>

In the event of a steam shortage it will become necessary to conserve all possible steam at each pressure level. Steps to be taken should include:

4.1 No Soot Blowing of Heaters.

4.2 Ascertain that Steam Turbine Driven Pumps are shut down and electric drives are in service.

4.3 Reduce stripping steam to all Towers to the very minimum. This can be determined by checking that product streams continue to meet specifications.

4.4 Check that all snuffing steam lines are blocked off.

4.5 Shut down all fuel oil burners in heaters that the Fuel Gas System pressure will allow.

4.6 Check that all Utility Stations are blocked in.

If steam shortage is for an extended time, or further conservation is necessary, crude charge rate should be reduced. This will permit a further reduction in all stripping steam and steam to vacuum ejectors, may be reduced as vacuum tower temperatures and pressures will permit.

5.0 Complete Steam Loss

If a complete steam loss occurs in the 600 PSIG System, there is no immediate action required on the crude unit, except no soot blowing.

If a complete steam loss occurs in the 150 PSIG System the Crude Unit will need to be circulated down.

5.0.1 Reduce Crude Charge Rates, as required.

5.0.2 Change all product lines to the Recirculation Line.

5.0.3 Reduce all heater fires to torches.

5.0.4 Shut off all oil burners.

5.0.5 Shut down reflux and product pumps as levels are pumped out.

5.0.6 Circulate atmospheric and vacuum heaters to start up lines, to cool down.

5.0.7 Charge wash oil to the unit and wash out all heavy oil circuits in preparation for restart.

5.0.8 Close all stripping steam steam valves.

5.1 If a complete steam loss occurs in the 40 PSIG system.

5.1.1 Shut down all waste gas burners and divert waste gas to the flare.

5.1.2 Shut down the ammonia system.

5.1.3 Check fuel gas burners for any possible liquid.

No further immediate action is required at this time.

C. Plant Air Failure

Under normal crude unit operation, a complete plant air failure will require only a check, to ascertain that all air outlets on utility stations are closed. If air failure should occur during a heater decoking operation, then air valves must be closed and steam flow adjusted to hold prescribed tube pressure.

D. Instrument Air Failure

1.0 Crude Heater and Preheat Section

1.1 Crude charge control valves and crude heater pass control valves fail open.

1.2 Water to and from the desalter regulators fail closed.

1.3 Fuel chopper valves to the curde heater fuel regulators fail closed.

1.4 Initial action should include the following steps:

a. Cut crude charge rate using handvalves upstream of exchangers 1-E1 A&B - leave enough to cool heaters. Adjust heater passes by handvalves to assure flow through each pass.

b. Steam heater to the crude tower. These heaters have a single steam line to their respective charge lines.

c. Vent superheater steam coils of heaters 1-B1 A&B to the atmosphere with hand valves located on each superheater coil outlet.

Crude heaters are not equipped with blowdown systems, but relieve and are steamed out to the tower.

2.0 Atmospheric Tower

2.1 All stripper draw regulators fail closed.

2.2 All steam to strippers and ATM tower fail closed.

2.3 All product to storage regulators fail closed.

2.4 All pump around reflux and overhead reflux regulators fail open.

2.5 Accumulator off-gas through PRC on compressor discharge fails open. PIC - 11 to the flare header fails closed.

2.6 Reduced crude heater passes fail open.

E. Fuel Loss, Gas - Oil

1.0 General

The Crude Unit Atmospheric Heaters 1-B1 A & B and Vacuum Heater 13-B2 are fired by a combination type fuel system. These two systems one (1) oil and one (1) gas, may be fired separately or in combination. A board mounted hand switch, (HIC) is provided to change heater outlet temperature control to fuel gas or fuel oil firing, and provide the following operations:

1.1 Heater outlet temperature control by TRC and Gas Fuel only.

1.2 Heater outlet temperature control by TRC-FIC cascade on Oil Fuel only.

1.3 Heater outlet temperature control by TRC and Gas firing, base loaded with oil on hand control set from FIC.

1.4 Heater outlet temperature control by TRC-FIC cascade oil firing, with gas on hand control to each gas firing valve.

2.0 Complete Fuel Oil Failure

In the event of a complete fuel oil failure, actions required for above operating conditions are:

2.1 No action required, main fuel oil supply valves will close on low pressure.

2.2 Change board mounted hand switch to gas firing position, -- heater outlet temperature control by TRC. Light additional gas burners as required, close oil firing control valves manually from FIC's, close fuel oil valve to each individual burner, steam through each burner until clear of oil and close steam valves.

2.3 Close oil firing control valves manually from FIC's, close fuel oil valve to each individual burner, steam through each burner until clear of oil, close steam valve, and light additional gas burners as needed.

2.4 Change board mounted hand switch to gas firing position, -- heater outlet temperature control by TRC, light gas burners as needed, close oil firing control valves manually from FIC's, close fuel oil valve to each individual burner, steam through each burner until clear of oil, and close steam valve.

3.0 <u>Complete Fuel Gas Failure</u>

In the event of a complete fuel gas failure, actions required for the above operating conditions are:

3.1 Change board mounted hand switch to oil firing position, heater outlet temperature control by TRC-FIC cascade. Light oil burners as required, close fuel gas valve to each individual burner.

3.2 No action required, main fuel gas supply valves will close on low pressure.

3.3 Change board mounted hand switch to oil firing position. Heater outlet temperature control by TRC-FIC cascade. Light additional oil burners as required, and close fuel gas valve to each individual burner.

3.4 Light additional oil burners as needed, and close fuel gas valve to each individual burner.

The center section (Fire Box #2) of the vacuum heater 13-B2 is not provided with fuel oil burners. In the event of a complete fuel gas failure, with 100% fuel oil firing. Individual pass outlet temperatures must be checked closely, and flows adjusted to prevent overheating in individual coils.

F. Heater Tube Rupture

1.0 General

In the event of a heater tube rupture, action taken will depend on the size and location of the failure and the heater involved. As there are no block valves or check valves between the heaters and the towers, this influences handling of emergencies.

The general procedure is to put snuffing steam in the fire box, block out the heater feed, steam through the tubes to the tower and block out all fuel systems.

These heaters have a single steam line to their respective charge lines and each pass must be steamed separately.

2.0 Crude Heaters 1-B1 A & B

Follow General procedure given above and then continue with normal shut down procedure. Leave steam to the tower and strippers to prevent vapors from flowing back to the heater. Bypass pump out.

3.0 Reduced Crude Heater 13-B2

Follow General procedure given above and then bypass reduced crude to resid, crude exchangers 13-E10A, B, C & D. Reduce vacuum by shutting down one ejector in each set of jets (3).

Increase steam to the tower as needed to break the vacuum. Vacuum is reduced to prevent pulling air into the tower. All ejectors should be shut down and steam left in the tower when steam is cut out of heater tubes. Pump out the entire vacuum side and gas oil wash the vacuum side as soon as possible.

G. Loss of Cooling Water

A failure of the cooling water system will cause the following equipment to heat to excessive temperatures.

1. Overhead Accumulator Vapor Condensors 1-E 13 A & B.
2. Compressor Discharge Coolers 1-E 14 A&B.
3. Compressor Circulating Coolant Cooler 1-E 26
4. Compressor Lub. Oil Coolers 1-E 25 A&B
5. Ejector 1st stage Intercondensers 13-E 18 A & B
6. Ejector 2nd stage Intercondensers 13-E 19 A & B
7. Ejector 3rd stage Aftercondensers 13-E 20 A & B

If a cooling water failure occurs proceed as follows:

1. Reduce crude charge rate for unit shut down.
2. Shut down all heater fires.
3. Shut down overhead gas compressors, allow excess pressure to flare.
4. Change run down lines to circulating line.
5. Shut down all ejectors.
6. Stop waste gas flow to atmospheric heaters, vent to the flare.
7. Proceed with unit shut down.
8. When cooling water flow returns to normal, restart unit.

H. Loss of Compressor; Single or Both

Under normal conditions the Overhead Gas Compressor's, 1-G1 A & B, handle the Crude Unit Overhead Gas production. Uncondensed off-gas from the Atmospheric Overhead Accumulator 1-D7 flows to the Compressor Knock Out Drum 1-D8 through Condensers 1-E 13 A & B. PRC-9 in the Compressor Discharge Line, controls the Crude Tower pressure and maintains the pressure at approximately 10 PSIG in the Accumulator.

In the event of a compressor shut down, gas make above that which can be handled by a single Compressor will be diverted to the flare by PIC-11 on the Accumulator. Unit feed rates will have to be adjusted to match the gas handling capacity of one compressor. If a shut down of both compressors occurs, unit feed rates must be reduced to the flare system gas handling capacity. Normal gas flow to the compressors is 3398 MSCFD for the sweet block. Compressor 1-G1 A & B design capacity is 2040MSCFD/Unit (Sweet Block).

I. Loss of Feed

If a total crude unit feed loss occurs action must be taken to prevent excessive temperature build up in equipment.

1. Notify the Oil Movements Control Room technician.
2. Stop all water, acid, etc., injection streams to the crude and desalter.
3. Cut out all heater fires, open stack and air dampers.
4. Place all heater's on circulation for cooling.
5. Stop all product draws and circulating reflux circuits to prevent over-heating crude exchangers.
6. Change all product run down lines to the slop header.
7. Take all necessary action to prevent excessive pressures, temperatures and levels.

When feed is available restart the unit.

J. Exchanger Leaks

Exchanger leaks will fall into two categories, external or internal. Operation of exchangers at pressure, temperatures or flow rates not in accord with design conditions may cause leaks in tubes and internal or external gaskets.

1.0 External Gasket leaks can be detected by a visual inspection of the following points:

1.1 Channel Section Gasket.

1.2 Channel Cover Plate Gasket

1.3 Shell Side Inlet and Outlet Nozzle Gaskets.

1.4 Bell Head Gasket

1.5 Tube Side Inlet and Outlet Nozzle Gaskets

In the event of a minor leak at any of the above locations, the first action taken should be to have all bolts checked for proper tightness, at operating temperatures. If leak cannot be stopped by this operation, then exchanger must be bypassed and removed from service for repair.

2.0 When a leak develops in an exchanger tube or internal gasket contamination will occur. The higher pressure stream will flow into the lower pressure stream in proportion to the pressure difference of the two streams and the size of the leak. When a leak of this nature is detected the exchanger must be removed from service and repaired.

K. Desalter Out of Service

If it becomes necessary to remove the Desalter from service under normal Crude Unit operations, bypass lines are provided.

Steps to be taken include:

1. PIC-01 Desalter pressure control to crude charge system must be on manual control.
2. All chemical, water, etc., injection to crude feed and Desalter must be stopped.
3. Shut down Desalter electrical system.
4. Bypass Desalter charge to Heater charge pumps 1-G2 A, B, & C, and block in Desalter.
5. Block out Desalter inlet and outlet lines.
6. Check and adjust preheat train temperatures and pressures, for normal operations.
7. Pump out the Desalter via the pumpout line provided to the suction of Crude Booster Pump 1-G2C.

L. Loss of Methanol Coolant System

A circulated Coolant System is used for cooling Combined Gas Oil Coolers 13-E 17 A thru D and Vacuum Mid. Pumparound Cooler 13-E 16. The heat absorbing liquid in this coolant system is water plus methanol. The coolant is circulated from the Coolant Surge Drum 13-D 12, through air coolers 13-E25 for heat removal, before returning to product coolers 13-E17 and 13-E16 . The system is circulated with pumps 13-G 24A and spare is 13-G 24B. The surge drum liquid level is maintained by the addition of boiler feed water and methanol as required.

A failure of the circulating coolant system will cause the following equipment to heat to excessive temperatures:

1. Combined gas oil Coolers 13-E 17 A, B, C and D.

2. Vacuum Mid. Pumparound Cooler 13-E 16.

In the event of a complete loss of the circulating cooling system the hot stream side (shell side) of coolers 13-E 17 A thru D and 13-E 16, must be bypassed to prevent overheating of the tube side. Allow enough flow through the coolers to prevent plugging, without overheating.

The combined Gas Oil Stream will be too high in tempeature (about 350°F) for FCC feed storage, and must be combined with resid to storage stream at battery limits.

The ability to pump the combined gas oil and resid streams to storage may be a limiting factor, so that crude charge rates will need to be reduced to meet conditions.

M. TO REMOVE A HEAVY OIL PUMP FROM SERVICE

Pumps in Heavy Oil Service are provided with a Wash Oil Line to flush the pump, suction and discharge lines, when the pump is removed from service. The Wash Oil is 550 E.P. product, from down stream of exchangers 1-E2, to down stream of each individual pump suction valve.

To remove pumps from service and flush with Wash Oil the following steps should be taken.

1.0 Atmospheric Tower Bottom Pumps 1-G 12 A&B

1.1 Slowly close the discharge valve and stop the pump to be removed from service. Ascertain that the spare pump is in service and at normal operating conditions.

1.2 Close the Suction Valve of the pump removed from service.

1.3 Check that block valve in wash oil line downstream of exchangers 1-E2 is open. Slowly open block valve in wash oil line to downstream of pump suction valve.

1.4 Restart the pump and slowly open the discharge valve enough to establish a flow as indicated by pump discharge pressure.

1.5 Only run pump long enough to displace Heavy Oil from the pump, suction and discharge lines. This is to be determined by a visual check of pump vent or drain line.

1.6 When pump and lines are clear, close discharge valve, stop the pump, close block valve in wash oil line, open pump drains and vents.

1.7 Check that block valves are open on the hot flow bypass line, if one is provided.

2.0 Vacuum Tower Recycle Pump 13-G21

This pump has no spare so operating conditions must be checked and adjusted when it is removed from service.

2.1 Slowly close FIC-13076 and the associated block valves.

2.2 Slowly close pump discharge valve, then stop the pump.

2.3 Close pump suction valve, check that block valves are closed on the hot flow bypass line.

2.4 Check that block valve is open in the wash oil line downstream of exchangers 1-E2. Slowly open block valve in wash oil line downstream of pump suction valve.

2.5 Restart the pump and slowly open the discharge valve enough to establish a flow as indicated by the pump discharge pressure.

2.6 Run the pump long enough to displace the heavy oil from pump, suction and discharge lines. This is to be determined by a visual check of the pump drain line.

2.7 When pump and lines are flushed clear, close discharge valve, stop the pump, close block valve in wash oil line, open pump drain line.

2.8 Close LICV-13013 and associated block valves.

3.0 Vacuum Tower Bottom Pumps 13-G 22 A&B

When these pumps and lines are flushed, 550 E.P. product must not be allowed to enter the resid run down line, due to resid storage tank temperatures of $\pm$ 400°F.

3.1 Slowly close the pump discharge valve and stop the pump to be removed from service. Ascertain that the spare pump is in service and at normal operating conditions.

3.2 Close the pump suction valve.

3.3 Check that block valve in Wash Oil Line downstream of exchangers 1-E2 is open.

3.4. Close block valve in seal oil line upstream of PCV.

3.5 Close block valve in 40 psig steam quench line.

3.6 Open block valve in wash oil line downstream of pump suction valve.

3.7 Open block valve in vent line from pump casing to the Vacuum Tower 13-D10.

3.8 When pump, suction and discharge lines have been displaced with 550 E.P. product into the Vacuum Tower, close block valves in the vent line and wash oil line. Open pump drain.

D-5 Operating Procedures - Chemical Transfer Process

The following is an example of an operating procedure for a chemical transfer process. It outlines the steps required to safely unload a tank truck containing methyl chloride, including the review of the appropriate MSDS and the proper personal protective equipment to be worn.

PROCEDURAL SUMMARY - UNLOADING A TANK TRUCK OF METHYL CHLORIDE

1. READ MSDS FOR METHYL CHLORIDE

2. WEAR PROPER PERSONAL PROTECTIVE EQUIPMENT

3. CHECK METHYL CHLORIDE LEVEL IN ST-9

4. CALCULATE FINAL LEVEL IN ST-9

5. PLACE TRAILER AND CHOCK WHEELS, ATTACH GROUNDING CABLE

6. CONNECT METHYL CHLORIDE UNLOADING LINE TO TRAILER HOSES

7. DURING UNLOADING, WATCH FOR LEAKS AND MONITOR ST-9 LEVEL

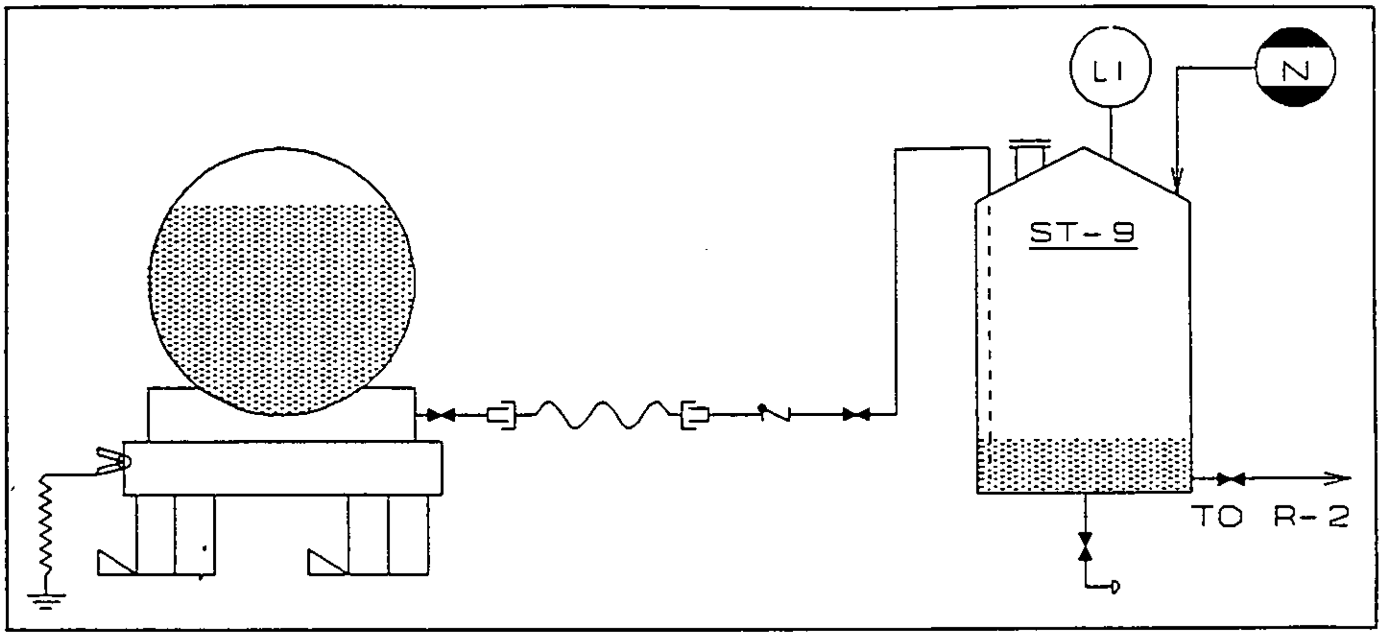
8. WHEN UNLOADING IS COMPLETE, PERFORM POST-UNLOADING TASKS

PROCEDURE AUTHORIZATIONS

PLANT MANAGER ____________________ DATE ____________

OPERATIONS MANAGER ____________________ DATE ____________

SAFETY AND HEALTH SUPERVISOR ____________________ DATE ____________



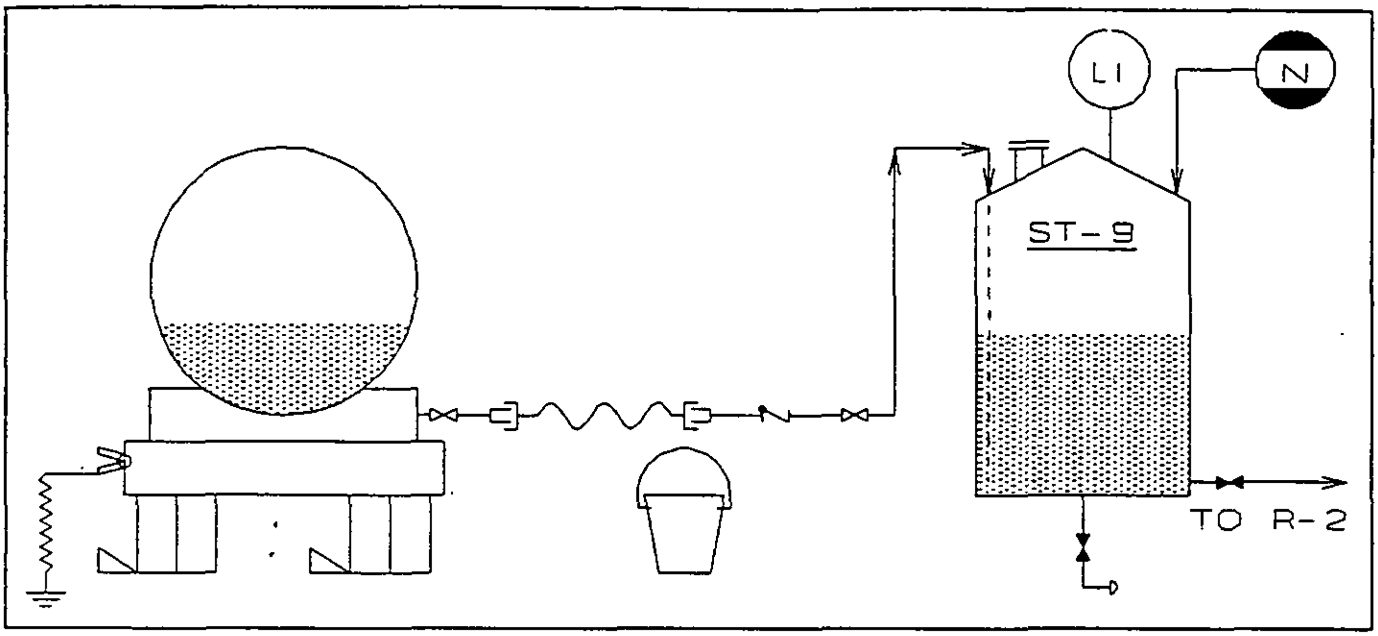
PROCEDURE	ACTION	NOTES

STANDARD OPERATING PROCEDURE
UNLOADING A TANK TRUCK OF METHYL CHLORIDE

SOP #92-101
REVISION C: 12/27/93

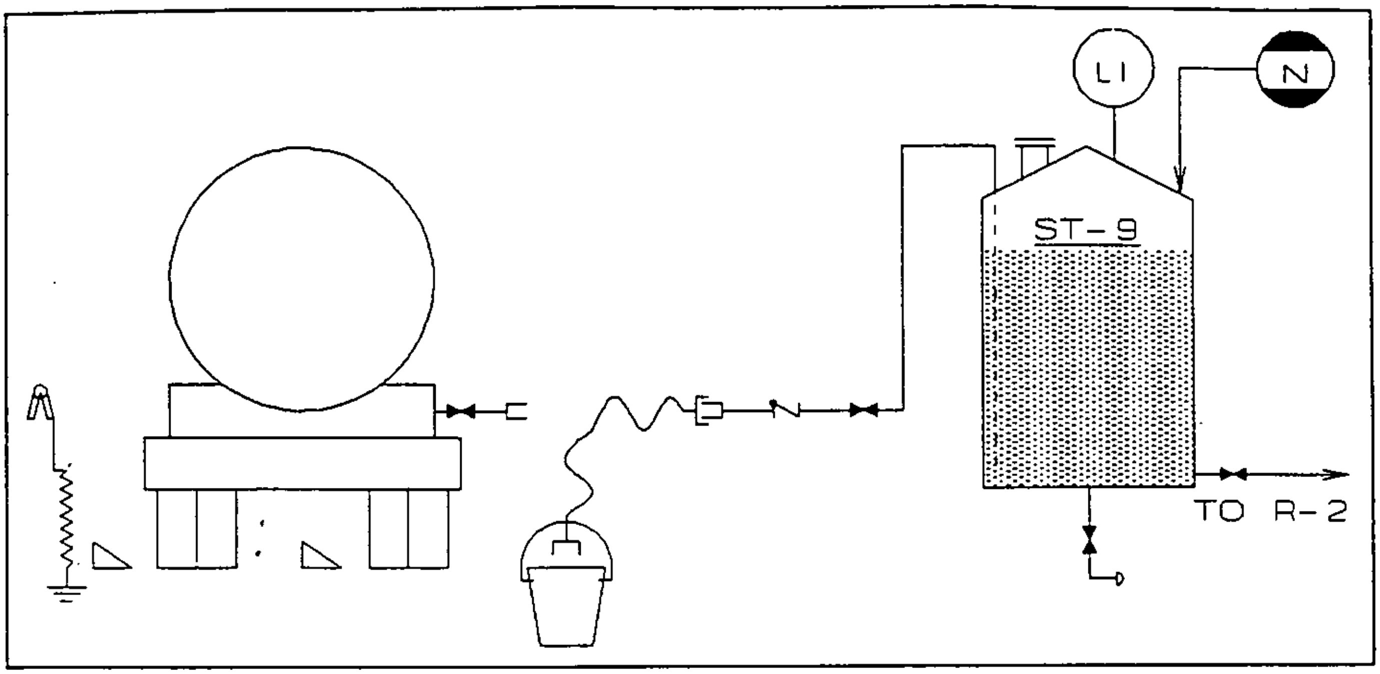
UNLOADING A TANK TRUCK OF METHYL CHLORIDE	1.	READ THE MSDS FOR METHYL CHLORIDE LOCATED IN THE HAZARDOUS MATERIALS NOTEBOOK	1.1	YOU MUST UNDERSTAND THE NATURE AND HAZARDS OF METHYL CHLORIDE BEFORE STARTING TO HANDLE THIS FLAMMABLE GAS
			1.2	**CAUTION: METHYL CHLORIDE IS SHIPPED AS A LIQUIFIED COMPRESSED GAS AND IS HIGHLY FLAMMABLE. KEEP SPARKS AND HOT EQUIPMENT AWAY FROM THE AREA WHILE UNLOADING METHYL CHLORIDE**
	2.	WEAR HARD HAT, RUBBER GLOVES, AND FACE SHIELD WHILE UNLOADING METHYL CHLORIDE	2.1	CONTACT WITH METHYL CHLORIDE WILL CAUSE FREEZING BURNS
	3.	CHECK THE METHYL CHLORIDE LEVEL IN STORAGE TANK ST-9 USING THE LEVEL GAUGE LOCATED ADJACENT TO THE STORAGE TANK	3.1	HAVE MAINTENANCE INSPECT THE LEVEL GAUGE IF IT IS NOT ACTING NORMALLY. **DO NOT RISK OVERFILLING THE STORAGE TANK**
	4.	REVIEW THE PAPERWORK FOR THE METHYL CHLORIDE SHIPMENT AND CONSULT WITH THE PRODUCTION SUPERVISOR TO CALCULATE THE FINAL LEVEL IN STORAGE TANK ST-9	4.1	ADD THE METHYL CHLORIDE WEIGHT IN THE TRAILER TO THE WEIGHT IN ST-9; THE TOTAL MUST BE LESS THAN THE FULL READING FOR ST-9

UNLOADING A TANK TRUCK OF METHYL CHLORIDE (CONTINUED)	5.	FILL OUT THE PAPERWORK WHILE PERFORMING THE STEPS IN THE TANK TRUCK UNLOADING PROCEDURE LOCATE THE TRAILER IN THE DIKED AREA, CHOCK THE WHEELS, AND ATTACH THE GROUNDING CABLE TO EXPOSED METAL ON THE TRAILER	5.1	THE PROCEDURE GIVES RULES FOR NORMAL TANK TRUCK UNLOADING AND DETAILS THE PAPERWORK NECESSARY FOR TRAILER UNLOADING
	6.	UNLOCK THE METHYL CHLORIDE UNLOADING LINE AND REMOVE THE CAP	6.1	BE SURE THAT THE CORRECT LOCK IS REMOVED TO MINIMIZE THE CHANCES OF MATERIAL CROSS CONTAMINATION
	7.	CHANGE ANY WORN GASKETS BEFORE CONNECTING HOSES	7.1	GASKETS WILL LEAK WHEN OVERLY WORN
	8.	ASSIST THE DRIVER IN CONNECTING TRAILER HOSES TO THE METHYL CHLORIDE UNLOADING LINE		



PROCEDURE	ACTION	NOTES
UNLOADING A TANK TRUCK OF METHYL CHLORIDE (CONTINUED)	9. OPEN THE VALVE AT THE METHYL CHLORIDE LINE CONNECTION GOING TO STORAGE TANK ST-9 10. DIRECT THE DRIVER TO OPEN THE VALVES ON THE TRAILER TO THE METHYL CHLORIDE TRANSFER LINE	9.1 THIS IS THE ONLY VALVE IN THE TRANSFER LINE INTO THE TOP OF STORAGE TANK ST-9

PROCEDURE	ACTION	NOTES
	11. WHILE THE DRIVER STARTS THE TRANSFER PUMP, WATCH FOR LEAKS AND DIRECT THE DRIVER TO STOP THE TRANSFER IF ANY LEAKS ARE OBSERVED	11.1 SINCE MOST LEAKS ARE OBSERVED ON START-UP, THE OPERATOR MUST BE IN ATTENDANCE AS THE TRANSFER BEGINS 11.2 THE DRIVER SHOULD BE IN A POSITION TO QUICKLY STOP THE TRANSFER IF A LEAK DEVELOPS
	12.. WHEN THE TRANSFER HAS BEGUN SATISFACTORILY, PERIODICALLY CHECK THE LEVEL IN ST-9 USING THE LEVEL GAUGE TO ENSURE THAT THE LEVEL IS INCREASING	12.1 IF THE LEVEL IS NOT INCREASING, STOP THE TRANSFER AND DIRECT MAINTENANCE TO INSPECT THE LEVEL GAUGE 12.2 THE GAUGE SHOULD RISE AS SOON AS MATERIAL IS PUT INTO THE TANK



PROCEDURE	ACTION	NOTES
UNLOADING A TANK TRUCK OF METHYL CHLORIDE (CONTINUED)	13. WHEN THE TRAILER IS EMPTY, CLOSE THE TRANSFER VALVE	13.1 COOPERATE WITH THE DRIVER TO COMPLETE POST-UNLOADING TASKS
	14. DISCONNECT THE METHYL CHLORIDE UNLOADING LINE FROM THE TRAILER, CAREFULLY VENTING THE LINE IN ORDER TO RELIEVE ANY EXCESS PRESSURE	

PROCEDURE	ACTION	NOTES
	15. INSTALL THE CAP ON THE UNLOADING LINE AND LOCK IT CLOSED	15.1 THIS WILL PREVENT AN UNAUTHORIZED MATERIAL TRANSFER INTO STORAGE TANK ST-9
	16. READ AND RECORD THE FINAL LEVEL IN STORAGE TANK ST-9	16.1 COMPARE THE FINAL LEVEL TO THE CALCULATED LEVEL. IF THE VALUES ARE SIGNIFICANTLY DIFFERENT, CHECK THAT THE TRAILER IS ACTUALLY EMPTY OR WHETHER THE LEVEL GAUGE IS OPERATING CORRECTLY
	17. FILL OUT THE POST-UNLOADING REPORT AND THE DRIVER'S PAPERWORK	
	18. REMOVE THE CHOCKS FROM THE TRAILER WHEELS AND REMOVE THE GROUNDING CLAMP	