

PROCESS OPERATIONS

TOPIC	OBJECTIVES
Introduction to Operations	<ol style="list-style-type: none"> 1. Discuss the importance of this course as a capstone experience in the Process Technology program and how the material learned here will prepare the student for work "on-the-job". 2. Recall the history and development of the process technician role within the process industries. 3. Apply the key concepts from the following course: <ul style="list-style-type: none"> • Process Technology I – Equipment • Process Technology II – Systems • Instrumentation 4. Discuss the term "operations" and its process industries synonyms. 5. List the various process technician roles and responsibilities (i.e., "outside" versus "control room" tasks) within an operating unit. <ul style="list-style-type: none"> • Operate and monitor unit from the control room (i.e., via DCS) • Operate and monitor unit from the outside (i.e., by making rounds) • Take and analyze (as required) samples (i.e., composite, grab, bomb, etc.) • Perform housekeeping activities • Conduct safety inspections • Handle materials • Prepare for, assist with, and/or perform maintenance as required. 6. Discuss the activities that may be the responsibility of the process technician of the future. 7. Discuss the importance of continual learning for process technicians.
Diagrams for the Operating Unit	<ol style="list-style-type: none"> 1. Discuss the purpose of a block flow diagram (BFD). 2. Identify the major processing stages, which make up the generic operating unit (i.e., TimTene, campus unit, or unit at a local facility). 3. Identify the plant auxiliary and utility systems, which support the generic operating unit. 4. Describe the purpose of a process flow diagram (PFD) and the information and symbology found on a PFD. 5. Trace the process flow through the operating unit using the PFD. 6. Identify all process systems included in the generic operating unit from the PFD. 7. Identify all major process equipment associated with the generic operating unit from the PFD.

PROCESS OPERATIONS

	<ol style="list-style-type: none"> 8. Describe the purpose of a plot plan and the information found on a Center for the Advancement of Process Technology plot plan. 9. Discuss the purpose of a piping and instrumentation diagram (P&ID) and the information and symbology found on a P&ID. 10. Describe how the various areas and systems within the operating unit will be monitored and controlled (i.e., making rounds vs. via DCS). 11. Identify all local instruments for a Generic Unit using P&IDs. (Note: Filtration and Refrigeration systems are normally used at local community colleges). 12. Describe local/field instruments in terms of: <ul style="list-style-type: none"> • The process variable monitored by the instrument • Normal range • Description of instrument function
Commissioning	<ol style="list-style-type: none"> 1. Define the term "commissioning". 2. Differentiate between starting up a new unit versus starting up an existing unit (i.e., design flaws, unknowns, etc.).
Procedure Writing	<p>Given a process scenario, the student PT will write a normal operations procedure that ensures safety and environmental compliance with SH&E and OSHA regulations and minimizes downtime.</p>
Normal Startup - Overview and Communication	<ol style="list-style-type: none"> 1. Discuss the different types of startups: normal/routine startup, startup after emergency shutdown, startup after equipment maintenance, and startup after turnaround. 2. Discuss unit startup activities as they relate OSHA's PSM (Process Safety Management of Highly Hazardous Materials) standard, specifically by PSM's Pre-Startup Safety Review element. 3. Describe the risks and hazards associated with unit startup. 4. Given a process flow diagram (PFD) and following safe operating procedures: <ul style="list-style-type: none"> • identify typical activities involved when placing equipment into service and bringing a unit online • List all the departments and personnel who will be involved in or affected by the unit startup • List the types of information that will need to be communicated regarding unit startup 5. Discuss the communication methods that might be used at different points during the process of starting up the unit
Normal Startup - Preparing Equipment for Return to	<ol style="list-style-type: none"> 1. Discuss the importance of obtaining an accurate estimate for when equipment will be returned from maintenance personnel. 2. List the energy and equipment isolation methods and devices that must to be removed after equipment

PROCESS OPERATIONS

<p>Service</p>	<p>maintenance.</p> <ol style="list-style-type: none"> 3. List the equipment used by maintenance or contractors, which may need to be removed. 4. List the final safeguards, which should be taken prior to returning the equipment to service. 5. List the common inspections needed to assure mechanical integrity.
<p>Normal Startup – Removal of Energy Isolation Devices</p>	<ol style="list-style-type: none"> 1. Review the OSHA Control of Hazardous Energy (Lockout/Tagout) standard. 2. Discuss the various methods and devices which can be used to isolate equipment from the various types of energy sources: <ul style="list-style-type: none"> • Lock • Tag • Blind • Double block and bleed • Break • Disconnect • Switch gear 3. Discuss the various types of energy sources that must be isolated: <ul style="list-style-type: none"> • Chemical • Electrical • Hydraulic • Mechanical • Pneumatic • Thermal 4. Identify the points where energy isolation is required, and the device/method used at each point. 5. Discuss who should remove the energy isolation devices. 6. Discuss the steps that must be followed when removing energy isolation devices.
<p>Normal Startup – Utilities and Auxiliaries</p>	<ol style="list-style-type: none"> 1. Describe the purpose and function of the utility and auxiliary systems, which support the operating unit: <ul style="list-style-type: none"> • Boiler Feed Water Treatment System • Steam Generation and Distribution • Cooling Tower and Cooling Water System • Air System • Water System • Electrical • Natural Gas • Nitrogen • Sewer • Flare and Relief • Refrigeration

PROCESS OPERATIONS

	<ol style="list-style-type: none"> 2. Describe the hazards associated with starting up each system. 3. Describe the precautions that must be taken to mitigate the hazards associated with starting up the utility systems. 4. Given a utility flow diagram (UFD) list the steps required to startup steam and systems, including valve alignment: <ul style="list-style-type: none"> • Identify all valves that must be checked for proper alignment. • State the proper position for each valve for startup. • State whether the valves will be check via the DCS and/or via the field technician. • Position the valves correctly
<p>Normal Startup - Process Unit</p>	<ol style="list-style-type: none"> 1. Describe the hazards associated with starting up each process system and the unit. 2. Describe the precautions that must be taken to mitigate the hazards associated with starting up each process system and the unit. 3. Discuss the order in which the various process, auxiliary, and utility systems should be started up. 4. List the steps required to start a process unit.
<p>Normal Operations – Field Technician</p>	<ol style="list-style-type: none"> 1. List all of the types of equipment within an operating unit, such as a Filtration System and Refrigeration System that will be monitored and/or started, stopped or switched by the field technician, such as: <ul style="list-style-type: none"> • Compressors • Exchangers • Motors • Pumps • Valves • Vessels • And others 2. Describe how specific types of equipment must be monitored to ensure proper operation. 3. Describe how to check various types of equipment for vapor and liquid leaks. 4. Explain the corrective action that should be taken for each type of leak. 5. Discuss environmental impact of leaks and failure to take corrective action. 6. Describe typical equipment, tools and personal protective equipment required when performing routine tasks in the field. 7. Discuss other types of personal protective equipment that may be required when performing routine field tasks in hazardous environments. <ul style="list-style-type: none"> • Flash suits

PROCESS OPERATIONS

	<ul style="list-style-type: none"> • SCBA (Self-Contained Breathing Apparatus) • Face shields • Chemical Resistant Suits <p>8. Discuss the methods used to document the technician's work in the field.</p>
<p>Normal Operations – Control Room Technician</p>	<ol style="list-style-type: none"> 1. Distinguish between an analog (pneumatic/electronic) control system versus a digital (Distributive Control System, Programmable Logic Controller) system. 2. Differentiate between instruments that: <ul style="list-style-type: none"> • Control • Indicate • Record 3. Identify instruments that have alarm and/or shutdown functions. 4. Identify instruments that are included in logic systems. 5. Identify the set point, alarm, shut down, and trip information. 6. List the possible causes for level and flow alarms. 7. List the corrective actions for level and flow alarms. 8. Discuss the importance of communicating with other technicians and other units prior to taking certain corrective action. 9. Discuss other duties typically assigned to the board operator, such as data entry, recordkeeping, etc.
<p>Normal Operations - Other Duties</p>	<ol style="list-style-type: none"> 1. Given a process scenario (i.e., process flow diagram, piping and instrument diagram, model, etc) during receiving, storage or transfer activities: <ul style="list-style-type: none"> • Identify the process streams within an operating unit that will require periodic sampling • Describe the sampling procedures and equipment that are used for different sampling events • Discuss the personal protective equipment that must be used while performing different sampling activities 2. Explain the importance of following the sampling procedure precisely. 3. Discuss the process technician's role in sample analysis. 4. Discuss the various types of analyses (methods and equipment) conducted on process samples. 5. Explain the importance of sample analysis to the proper unit operation. 6. Identify the points within the operating unit where the following types of process materials are handled manually: <ul style="list-style-type: none"> • Supply materials (lube oil, etc.)

PROCESS OPERATIONS

	<ul style="list-style-type: none"> • Catalyst and chemicals <ol style="list-style-type: none"> 7. Discuss the equipment used to receive, store or transfer materials at various points. 8. Discuss the procedures used to receive, store or transfer materials including: <ul style="list-style-type: none"> • Proper labeling • Proper documentation • Product identification • Specifications (Certificate of Quality, etc.) 9. Discuss the hazards associated with receiving, storing or transferring various raw materials and finished products. 10. Discuss the personal protective equipment that must be used while performing various receiving, storage or transfer during material handling activities.
<p>Normal Operations – Housekeeping and Complying with SH&E Policies</p>	<ol style="list-style-type: none"> 1. Define "housekeeping" in process industries terms. 2. List the types of tasks that can be categorized as housekeeping. 3. Explain why attention to housekeeping is important. 4. Discuss the personal protective equipment that must be used while performing various housekeeping activities. 5. Discuss safety, health, and environmental risks or hazards found within the process industries. 6. Discuss methods to minimize or prevent these risks or hazards. 7. Discuss typical SH&E policies and procedures, which may be implemented in order to minimize or prevent SH&E risks and/or hazards. 8. Discuss how unit personnel assist in this implementation. 9. Identify the safety equipment located in the various areas of the operating unit. 10. Describe what items are inspected when checking each piece of safety equipment. 11. Describe how often each piece of safety equipment is inspected.
<p>Normal Operations - Verbal Communication</p>	<ol style="list-style-type: none"> 1. Discuss the basic components associated with effective verbal communication: sender, receiver, message, interference, and feedback. 2. Discuss the key obstacles that prevent effective verbal communication. 3. Demonstrate effective verbal communication techniques to ask for or provide information. 4. Identify and describe the various roles within the Operations Department with which process technicians will communicate.

PROCESS OPERATIONS

	<ol style="list-style-type: none"> 5. Identify and describe the various roles from other areas of the plant with which process technicians will communicate. 6. Discuss the various types of information that may be exchanged verbally (face-to-face) between these personnel/departments and process technicians. 7. Discuss verbal and non-verbal communication methods used in noisy environments (i.e., Hand signals). 8. List the different types of electronic communication devices (radios, intercoms, phones, cell phones, voice-activated radios, etc.) used in the process industries today. 9. Discuss the various features and functions of electronic communication devices. 10. Discuss the features and functions that should be tested for operability prior to using the electronic communication device. 11. Demonstrate how to test the electronic communication device for operability. 12. Discuss proper protocol for using these different types of electronic communication devices.
<p>Normal Operations - Written Communication</p>	<ol style="list-style-type: none"> 1. Review the basic components of written communication (grammar, spelling, style, legibility, transitions, etc.) for clear, concise, and descriptive communication. 2. Review the basic components of good writing: preparation, formatting, drafting and proofreading. 3. Identify and describe the various personnel within the Operations Department with which process technicians will communicate in writing. 4. Identify and describe the various personnel from other areas of the plant with which process technicians will communicate in writing. 5. Discuss the various types of information that may be exchanged in written form (using paper or electronic means) between these personnel/departments and process technicians. 6. Discuss situations when written communication (electronic or paper) should be used rather than verbal communication, and vice versa. 7. Discuss the importance of following company guidelines when preparing written communication whether paper or electronic. 8. Demonstrate effective written communication techniques for asking or providing information.
<p>Normal Operations - Shift Change</p>	<ol style="list-style-type: none"> 1. State the types of information which need to be communicated during shift change: <ul style="list-style-type: none"> • Unit status • Alarms • Equipment condition/problems • Procedures in progress • Process trends • Maintenance activity completed, in-progress, and planned

PROCESS OPERATIONS

	<ul style="list-style-type: none"> • Presence of non-operating personnel • Status of permits in force <ol style="list-style-type: none"> 2. Discuss the level of detail necessary to accurately convey complete unit status information. 3. Describe how a typical shift change occurs. <ul style="list-style-type: none"> • personnel involved • importance of making timely relief • location 4. List the documentation used during a typical shift change. 5. Discuss the importance of establishing good relationships with members of your shift and members of other shifts.
<p>Abnormal Operations - Emergencies</p>	<ol style="list-style-type: none"> 1. Discuss what types of events could be considered "emergency situations". 2. Describe how operating personnel prepare for each situation (i.e., drills, exercises). 3. Discuss actions that should be taken to mitigate each situation. 4. Discuss what types of conditions could be considered "emergency operations". 5. Identify possible causes for these various conditions. 6. Discuss possible corrective action for each of the various possible causes. 7. Discuss how each of these critical conditions could affect the normal operation of the unit's process, utility, and auxiliary systems. 8. Discuss the field technician's role during emergency situations and operations. 9. Discuss the board technician's role during emergency situations and operations.
<p>Abnormal Operations - Applications</p>	<ol style="list-style-type: none"> 1. Given a potential emergency scenario and appropriate resources (P&IDs, process flow sheets, etc.), write an emergency procedure that complies with SH&E practices and OSHA regulations. 2. Given an emergency scenario and an emergency procedure, demonstrate the appropriate emergency response to the emergency operating situation that complies with SH&E practices and OSHA regulations.
<p>Normal Shutdown - Overview and Communications</p>	<ol style="list-style-type: none"> 1. Differentiate between the types of shutdowns: normal/routine shutdown, emergency shutdown, shutdown for equipment maintenance, and shutdown for turnaround. 2. Describe the risks and hazards associated with unit shutdown. 3. Describe how unit shutdown activities are covered by OSHA's PSM (Process Safety Management of Highly Hazardous Materials) standard. 4. List the key activities involved in performing a normal/routine shut down. 5. List all departments and personnel who will be involved in, or affected by, the unit shutdown.

PROCESS OPERATIONS

	<ol style="list-style-type: none"> 6. List the types of information that will need to be communicated regarding unit shutdown. 7. Discuss the communication methods that might be used at different points during the process of shutting down the unit.
<p>Normal Shutdown - Shutdown Process Unit</p>	<ol style="list-style-type: none"> 1. Given a scenario, discuss the order in which the various process auxiliary and utility systems should be shut down. 2. For a process system: <ul style="list-style-type: none"> • Describe the hazards associated with shutting a system down. • Describe the precautions that must be taken to mitigate the hazards associated with shutting down each system. • List the steps required to shut down each system. • Discuss how shutdown of the process system affects upstream and downstream processes 3. For an auxiliary system: <ul style="list-style-type: none"> • Describe the hazards associated with shutting down the system. • Describe the precautions that must be taken to mitigate the hazards associated with shutting down each system. • List the steps required to shut down each system. 4. For a utility system: <ul style="list-style-type: none"> • Describe the hazards associated with shutting down the system. • Describe the precautions that must be taken to mitigate the hazards associated with shutting down each system. • List the steps required to shut down each system. 5. Discuss the importance of following the written procedure and the protocol for handling discrepancies between the documented procedure and actual steps followed to complete the task.
<p>Equipment Maintenance - Overview and Communications</p>	<ol style="list-style-type: none"> 1. Describe the risks and hazards involved when preparing equipment for routine maintenance. 2. Given a piece of equipment, describe the key activities necessary for preparing the equipment for routine maintenance. <ul style="list-style-type: none"> • Shutdown • Decontamination • Isolation • Lockout 3. Discuss all departments and personnel who will be involved in, or affected by, the equipment maintenance. 4. Discuss the types of information that will need to be communicated regarding the preparation of equipment

PROCESS OPERATIONS

	<p>for routine maintenance.</p> <p>5. Discuss the communication methods that might be used at different points during the performance of routine maintenance.</p>
<p>Equipment Maintenance - Economic Impact (preventive versus reactive)</p>	<ol style="list-style-type: none"> 1. Discuss the advantages of preventive maintenance with the disadvantages of reactive maintenance. 2. Discuss the types of preventive maintenance that should be performed on a piece of equipment. 3. Discuss the process technician's role in the performance of various preventive maintenance activities. 4. Propose a schedule for performing preventive maintenance for the selected piece of equipment. 5. Describe the types of expenses associated with preventive maintenance. 6. Describe the types of expenses associated with reactive maintenance. 7. Compare the economic impact associated with preventive maintenance versus reactive maintenance. 8. Describe the types of reactive maintenance that may be required in the absence of a preventive maintenance program.
<p>Equipment Maintenance - SH&E Impact</p>	<ol style="list-style-type: none"> 1. Provide examples of possible safety issues surrounding equipment maintenance activities: <ul style="list-style-type: none"> • Breaking into piping or equipment • Vessel entry • Electrical work • Hot tapping, etc. 2. Describe measures to take to minimize the safety issues surrounding equipment maintenance such as: <ul style="list-style-type: none"> • Confined space entry • Energy/Equipment isolation • Equipment Decontamination • Equipment identification • Fall protection • Barricades • Proper communication 3. Discuss examples of possible health issues surrounding equipment maintenance (such as exposure to hazardous materials). 4. Discuss measures to take to minimize the health issues surrounding equipment maintenance such as. <ul style="list-style-type: none"> • Proper use of PPE • Issuance of all necessary permits • decontamination 5. Discuss possible environmental issues surrounding equipment maintenance such as:

PROCESS OPERATIONS

	<ul style="list-style-type: none"> • Leaks • Spills • Contaminated equipment • Chemical waste <p>6. Describe measures to take to minimize the environmental issues surrounding equipment maintenance.</p> <ul style="list-style-type: none"> • Waste disposal • Spill cleanup • Housekeeping • Proper decontamination
<p>Equipment Maintenance - Documentation and Permits</p>	<ol style="list-style-type: none"> 1. Discuss the types of documentation that must be completed prior to performing maintenance on a selected piece of equipment. 2. Discuss the role the process technician may have in preparing each type of documentation. 3. Explain the purpose of a work permit. 4. List the various types of work permits used within the process industries. 5. List the departments or groups that may need to be consulted and/or sign a work permit.
<p>Equipment Maintenance - Equipment Isolation</p>	<ol style="list-style-type: none"> 1. Differentiate between energy sources and devices used for isolation. 2. Discuss the methods used to clear equipment. 3. Describe the purpose of various PPE (Personal Protective Equipment) used during equipment clearing and isolation. 4. Identify the appropriate PPE (Personal Protective Equipment) for use in a specific clearing and isolation scenario.
<p>Turnarounds</p>	<ol style="list-style-type: none"> 1. Define the term "turnaround". 2. Differentiate between routine maintenance and work performed during turnaround. 3. Given a scenario, list the tasks which must be completed and discuss the process technicians role to adequately prepare for a turnaround. 4. Compare and contrast routine shutdown versus shutting down for turnaround. 5. Describe the role of the process technician in unit turnarounds. 6. Compare and contrast routine startup versus starting up after turnaround. 7. Discuss PSM's Management of Change requirements in relationship to turnarounds. 8. Discuss the PSM's Pre-Startup Safety Review requirements in relationship to turnarounds.

PROCESS OPERATIONS

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| | <p>9. Given a scenario, list the tasks which must be completed and discuss the process technicians role for successful startup following a turnaround.</p> <ul style="list-style-type: none">• Removal of energy isolation devices• Purging• Pressure testing of equipment• Vessel and/or piping inventory• Installation of plugs, caps, blind flanges, etc. <p>10. Explain how unit personnel would evaluate the success of a turnaround.</p> <ul style="list-style-type: none">• Zero injuries• Zero environmental incidents• Successful startup• On time and on budget• Improved plant performance |
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