Compliance with
Contra Costa County Industrial Safety Ordinance (ISO)

Fluid Catalytic Cracking Unit
Safety Inspection Report
Notice of Findings

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Site ID: 729718
CERS ID: 10476676

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CONTRA COSTA
HEALTH

Final Report

SUMMARY:

The Martinez Refining Company LLC (MRC) had a particulate matter release from their Fluid Catalytic Cracking Unit (CCU) on November 24-25, 2022. This release was estimated to have emitted 20-24 tons of fine particulate matter, called spent catalyst, into the surrounding community. After this incident, Contra Costa Health Hazardous Materials Programs (CCHHMP) conducted a Safety Inspection of the CCU. This document is the Safety Inspection Report.

The Safety Inspection was designed to assess compliance with select safety programs required under Contra Costa County's Industrial Safety Ordinance (ISO). The Safety Inspection was focused on reviewing safety programs associated with the CCU although not every safety program listed under the ISO was reviewed. If a regulatory program element is not discussed in this report, CCHHMP did not review it.

The MRC Safety Inspection and this report are separate from the triannual report developed after a California Accidental Release Prevention (CalARP) / ISO audit. The triannual audits are designed to review each safety program in detail for the entire site. The last such triannual audit took place in January 2021. The next such audit is anticipated to take place in January 2024.

For this Safety Inspection, CCHHMP conducted interviews and reviewed many onsite documents. CCHHMP examined the application of the regulatory program elements within the CCU that included: operating procedures, human factors, training, process safety information, management of change, process hazard analysis, and incident investigation. CCHHMP also assessed the following topics in general associated with the CCU, which are subsets of these regulatory programs: fatigue management and shift turnovers. CCHHMP had four team members participate who spent approximately 310 hours on this Safety Inspection. In general, data records associated with the regulatory program elements were reviewed from the time period from 2016 through 2023.

CCHHMP did not discover any ISO regulatory issues. If these issues were found, each would be labeled as a "Regulatory Concern" within this report. CCHHMP identified 2 opportunities for enhancement, each labeled as an "Improvement Suggestion". Regulatory Concerns are items that fail to meet an ISO regulatory requirement and must be corrected. Improvement Suggestions are not mandatory since they have no ISO regulatory basis and are optional to be addressed.

BACKGROUND:

The Catalytic Cracking Unit (CCU) contains a powdered catalyst that circulates within the process. The catalyst is used to assist in converting long hydrocarbon chains into smaller and more usable hydrocarbon chains primarily to produce gasoline. Normal process conditions and high-efficiency cyclones keep most of this catalyst inside the unit. As the catalyst gets smaller over time, it passes through these cyclones and is collected in electrostatic precipitators (ESPs) before the combustion gases from the unit are discharged into the atmosphere.

On November 24, 2022, MRC was reintroducing feed to the CCU after a maintenance outage. The startup of the CCU is a multi-day process. During the late evening of November 24th and early hours of November 25th, approximately 20-24 tons of MRC's CCU catalyst was discharged into the atmosphere and the surrounding community. This phase of the CCU startup was taking place without the unit's ESPs being in service. This is common industry practice since the 2015 Torrance Exxon Refinery ESP explosion, which was due to flammable materials being sent into an oxygen-enriched environment where ignition sources were present. [1]

Immediately after the catalyst was released into the community, MRC was unaware any release occurred and did not notify any emergency responders of the release. MRC did not use the County's Community Warning System (CWS) or other means to notify any emergency responders or the public of the incident on November 24th or on November 25th. On November 26, 2022, MRC acknowledged they had a catalyst release from their CCU unit and began their own investigation into the incident. A copy of their final root cause analysis incident report can be found at this link: https://cchealth.org/hazmat/pdf/MRC-Refinery-incident-2022-1124-Root-Cause-Analysis-Report.pdf

Since the event was not initially reported, it took time before CCHHMP agreed on the proper CWS classification. On December 14, 2022, CCHHMP identified this incident met the criteria for a CWS Level 2 or higher incident and as a result, was a Major Chemical Accident or Release (MCAR). The County's Industrial Safety Ordinance (ISO) identifies that CCHHMP may elect to do its own independent root cause analysis or incident investigation associated with an MCAR. That process is currently taking place and is separate from this Safety Inspection.

CCHHMP has the authority to conduct this Safety Inspection as outlined under Sections 450-8.018(f), (g), and (h) of Contra Costa County's Industrial Safety Ordinance (Ord. 98-48).

Safety Inspection Reporting Process

The requirements for issuing this notice of findings report for the Safety Inspection are outlined under 450-8.018(h) of Contra Costa County's Industrial Safety Ordinance (Ord. 98-48) and are summarized in this paragraph. It is customary that after CCHHMP completes an audit or inspection required under Contra Costa County's Industrial Safety Ordinance that an Administrative Draft Report is issued, and the regulated Stationary Source has 14 days to respond in writing to identify any technical or factual inaccuracies. If no written technical or factual inaccuracies are received, the Draft Report will then become the Final Report. Contra Costa County's Industrial Safety Ordinance requires that once the Final Report has been received, the Stationary Source has 60 calendar days to make any corrections related to any regulatory deficiencies reported. The Stationary Source may request, in writing, a one-time 30-day calendar day extension to make corrections.

[1] The U.S. Chemical Safety and Hazard Investigation Board (CSB) report on the February 18, 2015 ExxonMobil Torrance Refinery Electrostatic Precipitator Explosion issued recommendation number 2015-02-I-CA-R10 to the American Fuel and Petroleum Manufacturers (AFPM) member companies to share practices that can prevent a similar incident. AFPM sponsored a 2017 Technology Summit where member companies identified that the ESP should be de-energized when the FCC is in standby, otherwise known as "safe park" mode.

The Stationary Source and/or any person may appeal this notice of findings as outlined under 450-8.018(h)(2) of Contra Costa County's Industrial Safety Ordinance (Ord. 98-48).

The Final Report will be made available to the public through a 45-day public review process. This process may include a public meeting, held to allow review and comment on the issues found during the Safety Inspection.

Notice of Findings

Operating Procedures

CCHHMP reviewed four startup, standby, and feed diversion procedures associated with the CCU. CCHHMP reviewed these procedures as they might be used during non-routine situations similar in nature to what happened in November 2022. Each procedure reviewed contained actionable steps and specific details to accomplish the expected tasks. Several procedures include log sheets for operators to record data to track specific details every hour while the unit is in a certain state. Troubleshooting steps are also included in case select parameters that are being monitored are trending into an undesirable range.

CCHHMP also reviewed procedures covering general topics like creating new procedures, revising procedures, reviewing procedures, and using procedures. These general procedures included requirements for assessing the relevant complexity of a particular task along with the potential negative consequences if the task was performed wrong. These criteria are used to determine the type of instruction to be written and the criticality of the task.

CCHHMP conducted operator interviews across three of the unit's four operational shifts. These interviews confirmed that operating procedures are reviewed on a set frequency, procedures must be followed as written unless modified through the Management of Change process, and complicated activities like a unit startup or addressing a feed diversion requires an expanded team of operators and supervisors who discuss the situation as well as the operating procedures and each step to be performed as a team before tasks are completed.

CCHHMP confirmed that the CCU startup procedure was evaluated through a procedural process hazard analysis in 2016 and 2017. This type of detailed review is outlined in the County's Industrial Safety Ordinance (ISO) and is typically only conducted on a small subset of operating procedures at an ISO facility.

CCHHMP confirmed that MRC's CCU is a Shell Global Solutions design. Before PBF took ownership of the refinery, Shell personnel, including corporate experts, reviewed and revised the unit's operating procedures to be consistent with industry best practices.

Regulatory Concern: None

Improvement Suggestion: None

Shift Turnover Review

Shift turnover is the process where personnel at the end of their shift communicate operational conditions to personnel beginning their shift. With each shift turnover, there is a verbal face-to-face meeting to discuss, review and highlight important aspects of the unit and a written report that summarizes these issues as well as many other details.

CCHHMP reviewed intermittent turnover records between March to November 2022 for three different positions (Shift Team Leader, Reliability Operator, and Console Operator) and observed that each position completes a separate report that is then reviewed by the employees receiving the shift. Each report documents relevant information to each position, such as alarms, critical alarms, limit exceedances, and off-target parameters. Additional information on the cause and action taken to respond to alarms and additional pertinent information must be entered manually by the operators in a comment section. The shift team leader completes an additional summary containing relevant operational information about the unit(s) being reported. Once completed, the turnover reports are published into the facility intranet, where they are accessible to all personnel.

Per interviews, communication between shifts occurs in person, during a unit walk-through. Typically, the outgoing operators will share any relevant information with the incoming operator at the start/end of a shift during a face-to-face conversation. Additionally, both operators will walk the unit and review the status of critical equipment, active alarms, and any other unit-specific information during the shift handover. The written turnover report is primarily used to document all the alarms throughout the shift and identify the cause and corrective action taken to address them. In addition, when a specific unit is experiencing a turnaround, unit start-up, or shutdown, shift priorities and other relevant operational strategies are typically discussed by the team before any work. CCHHMP confirmed that completed shift turnover reports include this detail and also document the face-to-face interaction between the operators involved in the shift handover.

Regulatory Concern: None

Improvement Suggestion: None

Human Factors

CCHHMP conducted a review of MRC's Human Factors (HF) policy, titled I(A)-15, Human Factors, dated 04/19, and confirmed that the HF program at the facility establishes requirements to conduct Human Factors evaluations for Process Hazard Analysis (PHA), Inherently Safer System Analysis (ISSA), qualifying incident investigations and Management of Organizational Changes (MOOC), as well as proposed major changes.

MRC addresses Human Factors in PHAs, Procedures, ISSA, and Incident Investigations, by completing a unique error-likely situation checklist for each program element. MRC's checklists are modified versions of the Latent Condition Checklist (LCC) published by CCHHMP. Each checklist was modified, typically by deleting, adding, and re-wording questions, to conduct a more accurate, efficient, and specific evaluation within each program element and prevent redundancies. Each checklist and the HF procedure are reviewed once every five years.

Per Subject Matter Expert (SME) and Operator interviews, basic awareness training on Human Factors is provided to all MRC employees to advise them on the different types of human error and how to recognize and understand underlying causes for errors. This training covers a basic understanding of HF, types of human errors, and causes of human errors, including latent conditions. Refresher HF Training is provided via computer to all Operating and Maintenance personnel, Operating department mentors, and engineers and is repeated every 3 years.

Any employee assigned to participate in an HF study team (e.g., PHA, Incident Investigation, and MOOC) receives specialized training on HF awareness and the expected use of the Latent Conditions Checklist (LCC). The specialized Human Factors training is presented by the study team facilitator, who is qualified in the study methodology and the use of the LCC. Study team members typically apply the training in the context of the study, under the guidance of the facilitator. The facilitator works with each study participant to ensure the training is understood. Specialized training is provided before starting any HF analysis (just-in-time).

PHA:
CCHHMP reviewed completed PHAs for the CCU from 2012, 2017, and 2018 and determined that the PHA team completes a PHA-specific LCC before the study to obtain insights and a better understanding of the consequences of the existing latent conditions within the unit under review. After completing the LCC, the PHA team evaluates the results and develops recommendations to close any identified gaps.

CCHHMP confirmed that the facility consistently conducts HF evaluations, as part of their PHAs, by completing a PHA LCC and effectively documents and addresses gaps identified during the study. In addition, CCHHMP observed that MRC also assesses Human Factors occurring during non-routine operations, such as “Startup” and Shutdown”, as part of the PHA’s global node, by generally evaluating what would happen if a “step was not performed” or performed incorrectly.

Operating Procedures:
Per SME interviews, MRC developed an Operating Procedure LCC to evaluate new maintenance and operating procedures and screen for latent conditions. Mentors in operations and team leaders in maintenance receive Human Factors training focusing on the expectations of operating and maintenance procedures. Mentors/Leaders review and develop procedures utilizing the Operating Procedures LCC as a screening tool to identify latent conditions within the document before publication. A procedure is considered compliant with Human Factors requirements once it meets all the requirements established by the Operating Procedure LCC. This process guarantees a consistent HF evaluation of each procedure utilized at the facility.

CCHHMP reviewed the Operating Procedure LCC used by MRC to evaluate all operating and maintenance procedures, as well as finalized operating procedures, and confirmed that all procedures complied with Human Factors requirements.

ISSA:
Per SME interviews, ISSAs consider human-machine interfaces and other HF considerations through their ISSA checklist. These studies are typically conducted by Control Systems Engineers. No separate LCCs are associated with this analysis.

Major Change:
Major Changes require HF evaluation through the completion of a checklist. The checklist is completed and then reviewed by a team, which will evaluate how the proposed change will impact latent conditions, consider possible consequences, and provide useful recommendations. In addition, H&S staff conducts a general review of the change to assess for other potential HF gaps resulting from the change.

CCHHMP confirmed that the CCU did not experience any major changes impacting the startup of the CCU or improving CCU safety since PBF took ownership.

MOOC:
Per SME interview, the facility will conduct an assessment focusing on staffing levels, the complexity of tasks, and the number of resources needed to complete them to determine whether an organizational change will have any impact on operational positions and how much, with the intent to identify any potential gaps in operation or reliability. CCHHMP reviewed a study that effectively evaluated potential issues stemming from an organizational change that consisted of the re-arranging of various production units within the facility's Light Oil Processing (LOP) area. MRC's LOP Area includes processes such as the Crude Unit, Vacuum Flasher, Straightrun and Catalytic Hydrotreaters, the Catalytic and Saturates gas plants, the CCU, Hydrocracker, Alkylation, Catalytic Reformer, Sulfur Recovery Units 1 and 2, Hydrogen Plant 1 and various utility systems.

Incident investigation:
Major Chemical Accidental Releases (MCARs) and near-miss MCARs require the completion of an incident investigation-specific checklist to determine whether a root cause was linked to a human factors issue. At the time of the inspection, there was only one incident investigation about the scope of the inspection. CCHHMP could not review the report for that incident as the investigation was ongoing.

Control Room Design/Assessment:
Per interviews, MRC assesses both the operators working in the control room as well as the actual controls. Typically, a CSE (Control Systems Engineer) will periodically evaluate, design, develop, and implement systems that will aid operators in controlling each unit. The monitoring of each unit, including operational status, equipment, and corresponding safety systems, is conducted through the control board by a control board operator. CSEs work closely with the control room operator to optimize the layout of control board displays and set alarm thresholds and instrumentation control loops, which will aid personnel in the operation of the unit, as well as help prevent various hazardous and undesired conditions from occurring.

Critical and standard alarms are designed to provide enough time for the operator to diagnose the situation and then act accordingly. Additional time is provided when the operator is required to travel to the control device location to perform an action. When an alarm is activated, operators are expected to identify and specify the cause for the alarm, and the type of response provided to stop the condition in an alarm log. CSEs review the alarm log monthly and verify that all alarms are accounted for. Alarms are re-evaluated when an unusually excessive number of active alarms is observed on the log.

CCHHMP confirmed through operator interviews that enough time is provided to operators to respond to critical and standard alarms and prevent unsafe conditions from occurring. In addition, CCHHMP notes that each control board display and functionality has been periodically evaluated and improved by CSEs, following relevant industry standards (i.e., ISA 18.2, ISA 84), to allow operators to successfully determine the operational status of a given unit, assess any potentially unsafe condition and make the right decision to control the situation.

Fatigue Management:
CCHHMP reviewed a set of MRC's policies addressing Fatigue Management, and its Fatigue Risk Management System (FRMS). In general, the policies and FRMS in place at MRC cover all employees working night shifts, rotating shifts, extended shifts, extended work sets or callouts, and involved in process safety-sensitive actions as required by management. CCHHMP verified that MRC's FRMS was designed to prevent employees from exceeding the hours-of-service limits provided by American Petroleum Institute (API) Recommended Practice (RP) 755, 2nd edition. API RP 755 provides guidance to employees, managers, and supervisors on understanding, recognizing, and managing fatigue in the workplace. CCHHMP considers API's recommended practices as Recognized and Generally Accepted Good Engineering Practices (RAGAGEP).

Per interviews and live navigation with the SME, MRC primarily manages its FRMS through a software scheduling tool that tracks employees worked hours and aids staff in developing schedules that comply with the limits set forth by API RP 755. The software assesses staffing levels and workload balance to ensure that fatigue risk is adequately managed within the facility. The software is designed to evaluate the hours each employee is expected to work during the upcoming shift and determine whether that employee will exceed any API RP 755 criteria after the end of their projected shift. The software also provides management with a daily overview of each unit's staffing status and records each instance of potentially exceeding API RP 755 limits at each unit in the refinery, indicating which specific limit of API RP 755 is being exceeded by a specific employee.

CCHHMP notes that facility tries as much as possible to avoid API RP 755 exceedances. Management is instructed, via policy *G(A)-34*, to reduce out-of-schedule hours through the redesign of work, and work schedules, designating backups, and evaluating risk if callout is delayed into normal work hours. MRC relies on scheduling software to actively track the worked hours of employees and to assist management in developing future work schedules.

Employees exceeding API RP 755 limits will be subject to an exception process before the proposed shift schedule can be made official. The exception is documented in a report, which identifies the reason for the exception, the risk assessment, the type of work to be performed, and how fatigue will be mitigated during the shift.

CCHHMP reviewed a set of exception reports and verified that all instances of employees exceeding API RP 755 limits were properly documented by the facility. However, the mitigation plan proposed by these reports only documented that "increased monitoring" would take place by direct supervision and did not specify frequency or any additional mitigation steps to minimize the risks associated with fatigue. The exceedance forms reviewed by CCHHMP identified the date(s) the employee must be off to rest and were signed and approved in a timely manner. A copy of this form is mailed daily to the Operations Manager and the Incident Response Manager. CCHHMP verified that all employees and supervisors receive annual training that includes recognizing symptoms of fatigue. Interviews with select SMEs also confirmed their understanding of the concepts. The "increased monitoring" statements listed on the exception reports satisfy the requirements of API RP 755, although could optionally be expanded to include additional details for supervision to observe.

CCHHMP observed that MRC's FRMS incorporates a process to provide initial and refresher training to all stakeholders on the basic scientific principles of sleep, sleep disorders, alertness,

circadian cycles, and fatigue physiology so that they can make informed decisions that will help them reduce the fatigue risks for themselves, their colleagues, and the people they may supervise or manage.

Staffing of CCU since the last CalARP audit

Catalytic Cracking Unit (CCU) staffing levels have been affected by external factors such as the pandemic or employee promotions/departures over the past two years. As a result, the overall facility's staffing levels decreased, which resulted in an increment of fatigue management exceedance reports to continue production. In general, CCHHMP found a low number of exceedance reports during this period due to select staff members (i.e., shift supervision) temporarily covering any vacant positions to minimize further API RP 755 limit exceedances. CCHHMP also reviewed the training records of staff members who were assigned roles in operations and confirmed that staff were qualified to operate the unit. MRC has also hired additional operators.

In addition, the policy titled Work Schedule Expectations for Staff (Exempt & Non-Exempt), has recently been revised to indicate that management/supervision staff fulfilling the role of an operator or making process safety-sensitive decisions is also subject to the hours-of-service limits and subsequent exception process established by the facility's FRMS and fatigue-related policies.

Regulatory Concern: None

Improvement Suggestion: Include specific details related to the extent of the mitigation plan for employees exceeding API RP 755 limits (such as type of monitoring, frequency, or any additional measures taken to mitigate fatigue) and document it on the exceedance form.

CCHHMP recognizes that the purpose of the exceedance form at MRC is to document employees who, due to the increase in work hours, do not comply with API RP 755 limits, and thus may be or may become fatigued. However, CCHHMP believes that documenting the whole extent of the mitigation plan will help the facility to develop more efficient and consistent strategies to deal with fatigue in the workplace and will improve the completeness of the facility's FRMS as well.

Training

CCHHMP reviewed six policies related to operator training at MRC that cover initial training, job-specific training, advanced training, and refresher training. These policies adhere to the County ISO regulatory requirements. CCHHMP reviewed a list of qualified field and console (AKA board) operators at the CCU and requested documentation associated with a sampling of these to confirm their initial training and refresher training. Documentation included signed and dated sheets and forms consistent with that outlined within the facility's policies and procedures. CCHHMP also reviewed an CCU console operator training plan, which outlined types of training and timeframes, as well as written, oral, and demonstration testing requirements.

Per SME interviews and policy review, operator training is divided into three phases. The first phase involves the initial training of newly hired individuals to get them orientated to refinery

equipment and work processes. This phase of training includes broad topics such as how to use operating procedures, fire training, issuing safe work permits, knowledge of common refinery equipment, understanding drawings, and tracing piping, The second phase of training is when recently oriented new hires are assigned to a processing unit to begin learning their first job. In this phase of training, new employees work with mentors to receive unit-specific training to understand what their assigned unit does, their assigned duties, and the associated operating procedures, Phase 3 training involves training to understand emergency situations and advanced training. Each phase of training has its own length of time to complete the training and testing requirements.

Through operator interviews, CCHHMP verified that employees are expected to be qualified for multiple jobs within their department and work each of these jobs every year. Training includes emphasis on safety and health hazards, procedures, and safe practices applicable to the operator's tasks. Employees are also required to receive refresher training every three years to remain qualified in every one of their jobs. Refresher training includes testing requirements so management can verify personnel understands all aspects of their assigned roles. Each operator who completes the training program shall have a documented certification record. This document will contain the identity of the operator, the date of the training, and the signatures of the person administering the training.

CCHHMP reviewed several years' worth of Red Tag Drills that documented monthly drills and exercises ensuring personnel understand and follow various emergency procedures.

Regulatory Concern: None

Improvement Suggestion: None

Process Safety Information

CCHHMP reviewed select process safety information associated with the CCU to verify the adequacy of the information. This included the review of piping and instrumentation diagrams (P&IDs) and process flow diagrams (PFDs). CCHHMP also compared select design information based on suggested improvements recommended by the CSB associated with the 2018 Husky Energy Superior Refinery Explosion and Fire that involved a CCU. In the CSB investigation, it was found that select equipment at the CCU in the Husky Energy Superior Refinery made with steel components failed due to brittle fracture and recommended metallurgy less prone to that damage mechanism. CCHHMP found that the metallurgy of relevant vessels at MRC's CCU was upgraded to resist brittle fracture. CCHHMP also verified that the CCU is a Shell Global Solutions design, and that MRC maintains copies of the CCU operating manuals from Shell Global Solutions.

Regulatory Concern: None

Improvement Suggestion: None

Management of Change

CCHHMP reviewed lists of changes made to the CCU through the Management of Change (MOC) process since 2015. CCHHMP also reviewed a list of MOCs completed for safety improvements since PBF took ownership of the refinery. From these lists, select MOCs were reviewed in more detail to verify the adequacy of the MOC process and to better understand how the changes impacted the process. CCHHMP found that through the MOCs reviewed that the facility's MOC process was followed and that the changes made did not impact maintaining a pressure balance between the regenerator and fractionator.

Regulatory Concern: None

Improvement Suggestion: None

Process Hazard Analysis

The most recently completed Process Hazard Analysis (PHA) for the CCU at MRC was the "Cracked Products Department CCU/CGP PHA" completed in June 2018. This PHA included the hazard review for both the Catalytic Cracking Unit and the downstream Cracked Gas Plant (CGP). For the Safety Inspection, CCHHMP focused much of the review on the process and equipment within the CCU since this was the part of the refinery where the spent catalyst release occurred. During the Safety Inspection, the facility was actively completing the 5-year revalidation of the PHA, which was not yet available for review. However, CCHHMP was able to speak with personnel from the facility on the PHA team to ask general questions about the process and significant changes from the previous version. CCHHMP also reviewed the 2012 PHA for the unit, but this PHA was not the focus of the Safety Inspection.

The 2018 PHA utilized a PHA methodology called Hazard and Operability Study (HAZOP). The HAZOP methodology is a widely used technique for identifying and analyzing potential hazards in industrial processes and systems. It involves a systematic and structured approach to examining each element of a system or process and identifying possible deviations from normal operating conditions that could result in hazards or process failures. These deviations are then analyzed to determine their potential consequences, and appropriate measures are developed to prevent or mitigate them. The HAZOP methodology is considered to be a highly effective tool for managing risk and ensuring the safety and reliability of industrial processes and systems and is approved for use by CCHHMP.

CCHHMP reviewed the PHA and notes that, in general, the PHA team accurately and comprehensively reviewed the process unit, identifying hazardous scenarios and safeguards in place to prevent the consequences. For scenarios with the highest risk, the PHA team performed a Layer of Protection Analysis (LOPA) to quantitatively identify the effectiveness of safeguards to control against a hazardous scenario occurring. For scenarios that were identified to have insufficient safeguards, recommendations were developed to reduce the risk. For most scenarios, CCHHMP found that the team appropriately risk-ranked the scenarios. One area where the facility could improve is the risk ranking of scenarios that have environmental, regulatory, and reputational

impacts. For some scenarios with environmental consequences within the PHA, the facility did not identify regulatory/reputational consequences. This included scenarios that involved the release of catalyst, including some that were similar in nature to the November 2022 incident. The November 2022 incident has emphasized the fact that scenarios that could have community impacts should be ranked higher and recognized in PHA studies. The facility already has a process to do this that meets the regulatory requirements although CCHHMP is suggesting that this process be enhanced. Based on interviews with the PHA SME, CCHHMP believes that the facility will more accurately rank these types of scenarios in future PHAs but was unable to verify this since the newest PHA was not yet finalized at the time of this Safety Inspection.

Recommendations generated by the PHA team were reviewed to ensure that they were effective at closing the risk gap and ensuring that the facility completed the recommendations as described in a timely manner. 14 total action items were generated in the 2018 PHA. CCHHMP found that each of the items was developed in a way to close the risk gap and were all completed before the proposed completion date and within regulatory requirements.

CCHHMP found that the facility included all the appropriate members on the PHA team (operations personnel, process engineers, facilitator, and subject matter experts as needed). Per interviews with various site personnel, no issues were found related to the PHA team composition.

Regulatory Concern: None

Improvement Suggestion: Assess the current risk ranking process to better rank the consequences of scenarios with environmental, regulatory, and reputational impacts.

Incident Investigation

CCHHMP reviewed 7 incidents that occurred within the CCU from 2013 to 2020 related to opacity exceedances from the Carbon Monoxide (CO) Boiler (or COB) stacks. These incidents were chosen for review because they were similar in nature to the release that occurred in November 2022. CCHHMP did not review the incident investigation for the November 2022 release as that was determined not to be part of this Safety Inspection due to it being part of the independent investigation being overseen by the MRC Spent Catalyst Release Oversight Committee.

In general, CCHHMP found that opacity-related incidents (including near misses) have for the most part been related to a process that the facility uses to clean the expander turbine blades in the part of the process before the CO Boilers and after the majority of the catalyst has been removed from the flue gas. The turbine blades must be cleaned periodically to remove catalyst buildup on the blades that lead to a reduction in the life of the equipment. In order to clean the blades, the facility has developed a process, and associated procedure, that consists of injecting ground walnut hulls upstream of the turbine blades to displace the catalyst that builds up on the blades. As expected, the increased material (walnut hulls) and the catalyst that is knocked off can lead to opacity violations at the CO Boiler stacks. Most of the time this process does not lead to opacity violations, however, it is the most common observed cause. Recommendations to reduce this type of incident generally revolve around changes to the walnut hull injection procedure, such as

changing the timing of the injections, or the quantity of walnut hulls injected. CCHHMP has not identified that the walnut hull injection-related incidents are a significant risk to the public.

CCHHMP reviewed three incidents that were not related to walnut hull injections. One of the incidents (2016) involved a unit trip that caused the Electrostatic Precipitators (ESPs) to shut down. Without the ESPs to remove particulate from the CO Boiler stacks, the facility exceeded the opacity limits. Once the facility was able to return the unit operation to target levels, the ESPs were restarted. The second incident (2020) involved an incident where it was discovered that a change in the differential pressures of some of the unit equipment led to excess catalyst being carried in the flue gas and a resulting opacity exceedance. Although the details of this incident were different from the November 2022 release, it has some similar characteristics (notably, an excessive pressure differential between equipment leading to increased catalyst in the flue gas). The third incident (2020) involved an issue that occurred during the shutdown of the process. During the shutdown process, excessive catalyst was carried over from the regenerator to the CO Boilers leading to the opacity exceedance. This incident was primarily caused by a valve malfunction which has since been remedied, as well as ambiguity in the unit shutdown procedure which could lead to mistakes by personnel without significant unit shutdown experience. The unit shutdown (as well as the startup) procedures were updated to provide more explicit direction and improved process descriptions to operators utilizing the procedure so that extensive experience was not required to shut down the unit. None of these three incidents were identified by CCHHMP or the facility to be a Major Chemical Accident or Release (MCAR), and the released quantities were significantly lower than the November 2022 release.

In addition to reviewing specific incidents, CCHHMP also reviewed a study conducted in 2015 that was performed to identify reasons that environmental-related incidents (generally opacity exceedances) have occurred in the CO Boilers. This study reviewed all environmental incidents in the CO Boilers from 2011 to 2015 and identified different common contributing causes for opacity-related events. As noted above, walnut hull injections were the number one cause. The next most common cause was ESP power failure, resulting in reduced removal of catalyst from the exhaust gas, and the third was "volatile COB conditions" which included lowering the hoppers that collect the catalyst fallout from the ESPs, balancing the load on each of the CO Boilers, and running the process with high baseline opacities. Per SME interview, the facility no longer runs the process at a high baseline and instead makes corrective actions to reduce opacity to minimize potential exceedances. CCHHMP notes that the facility has had opacity/catalyst releases occur periodically in the last 10+ years and the facility should continue to make efforts to reduce these incidents and learn from near misses and incidents.

CCHHMP reviewed the action items from each of the investigations and found that they were appropriate for reducing the potential of the incident from reoccurring. During a live navigation of the action item database, CCHHMP reviewed a selection of the action items to confirm that they were appropriately closed out. During this process, it was discovered that some of the older action items (5 years or older) were not always available for review as a result of the facility changing databases used to store action items and their resolutions. Although the facility may have had records for each action item, changing the nomenclature between each database made searching for specific action items difficult. These actions and investigations were outside the required retention period of five years, so there is no regulatory issue for these items. For more recent incidents, the facility was able to show the appropriate timely resolution of all the action items.

Regulatory Concern: None

Improvement Suggestion: None