

Improving Public and Worker Safety at Oil Refineries



Draft Report of the Interagency Working Group on Refinery Safety Governor Jerry Brown

July 2013

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Executive Summary

In the aftermath of a serious chemical release and fire at Chevron's Richmond oil refinery in August, 2012, the Brown Administration formed an Interagency Working Group to examine ways to improve public and worker safety through enhanced oversight of refineries, and to strengthen emergency preparedness in anticipation of any future incident. The Working Group consisted of participants from 13 agencies and departments, as well as the Governor's office. Over an eight-month period, the Working Group met internally and with industry, labor, community, environmental, academic, local emergency response and other stakeholders. The Working Group's findings and recommendations include:

Findings

- ***Oversight and Coordination:*** Multiple regulatory agencies have responsibility for oversight of aspects of refineries, sometimes with overlapping jurisdiction. Agency actions and efforts to ensure information sharing, joint prioritization of enforcement or regulation, or other coordinated efforts to avoid potential duplicative action, are insufficient.
- ***Emergency Response and Preparedness:*** Regulations need to define more precisely a refinery's requirements for reporting leaks or releases of a hazardous material to local and state agencies. Hazardous Materials Area Plans developed at the local level are written as general response guidance and not specifically to address the unique hazards a refinery poses. The current air monitoring network also does not provide real-time air pollution tracking following an industrial accident in all geographic regions.
- ***Safety and Prevention of Hazardous Events:*** Refineries are subject to California Accidental Release Program (CalARP), Risk Management Program (RMP), and Process Safety Management (PSM) regulation, as well as an Industrial Safety Ordinance in Contra Costa County, where four refineries are located. However, gaps in the regulatory schemes exist, including limitations on their ability to cover all aspects of process safety and the extent to which they are enforceable. Regulatory agencies face multiple issues relating to inspection and enforcement capabilities including: difficulty in hiring, retaining, and training inspectors; lack of mechanisms for information sharing and coordination; deficiencies in data and transparency; and, insufficient penalties to create meaningful deterrence.
- ***Community Education and Alerts:*** There are shortcomings in existing emergency alert systems, public education and timely dissemination of public information. These difficulties include coordination between emergency responders and challenges in communicating with surrounding

communities regarding health risk and appropriate actions. Public involvement is not well integrated into air monitoring improvement discussions.

Recommendations

- **Oversight and Coordination:** An Interagency Refinery Task Force will be created within the California Environmental Protection Agency (Cal/EPA) by September 1, 2013, to coordinate agencies' activities and carry out the recommendations in this report.

Glossary of Terms

Damage mechanism hazard review is an assessment of potential damage mechanisms that can affect refinery processes, including corrosion, stress cracking, and mechanical degradation of metals.

Human factors is a scientific discipline concerned with understanding the interaction of individuals with each other, with facilities and equipment, and with management systems.

Inherently safer systems requirements ensure that refineries incorporate the highest level of reliable hazard reduction to the maximum extent feasible.

Leading and lagging indicators are predictive and retrospective metrics used to identify potential weaknesses and recurring problems, and also identify potential corrective action.

Root cause analysis is an analysis that addresses the fundamental underlying problems after an incident.

Safety culture is a commitment to safety as an overriding priority at all management levels of a facility.

Safety case is an alternative regulatory approach focused less on prescriptive regulation and more on comprehensive safety plans developed by facilities.

- **Emergency Response and Preparedness:** The Governor's Office of Emergency Services (Cal OES), formerly the California Emergency Management Agency (Cal EMA), will coordinate improved emergency response by clarifying reporting thresholds during hazardous materials release or threatened release, and work with local Certified Unified Program Agencies (CUPAs) to create refinery-specific elements in Hazardous Materials Area Plans. The Working Group has identified at least four elements that must be included in the Area Plans: (1) alignment of radio communications between response officials; (2) clear criteria for the establishment of a Unified Incident Command and Joint Operation Center; (3) plans and protocols for persons outside the refineries; and (4) requirements for joint drills and exercises. The California Air Resources Board (ARB), in collaboration with the California Air Pollution Control Officers Association (CAPCOA), is working on a parallel effort focused on toxic air contaminant monitoring to improve knowledge and information sharing for real-time air data.
- **Safety and Prevention of Hazardous Events:** Existing regulations and practices must be strengthened to ensure that more data and information is provided to agencies. In addition, agency enforcement capabilities need to be enhanced. Additional regulatory changes to improve refinery safety procedures include five prevention strategies that should be required as soon as possible, requiring refineries to: (1) implement inherently safer systems to the greatest extent feasible; (2) perform periodic safety culture assessments; (3) adequately incorporate damage mechanism hazard reviews into Process Hazard Analyses; (4)

complete root cause analysis after significant accidents or releases; and (5) explicitly account for human factors. The Working Group additionally identified three areas for further study that include reporting of leading and lagging indicators, increasing worker involvement, and exploring the safety case approach.

- ***Community Education and Alerts:*** State agencies will evaluate improvements to public input during the emergency planning process, create enhanced public information and outreach protocol for use during a toxic chemicals release or fire, and improve alerts and public access to information during emergency events. Agencies are also working toward enhanced public availability of air monitoring information.

For actions identified in this report requiring regulatory change, the Governor's office has directed the relevant agencies to begin that process immediately. Where actions identified require Legislative authority, the relevant agencies will consult with the Legislature. This report also identifies interim steps to improve interagency coordination and public communication, and to improve air monitoring near refineries, which the relevant agencies will undertake as soon as possible in order to ensure that this report results in measurable progress in the coming year.

A. Introduction

On August 6, 2012, the Chevron refinery in Richmond, California, experienced a catastrophic pipe failure, releasing flammable fluid that partially vaporized into a large cloud. The vapor cloud engulfed 19 employees, including one fire-fighting employee who ran directly through the ensuing fire. All employees fled quickly, barely escaping serious injury or death. The ignition and burning of the vaporized fluid created a large plume that spread well beyond the refinery confines, causing approximately 15,000 people in the surrounding communities to seek medical attention.

Multiple agencies opened investigations after the incident, with those investigations by the California Division of Occupational Safety and Health (Cal/OSHA) and the U.S. Chemical Safety and Hazard Investigation Board (CSB) now completed and reported publicly. Chevron also completed its own internal investigation. All three investigations identified serious concerns about process safety management procedures at the refinery and expressed need for stronger preventative safeguards.

The incident at Chevron also provided an opportunity to take a more comprehensive look at industry performance, as well as agency regulation and oversight. While refineries in California are subject to detailed regulation by multiple agencies and already have extensive health and safety programs in place, additional measures and alternative approaches offer the potential for enhanced prevention and risk reduction, without imposing significant new regulatory burdens.

In October 2012, the Brown Administration formed an Interagency Working Group on Refinery Safety to identify means of improving refinery and agency performance. These agencies met regularly over the course of eight months and analyzed their respective roles and responsibilities to identify gaps, areas of overlap and areas in need of improved coordination.¹

The Working Group examined the following areas:

¹ The group consisted of the following agencies and departments: California Emergency Management Agency (Cal/OES); California Energy Commission (CEC); California Environmental Protection Agency (Cal/EPA); Cal/EPA – Air Resources Board (ARB); Cal/EPA – Department of Toxic Substances Control (DTSC); Cal/EPA – State Water Resources Control Board (SWRCB); California Technology Agency (CTA); Department of Finance (DOF); Department of Public Health (DPH); Labor and Workforce Development Agency (LWDA); LWDA – Department of Industrial Relations (DIR); LWDA/DIR – Division of Occupational Safety and Health (Cal/OSHA); and Office of the State Fire Marshal (OSFM) .

- **Oversight and Coordination** – How to coordinate actions of multiple agencies and oversee implementation of recommendations.
- **Emergency Response and Preparedness** – How to strengthen emergency preparedness and response in the event of an incident, through planning, coordination and communication among agencies at all levels.
- **Safety and Prevention of Hazardous Events** – How to prevent refinery accidents that threaten the health and safety of workers, communities and the environment, and promote greater safety and avoidance of hazards.
- **Improved Communication and Interaction with the Public and Surrounding Communities** – How to better inform and educate the public about refinery safety risks, preventive measures, emergency procedures, and agencies’ roles and responsibilities relating to refinery safety and emergency preparedness and response.

The Working Group grounded its recommendations in the experience and insight of refinery workers, community residents, oil industry executives, governmental enforcement agency staff, and firefighters from city and county fire departments. It conducted a series of meetings with key stakeholders in northern and southern California. Technical consultants from the RAND Corporation and the University of California, Berkeley, assisted in planning and conducting the meetings and analyzing the results. Additionally, as part of this interagency effort, the California Air Resources Board began collaborating with the California Air Pollution Control Officers Association, which represents local air pollution control districts, to develop a plan that will examine state and local air monitoring practices in the event of a refinery accident involving the release of toxic air contaminants, suggest areas of improvement, and encourage statewide best practices.

This report contains the Working Group’s conclusions and recommendations, but it is not intended to be exhaustive or the final word on this subject. Some recommendations can and will be implemented immediately, including the creation of an Interagency Refinery Task Force starting on September 1, 2013. Other recommendations will require sustained effort and collaboration among agencies and others to implement; still others will need further evaluation and development before a decision is made about whether to put them in place. We welcome feedback on the report. The Task Force will carefully review comments received and issue a final report in the months ahead.

B. Stakeholder Perspectives

Over a six-month period, the Working Group held meetings and engaged in discussions with labor, community, industry, enforcement agencies and emergency response stakeholders. Major themes discussed are summarized below.

“Refinery Safety in California: Labor, Community and Fire Agency Views”

The Labor Occupational Health Program at UC Berkeley, which helped facilitate both the labor and community stakeholder meetings, published a report, “Refinery Safety in California: Labor, Community and Fire Agency Views.” In the area of emergency response, the report called for better coordination between on-site fire brigades and public agencies, improved monitoring and public disclosure of air pollutant releases during both incidents and routine refinery operations, and improvements in the current emergency public warning system required to facilitate greater community preparedness.

The report also noted that the medical services costs of refinery incidents and the long-term health status of affected individuals are not tracked long-term. To prevent further incidents, the report suggests strengthening risk management by requiring a comprehensive audit of corrosion damage, improving means for workers to report unsafe conditions, and improving public disclosure of information to government and the public on maintenance and corrective actions. It also recommends greater worker involvement in management decisions pertaining to health, safety and environmental performance. Finally, the report outlines concerns over the growing sulfur content of crude oil imports and energy intensive operations of refineries, and their impacts on air emissions.

1. Labor

Workers involved in facility operations, represented by the United Steelworkers, reported that refinery structures are old and outdated, corrosion is pervasive, process safety management staffing has been reduced and preventive maintenance is often not conducted before failure occurs. Workers who exercise their authority to shut down unsafe operations may experience retaliation by management. Several workers additionally reported that management does not take seriously the monitoring of employee exposures to hydrogen sulfide, which can be acutely fatal.

The operations workers recommended that the process safety management (PSM) requirements enforced by Cal/OSHA be enhanced based on an Industrial Safety Ordinance (ISO) adopted by Contra Costa County. Process safety management refers to regulatory standards developed by U.S. OSHA to prevent accidental releases of hazardous substances. In addition, refineries should be required to share useful leading indicators (early warning signs) of safety risks with workers and enforcement agencies. Criminal sanctions to deter unsafe practices were also recommended.

Workers involved in maintenance, represented by building and construction trades unions, reported that training of most maintenance workers is inadequate. They also reported that refineries use mostly contract workers, including out-of-state workers, to conduct maintenance during planned shutdowns of a refinery process (also referred to as turnarounds), and that contract workers have less training and experience and, therefore, are less safe.

The construction trades workers recommended that refineries be required to train maintenance workers through state-approved apprenticeship programs. The same workers also echoed the recommendation of large civil and criminal penalties for unsafe practices.

2. Community

Meetings with community members were held in northern and southern California. Northern California participants included members of an ongoing Refinery Safety Collaborative consisting of labor, community groups and environmental organizations.

Participants in both locations called for more information about long-term exposures and health effects from refinery emissions. Residents in southern California expressed concerns about visible flaring of gases from refineries. Participants in the northern California meetings reported that immediately after the Chevron fire, emergency communication from local agencies – via sirens and telephone – was inconsistent and unclear. They recommended state-of-the-art, real-time monitoring of air contaminants where people live beyond refinery property lines (fence lines), as well as air quality monitoring to help predict exposure levels. They also recommended the establishment of clear criteria to trigger notification to local residents of an incident that provides clear information and instructions.

3. Industry

Oil industry executives with expertise in refinery operations attended a day-long workshop facilitated by the RAND Corporation. Participants discussed the number of agencies involved in refinery oversight and the need for better coordination. The group also acknowledged the aging of refinery facilities and the changing workforce. The group discussed best practices for ensuring that refineries operate safely, including resource prioritization, mentorship, knowledge sharing, a strong safety culture with an emphasis on management of change, mechanical integrity assurance through high-quality maintenance, employee engagement in the risk management decision process, and support for employees who raise safety issues.

The group also recommended simplifying agency involvement and establishing one point of contact in government for refineries. They further recommended a focus on safety problem prevention rather than traditional enforcement and issuance of penalties. The Contra Costa County ISO was cited as a successful model of regulation due to its focus on human factors² and safety culture³. The “safety case approach”—an alternative regulatory approach under which there is less prescriptive regulation and

²“Human factors” is a scientific discipline concerned with understanding the interaction of individuals with each other, with facilities and equipment, and with management systems.

³ Safety culture is a commitment to safety as an overriding priority at all management levels of a facility.

more focus on comprehensive safety plans developed by facilities — was also cited as a potential model for consideration. This is discussed in greater detail further in the report.

A smaller group organized by the Western States Petroleum Association (WSPA) met to further discuss recommendations based on Contra Costa County's ISO model. The group recommended that Cal/OSHA inspectors work collaboratively with local inspectors from the Certified Unified Program Agencies, or CUPAs. CUPAs are coordinated local agency enforcement programs for regulating hazardous materials through Area Plans for Hazardous Materials Emergency Response (Area Plans) and facility-specific Hazardous Materials Business Plans to prevent or minimize releases of hazardous materials.

In some geographic locations, steps would need to be taken to ensure that CUPA staff are sufficiently qualified to enforce regulations related to prevention. The group also echoed recommendations for adopting a possible safety case model in which refineries would submit safety plans that could serve as a blueprint for Cal/OSHA to use in administering existing Process Safety Management regulations.

4. State and Local Agencies

Enforcement agency staff, including Cal/OSHA and CUPA employees, discussed the need for better understanding areas of responsibility and increased coordination. Enforcement staff recommended that interagency coordination be increased through written standardized protocols and regular cross-training of staff, including drills. They also recommended stronger safety incentives and penalties for multiple and repeat violations. Finally, staff recommended further study of the safety case approach.

City and county firefighters noted a need to improve immediate access to a refinery during an emergency and improved communication between their departments and the firefighting staff of refineries. Firefighters recommended that mechanisms be developed to ensure immediate access to a refinery during an emergency, and that a protocol be developed for effective communication between their departments and firefighting staff at refineries. They additionally echoed recommendations to adopt requirements based on the Contra Costa County ISO throughout California.

5. RAND Corporation Findings

The RAND Corporation prepared a memo, "Refinery Process Safety Performance and Models of Government-Industry Relations," discussing some of the issues involved in considering new models of industry regulation. The memo notes that evidence is mixed as to whether refinery safety in the U.S. has improved over the past 30 years, but that the safety record of U.S. refineries is not as strong as in other countries. It argues that Cal/OSHA's current enforcement program is not achieving significant prevention gains, both because the agency has limited resources to devote to inspections, and because its inspections in recent years have not detected many violations or hazards. RAND advocates that Cal/OSHA move in the direction of the safety case approach, but notes that evidence to date on whether

the safety case has improved performance is mixed, and that implementing this approach requires significantly greater agency resources than currently employed. The memo suggests that Cal/OSHA adopt an incremental approach for transitioning to the safety case, perhaps by expanding the Contra Costa County ISO. The memo also discusses the desirability of developing lagging and leading indicators of refinery performance and suggests that this be done through a collaborative industry-labor process.

A copy of the RAND Corporation memo can be found in the Appendix.

C. Investigative Findings to Date

On January 30, 2013, the state's Division of Occupational Safety and Health (Cal/OSHA) issued 25 citations to Chevron, including 11 "Willful Serious" citations, and almost \$1 million in civil penalties after a six-month investigation of the Richmond refinery fire. On April 12, 2013, Chevron released its own internal incident report. On April 19, 2013, the U.S. Chemical Safety and Hazard Investigation Board adopted an Interim Report on the causes of the incident and made specific recommendations to Chevron and federal, state and local government agencies and authorities.

1. Cal/OSHA and CSB Findings

Both Cal/OSHA and CSB documented deficiencies at the Chevron refinery occurring before, during and after the August 6, 2012, incident that threatened the health and safety of the refinery's workers and surrounding communities. The agencies' findings include:

Before the incident:

- Chevron failed to follow the repeated recommendations of its own pipe inspectors and metallurgical scientists, dating back to 2002, to replace the 36-year-old corroded pipe that ultimately ruptured and caused the fire;
- Chevron failed to test the thickness of piping in all areas identified as susceptible to corrosion and leaks due to the high sulfur content of the crude oil and the high temperature and pressure of the liquid passing through the piping; and,
- Chevron failed to conduct an effective Process Hazard Analysis⁴ of the operations of the No. 4 Crude Unit.

During the incident:

- Chevron failed to implement its own emergency procedures to shut down the No. 4 Crude Unit when the leak occurred;
- Chevron failed to recognize the potential for a catastrophic release of ignitable gas-oil leaking from the pipe, ordered its own employees to strip insulation from the leaking pipe with metal

⁴ Process Hazard Analysis is an assessment of potential hazards associated with an industrial process. It is used to make risk management decisions to prevent accidental releases of hazardous chemicals.

tools and a high-pressure water stream, and ordered contract employees to erect a scaffold below the leaking pipe;

- Chevron failed to conduct air monitoring for hazardous chemicals where employees were working during the uncontrolled leak; and,
- Chevron failed to limit the number of workers who entered the incident zone and ensure that all workers exposed to hazards were provided with and were using the necessary personal protective equipment.

After the incident:

- Chevron allowed workers to enter the demarcated danger zone after the fire was extinguished despite the known hazards posed by metal structures, vessels and piping that were determined by Chevron's own certified civil engineer to be structurally unsound;
- Chevron failed to conduct an evaluation of the new pipe materials before selecting them as part of the rebuild of the fire-damaged unit; and,
- A second Cal/OSHA inspection investigating Chevron's leak repair procedures found that clamps and fittings used as temporary repairs on the outside of leaking piping systems throughout the refinery were not removed and replaced permanently at the next scheduled turn-around (shut down for major repairs) as required by Chevron's own procedures and the industry association's recommended practice⁵.

Copies of the Cal/OSHA citations and the CSB Interim Report, and the full details of these investigations' findings, are included in the Appendix.

2. Chevron's Internal Investigation Findings

Chevron's internal report found that the incident was caused by incomplete and inadequate hazard recognition, insufficient responses to identified hazards, and that the refinery's emergency response was also deficient. Specific findings in this report include:

- The Process Hazard Analysis for the No. 4 Crude Unit did not consider the potential for corrosion due to the high sulfur content of liquid at high temperatures and pressures, and the

⁵ This practice is known as American Petroleum Institute Recommended Practice 570, Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-Service Piping Systems.

low silicon content of the failed carbon steel pipe (piping with high silicon content better resists corrosion caused by sulfur in crude oil);

- The pipe wall thickness threshold for inspection and repair of piping did not incorporate safety factors in Chevron’s existing guidelines or the American Petroleum Institute (API) Recommended Practice 574⁶;
- The 2002 wall thickness testing information was not captured by Chevron’s data system and acted upon;
- The 2009 review of the piping circuit “did not include a 100% component-by-component inspection”;
- The 2011 turnaround did not include every component in the carbon steel piping connecting the No. 4 Crude Unit to the atmospheric distillation tower, known as the 4-sidecut piping circuit;
- The June 2012 pipe inspection results were not entered in the data base and no re-inspection occurred;
- Inspection guidelines of piping “were not fully implemented and action items were not tracked until completion”;
- Piping circuit inspections need to include “appropriate damage mechanisms using a standardized methodology and documentation system”; and,
- The emergency response and assessment after the discovery of the leak “did not fully recognize the risk of piping rupture and the possibility of auto-ignition”.

A copy of the Chevron internal incident report is included in the Appendix.

Copies of CSB investigation reports of previous oil industry incidents, and the testimony of U.S.OSHA officials, are also included in the Appendix.

⁶ American Petroleum Institute Recommended Practice 574: Inspection Practices for Piping Components.

D. Chemical Safety Board and Chevron Investigators' Recommendations

The CSB's Interim Report (April 19, 2013) contained 20 recommendations directed at Chevron USA, local officials in the City of Richmond and Contra Costa County, the Governor, Legislature, state agencies of California, and the U.S. Environmental Protection Agency. The CSB presented its recommendations at a public forum in Richmond on April 19, 2013.⁷ The recommendations include:

- Establishment of a multi-agency process safety regulatory program for all California oil refineries to improve public accountability, transparency and performance of chemical accident prevention and mechanical integrity programs, as well as greater sharing of data and coordination of enforcement activities between all affected government agencies;
- Revision of the Industrial Safety Ordinance currently in effect in Contra Costa County to require facilities to determine the effectiveness of the safeguards documented in the Process Hazard Analysis; to incorporate stronger requirements for the use of "inherently safer" systems and materials; and, to consider establishment of similar ISOs in other California counties where oil refining occurs;
- Revision of Cal/OSHA's regulation on "Process Safety Management of Acutely Hazardous Materials", to require improvements to mechanical integrity and Process Hazard Analysis programs for all California refineries, and require the incorporation of applicable industry best practices and inherently safer systems and materials to the greatest extent feasible;
- Increased use of advanced methodologies for hazard analysis and evaluation of safeguards by industry and government agencies, including use of both "lagging" and "leading" indicators – which provide early and later warning signs – to monitor and evaluate refinery performance; and,
- Greater dissemination to the general public and between collaborating government agencies, the results of hazard analyses and performance evaluations conducted by the refineries themselves and by government agencies.

Chevron's internal incident investigation also contained a series of recommendations for the corporation going forward. Several of these recommendations mirror those of the CSB and the abatement requirements arising from the Cal/OSHA citations. These include:

⁷ Recommendations from the Chemical Safety Board are advisory in nature and are not legally binding on any party.

- Piping circuit inspections that include “appropriate damage mechanisms using a standardized methodology and documentation system”⁸;
- Changes are needed in inspector training and competency, oversight of mechanical integrity, inspection plans and escalation procedures; and,
- Revised policies and checklists so that process safety and inspection information is “considered when evaluating leaks and addressing the issue of whether to shut down or continue operation of equipment.”

⁸ Damage hazard mechanisms are further discussed in Section F.3.c.

E. Findings

1. Oversight and Coordination

Regulatory agencies with responsibility for refinery oversight have overlapping jurisdictions, and no single state or local regulatory entity has a complete picture of the compliance status of a refinery. Multiple agencies with varying authority engage in relatively limited information sharing about regulatory compliance requirements. Overall coordination among the various agencies that regulate refineries is also limited. Improved coordination, communication and oversight are essential and will result in smarter, more targeted enforcement, while avoiding the potential for inconsistent and unnecessary regulatory requirements. Improved coordination will also increase opportunities for exploring innovative approaches to improve refinery safety and performance (*see Recommendation F.1*).

2. Emergency Response and Preparedness

The Chevron incident revealed shortcomings in the corporation's emergency response protocol, difficulties in coordination between emergency responders, and challenges in communicating with surrounding communities regarding health risk and appropriate actions. Emergency response by refineries and state and local agencies will likely be inadequate unless coordination is improved and other changes are made to existing emergency planning and preparedness programs.

Regulatory Background

The lead agency responsible for emergency response coordination at the state level is the Governor's Office of Emergency Services. Cal OES develops the State Emergency Plan, which includes various emergency functions that address specific emergency planning topics. Cal/EPA is the lead agency for the Emergency Function for Hazardous Materials and Oil (EF-10), an Annex to the State Emergency Plan. Cal/EPA also oversees the 83 local Certified Unified Program Agencies, which have the responsibility to produce Area Plans for Hazardous Materials Emergency Response and to oversee facility-specific Hazardous Materials Business Plans to prevent or minimize releases of hazardous materials. Area Plans and Business Plans are part of the six Unified Hazardous Waste and Hazardous Materials Management programs which fall under CUPA responsibility. In addition to these responsibilities, CUPAs have other duties as determined by their local government that include participating on local Hazardous Materials (HazMat) teams to varying degrees.

The Area Plan is the local government blueprint for response to a hazardous materials release or threatened release. Area Plans must include requirements for multi-agency notification and coordination, impact minimization and emergency response. Agencies covered by Area Plan provisions

include law enforcement, fire services, medical and public health services, poison control centers, and care and shelter services. State law and regulations establish minimum standards for these plans.

In preparing and amending Area Plans, CUPAs incorporate information collected from the Hazardous Materials Business Plans submitted annually by refineries and other facilities that handle hazardous materials. Because the Business Plans identify hazardous materials at the facilities, they are useful to determine the appropriate level of emergency planning necessary to respond to a release. The Business Plan regulations also require businesses to prepare a site map, develop an emergency response plan, and implement a training program for employees.

California emergency response agencies at the local and state level use the Incident Command System to assure command and control for any major disaster, establishing a Unified Incident Command to ensure that all agencies are working together and a Joint Information Center to coordinate communication with the public. Refineries and other facilities are obligated to immediately report a significant release of hazardous materials to local emergency responders, CUPAs and the State Warning Center.

The federal Emergency Planning and Community Right-to-Know Act (EPCRA) also requires facility owners to submit inventories of hazardous materials and report certain accidental releases that must be included in EPCRA. Additionally, EPCRA requires the following elements: (1) a State Emergency Response Commission (SERC); and (2) Local Emergency Planning Committees (LEPCs). Cal OES provides staff support to the SERC and the six LEPCs across California. The LEPCs are intended to serve as a forum for discussion and public input and for stakeholders and agencies to work together on training and other hazardous materials emergency planning activities at the local level.

Findings

The Working Group made the following specific findings about emergency response protocols.

2.1 Area Plans

Hazardous Materials Area Plans do not have a specific element for refineries but are instead written as general response guidance. Refineries are uniquely dangerous and capable of generating significant fires, and plumes of toxic smoke, chemicals and vapors in communities. Refinery-specific elements in Area Plans could help improve overall community preparedness in the event of an emergency such as the Chevron incident. Some specific deficiencies identified include the following:

a. Alignment of Radio Communications Between Response Officials

The refinery and the responding public fire agencies did not communicate or could not communicate with one another on the same radio frequency during the response to the Chevron

incident. When on-site fire brigades and public fire agencies operate on different radio frequencies during a disaster, they cannot communicate and coordinate their efforts (*see Recommendation F.2.1.a*).

b. Establishment of a Unified Incident Command and Joint Operation Center.

The refinery and the local agencies did not establish a Unified Incident Command (UIC) and a Joint Operation Center (JOC) with a Joint Information Center during the Chevron incident. This hampered the ability of the response agencies to rapidly assess the public health risk associated with the fire and translate that into actionable information for other entities including local hospitals (*see Recommendation F.2.1.b*).

c. Plans and Protocols to Protect Persons Outside of a Refinery

Area Plans generally do not address issues such as how to alert and direct public transit systems during a release or fire. For example, during the Chevron incident, the Bay Area Rapid Transit (BART) system and Amtrak had no guidance from responding agencies about what actions to take. Gaps also exist for alerting and directing businesses and public agencies, such as utilities and public works agencies, potentially putting workers in danger. In addition, there are generally no protocols for how to deal with public spaces such as shopping malls where people may congregate. These issues could be better managed at the time of an incident with a Unified Incident Command, and Area Plans could specify how to address these issues (*see Recommendation F.2.1.c*).

d. Drills and Exercises

Local emergency response professionals throughout California underscored the importance of regular practice exercises and drills with refinery and public emergency response teams. In practice, the frequency of drills varies significantly. Contra Costa County engages in drills at least annually with each of their four refineries, whereas drills are less frequent in other areas. It can be financially difficult for local agencies to provide response resources and cover the cost of emergency exercises and drills (*see Recommendation F.2.1.d*).

e. Preparation for Airborne Releases

Area Plans often do not include any design, technical review, or advisory role for the ARB, even though worst-case scenarios often involve serious toxic air contaminant releases. Review of Area Plans by local air districts and the ARB, especially in all communities with refineries and other large facilities that could release toxic air contaminants, could help ensure that the plans incorporate appropriate information and responses (*see Recommendation F.2.1.e*).

2.2 Assessment Plan for Monitoring of Toxic Air Contaminants

The Chevron incident highlighted the need to evaluate emergency air monitoring protocols and capabilities. Accidental air emissions at industrial facilities are generally short-lived, and therefore local air districts play an important role in monitoring at the time of the event. While a statewide air monitoring network exists, it is primarily designed to track compliance with long-term state and federal air quality standards. The technical capability to monitor, evaluate and report local releases of toxic air contaminants on a real-time basis following an industrial accident or other unplanned release varies among local air pollution control districts. Air districts would benefit from an assessment of the best preparedness and response practices and emerging technologies that would enable them to determine real-time exposures to airborne emissions during local emergencies. Furthermore, increased coordination between the local air districts, public and environmental health departments, the CUPAs, and local hazardous materials responders will help provide enhanced local response for future refinery incidents (*see Recommendation F.2.2*).

2.3 Early Notification of Release or Threatened Release of a Hazardous Material

Reporting requirements when there is a leak or release of a hazardous substance are not well defined, making them challenging to comply with and enforce. Under California Health & Safety Code Section 25504 (b), the Business Plans for refineries must contain emergency response plans and procedures to govern their activities “in the event of a reportable release or threatened release of a hazardous material.” These plans must require “immediate notification to the administering agency and to the appropriate local emergency rescue personnel”, as well as notification to the State Warning Center. The term “immediate” is not defined, nor is the size or nature of the release that triggers the requirement. As a result, refineries do not always notify local agencies promptly when there is a leak or possibility of fire. During the Chevron incident, for example, the company failed to immediately notify local agencies after the leak, and finally made the initial call eight minutes after the fire broke out (*see Recommendation F.2.3*).

3. Safety and Prevention of Hazardous Events

The three investigations of the Chevron incident raise significant concerns about ongoing refinery practices and prevention of future accidents. Each of the investigation reports identified incomplete or inadequate policies and procedures at the Richmond refinery, incomplete or ineffective implementation of existing policies and procedures, a failure to evaluate the pipe safety problem during the Process Hazard Analysis, and a failure to act on internal reports about hazards (reports that were not made available to regulatory agencies).

While the investigation reports focused on the Chevron Richmond refinery, the findings raise significant issues relevant to the state's 14 other oil refineries. Following the Richmond incident, for example, Cal/OSHA found a similarly corroded pipe in a crude unit at Chevron's El Segundo refinery. More general trends in refinery safety also give rise to concern. According to CSB, as well as the RAND report noted above, the U.S. oil industry's safety record is inferior to its global counterparts. A 2008 report by the insurer Swiss Re found accident-related losses four times higher at U.S. refineries than the rest of the world. Additionally, in recent Congressional testimony, U.S. OSHA officials stated that the same causal factors leading to the Richmond refinery incident in August 2012 could be found throughout the country's oil refineries. U.S. OSHA also reports that refinery managers fail to take steps to prevent catastrophic accidents even after serious accidents have occurred. As a result, U.S. OSHA implemented a National Emphasis Program in 2007 to comprehensively inspect the process safety management programs of most of the nation's refineries because of persistent problems in refinery performance. Unfortunately, that program ended in 2010 due to resource constraints.

The Working Group concludes that refinery safety in California can and must be improved. But prevention of dangerous events at California refineries is complicated by the fact that refineries are highly complex environments requiring specialized expertise and information to detect potential hazards. Other challenges identified at the stakeholder meetings include: California refineries are aging; they are processing higher sulfur crude which increases corrosion; maintenance is often deferred; and, worker and contractor training may not always be adequate.

Regulatory Background

The federal Clean Air Act Amendments of 1990 (United States Code, Title 42, Section 7412(r)) required the U.S. EPA to promulgate rules to prevent accidental releases of regulated substances and reduce the severity of releases that do occur. Congress required that the U.S. EPA program be coordinated with a comparable U.S. OSHA process safety management program.

In response to Congressional directive, U.S. OSHA adopted the federal Process Safety Management standard in 1992, and the California Department of Industrial Relations (DIR) adopted the state's PSM standard (California Code of Regulations, Title 8, Section 5189) pursuant to its mandate to adopt standards that are at least as effective as U.S. OSHA standards. DIR, through Cal/OSHA, administers and enforces this standard. The purpose of the PSM standard is to prevent releases of hazardous chemicals that could expose employees and others to serious hazards. After the 1999 fire at the Tosco Refinery in Martinez, California, which killed four workers, the state established a dedicated Process Safety Management Unit. Cal/OSHA's PSM Unit is the only such dedicated program in the nation.

U.S. EPA adopted the federal Chemical Accident Prevention Provisions (CAPP), also known as the Risk Management Plan Rule, in 1996. These regulations require facilities to submit risk management plans

(RMPs) if they have more than a threshold quantity of a regulated substance in a process. The RMPs must include a hazard assessment of the facility, an accidental release prevention program, and an emergency response program (Code of Federal Regulations, Title 40, Chapter I, Subchapter C, and Part 68). California had previously adopted its own accidental release prevention program, and amendments to this program in 1997 created the current California Accidental Release Prevention Program (California Health & Safety Code, Division 20, Chapter 6.95). The CalARP program operates in parallel to the federal CAPP regulations with certain state-specific requirements. Cal OES administers CalARP as part of the State's Unified Hazardous Waste and Hazardous Materials Management Program and the CUPAs implement the program at the local level. The purpose of the CalARP program is to prevent accidental releases of substances that can cause serious harm to the public and the environment, to minimize the damage if releases occur, and to satisfy community right-to-know law.

The requirements of the Cal/OSHA PSM program and the CalARP program are very similar because the same industrial processes affecting workers may also affect public health and the environment. Both programs include requirements related to process safety information, process hazard analyses, mechanical integrity, and management of change. The difference is in focus; Cal/OSHA's PSM program focuses on potential on-site chemical releases and processes that affect the health and safety of workers, while the CalARP RMP focuses on potential off-site chemical releases and emergency response.

In 1998, Contra Costa County adopted County Ordinance Chapter 450-8, the Industrial Safety Ordinance. The ISO expands on the CalARP program for refineries and chemical plants that are already required to submit an RMP. Although the Contra Costa County ISO only includes facilities in unincorporated portions of the county, the City of Richmond adopted an Industrial Safety Ordinance in 2000 (Municipal Code Chapter 6.43, RISO) that is similar to the County's. The Chevron refinery located in the City of Richmond is subject to this ordinance. The purpose of the ISO is to prevent accidental release of hazardous chemicals; improve accident prevention by soliciting participation from industry and the community; and, conduct periodic audits of the plans and inspections of the industrial plants.

The PSM and the CalARP programs, as well as the Contra Costa County ISO, require refineries to submit and regularly update safety plans. The safety plans must describe a number of elements of a safety program, including a hazard review, written operating procedures, worker training requirements, maintenance requirements, compliance audits, and incident investigation procedures.

Evaluation of Existing Programs

The Working Group studied the Cal/OSHA PSM program, the CalARP program, and the Contra Costa County ISO to identify areas for improvement. Overall, the Working Group concluded that the ISO contains the most far-reaching provisions and holds the most promise for improving safety. Specifically, the ISO expands significantly on the PSM and the CalARP program by requiring:

- A safety plan that is a public document, and which must be submitted to the local CUPA (in the case of Chevron, to the Contra Costa Health Services);
- A root cause analysis, performed by the facility, as part of their incident investigations for major chemical accidents or releases, and submission of the root cause analysis report to the CUPA (*see Recommendation F.3.1.d*);
- A Human Factors Program is required for certain elements, including the Process Hazard Analysis, operating procedures, incident investigation, training, and managing change to the emergency response and operations organizations (*see Recommendation F.3.1.e*);
- An independent incident investigation, including a root cause analysis, by the county at the county's discretion;
- Consideration and evaluation of inherently safer technologies and materials by the refineries in some decisions (*see Recommendation F.3.1.a*); and,
- Public meetings after safety plan reviews and preliminary audits by the county.

The Working Group also identified significant areas for improvement based on specific gaps in the ISO, the CalARP program and the Cal/OSHA PSM regulation:

- The Contra Costa County ISO is only valid in unincorporated areas of the county, and the City of Richmond's ordinance was not as extensive as the Contra Costa ordinance at the time of the Chevron accident. Although the City of Richmond has amended its ISO to conform to the county's model, other cities and counties that contain refineries do not have an ISO. There is no statewide consistency.
- Both the Contra Costa County and City of Richmond ISO contain permissive or discretionary compliance language, which limits enforceability of some provisions of the ordinance.
- Under the ISO, refineries are only required to implement inherently safer systems to the extent feasible, are only required to do so during Process Hazard Analysis, and inherently safer systems are only required in new construction but not in rebuilds, repairs, or corrective action. Although documentation is required when a refinery rejects an inherently safer system as infeasible, the ordinance does not require the refinery to provide supporting documentation to show that any selected system is inherently safer, making it difficult or impossible for agencies to verify the claim (*see Recommendation F.3.1.a*).
- The CalARP program only requires the refinery to conduct a compliance audit every three years and to maintain a copy of the audit on site, a schedule not frequent enough to ensure compliance with regulatory requirements (*see Recommendation F.3.2*).
- The CUPA is required to evaluate the CalARP RMP at a refinery "periodically" and conduct inspections for compliance only once every three years (*see Recommendation F.3.2*).
- The Cal/OSHA PSM regulation and the CalARP program describe procedures that refineries must follow to prevent catastrophic releases of toxic, reactive, flammable, or explosive chemicals, but

do not specify exactly how the employer will carry out those procedures. This can leave regulators without clear interim benchmarks or authorization to use all available methods of evaluating the safety performance of refineries (*see Recommendation F.1.1*).

- The PSM regulation and the CalARP program do not explicitly authorize Cal/OSHA or the CUPAs to evaluate and enforce the following aspects of process safety: inherently safer systems; use of indicators to evaluate performance; the impact of human factors on safe operations; management of change when applied to organizational shifts; damage mechanism hazard review as part of the standard Process Hazard Analysis; effectiveness assessments of the Process Safety Analysis safeguards; and, an assessment of the safety culture at the facility (*see Recommendation F.3.1*).

In addition to the above limitations in the three existing safety structures, the Working Group identified pervasive issues relating to enforcement capacity, including serious limitations in staffing of regulatory agencies; difficulty hiring, retaining, and training inspectors with the necessary skill set; lack of mechanisms for information sharing and coordination among agencies with overlapping or complementary jurisdictions; and, insufficient penalties to create meaningful deterrence. For example, in response to Cal/OSHA's findings of 25 willful and serious violations at Chevron, the maximum penalty Cal/OSHA was statutorily authorized to assess was \$963,200. Air districts for their part are limited to penalties no greater than \$10,000 for releases of toxic air contaminants that constitute an air toxics nuisance. These penalty amounts are unlikely to provide a meaningful deterrent to noncompliance, considering that average revenue at California refineries exceeds \$185 million per day.⁹ Finally, there is a significant data and transparency deficiency. Refineries are not required to provide regulatory agencies with critical information that could help agencies assess safety and plan for effective oversight and prevention, including self-inspection reports, certain testing reports, and turnaround work plans and schedules (a turnaround is a planned, periodic shut down of a refinery process unit or plant to perform inspection, maintenance and repair work) (*see Recommendation F.3.3*).

4. Community Education and Alerts

The investigative reports and stakeholder meetings highlighted shortcomings in communication of emergency alerts and other relevant information to the public. These include:

1.1 Emergency Alerts and Public Education

⁹: California Energy Commission analysis of weekly refinery data and Oil Price Information Service pricing information.

During the Chevron incident, nearby residents immediately saw the rapidly forming black cloud from the refinery, but had little sense of the severity of the situation or what individual actions they should take in response, including what to do when the siren alert sounded. Furthermore, the auditory alarms and automated phone systems in place were not widely heard. The reverse 911 system used to communicate a warning and shelter in place to the surrounding communities did not work as expected during the incident, and calls were delayed to some people for hours.

At the local and state level, the Incident Command System is used to establish a Unified Incident Command and establish a Joint Information Center (JIC) to coordinate public communication. During the Chevron incident, the local agencies did not establish a Joint Operation Center (JOC) and JIC. As a result, communication with the public was not well-coordinated. This resulted in conflicting statements being made by responding agencies and confusion among members of the public and local health care providers.

Moreover, relatively few people in Richmond had registered in the local Community Warning System (CWS) for cell phone alerts during emergencies, and there were no other mechanisms at the time of the incident for alerting people via email, text, or other electronic means. Overall, information was poorly disseminated to the public and other media sources.

More generally, the Working Group found that members of local communities and the public do not have consistent, accessible, adequate and timely information about refinery safety risks, preventive measures, emergency procedures, and different agencies' roles and responsibilities relating to these areas (*see Recommendation F.4.1*).

4.2 Public Involvement in Emergency Planning

Currently, the main mechanism for public involvement in local emergency response specific to chemical hazards is through the Local Emergency Planning Committees (LEPCs), established pursuant to the federal Emergency Planning and Community Right-to-Know Act (EPCRA). As required by EPCRA, LEPCs must be comprised of the public, industry and government. The six LEPC regions in California cover very large geographic areas, making the involvement of community members difficult because of travel time and expense of attending meetings. The large geographic areas covered by LEPCs also contribute to the loss of a sense of community. LEPC duties and functions depend on voluntary efforts by individuals. Many of the LEPCs in California are fairly inactive and several have not updated their emergency plans on a regular basis, as required. Since California law directs the CUPAs to collect and make available to the public chemical information from facilities, LEPCs, which are not aligned geographically or functionally with the CUPAs, have become disconnected from community right-to-know efforts in California (*see Recommendation F.4.2*).

1.3 Public Involvement in Air Monitoring Improvements

ARB and local air districts currently make hourly ambient air monitoring data from the existing network for particulate matter and ozone readily accessible on the Internet. But people living near refineries generally have limited or no access to immediate data on toxic air contaminant levels in the community or information on associated health risks. More comprehensive and timely information on the latter should be gathered and made available on the Internet (*see Recommendation F.4.4*).

1.4 California Air Response Planning Alliance

The California Air Response Planning Alliance (CARPA) is a statewide organization that consists of representatives from Cal OES, Cal/EPA, ARB, the Office of Environmental Health Hazard Assessment (OEHHA), U.S. EPA, local air districts, health officers, and other first responders. CARPA was formed to help develop standard procedures and statewide capabilities to monitor sudden air releases following a disaster and to provide technical expertise to evaluate the risk of exposure to the public. CARPA may be a resource that can be used in planning, preparedness, training, and exercise efforts of enhanced community-based monitoring for airborne release emergencies (*see Recommendation F.4.5*).

F. Recommendations

The Working Group recommendations fall into four broad categories: (1) improved agency coordination through the establishment of an Interagency Refinery Task Force; (2) emergency management and response; (3) safety and prevention; and (4) education and outreach to the public.

1. Interagency Refinery Task Force

An Interagency Refinery Task Force will be created to carry out the recommendations contained in this report and to promote more coordinated agency oversight of refineries.

The Task Force will work with state, federal and local agencies to facilitate and monitor the implementation of recommendations in this report. While the process has identified a number of initial recommendations, other concepts will require additional study, experience and discussion to ensure they meet California's needs.

The Task Force will be located within the California Environmental Protection Agency, building on the agency's experience overseeing 83 local Certified Unified Program Agencies, coordinating the implementation of the Unified Hazardous Material Program, and developing and managing the California Environmental Reporting System, a statewide electronic reporting database.

The Task Force will be formed by September 1, 2013.

Participating agencies will include: Cal OES, Cal/EPA, ARB, DTSC, SWRCB, DIR, Cal/OSHA, DPH, the California Emergency Medical Services Authority (EMSA), and OSFM. U.S. EPA, CUPAs, and local air pollution control districts in locations where refineries operate will be invited to participate as members of the Task Force.

The Interagency Refinery Task Force is not a substitute for state and local agency activities. Rather its role will be to better coordinate each agency's individual functions and to facilitate information sharing, with the goal of ensuring that refineries comply with all regulatory requirements and continue to improve and enhance protections for workers, communities and the environment. One of the benefits and challenges of the Task Force will be to bridge the gap between agencies with distinctly different mandates.

Specifically, the Interagency Refinery Task Force will complete the following tasks:

- 1.1. Enhance coordination of oversight and enforcement activities by regulatory agencies, including the following:
 - a. Facilitate coordination of enforcement activities, including cross-referrals, cross-training, and joint or coordinated inspections and auditing, as appropriate;
 - b. Communicate to workers and communities information about the availability of hotlines to report potential violations to the state, and create a system to ensure that agencies share information about refinery-related calls from all systems, including web-based complaint systems and call lines;
 - c. Analyze patterns and trends in refineries' worker safety and environmental performance to determine if additional regulatory authority is needed and to encourage the adoption of industry best practices at refineries, and identify what additional information is needed from refineries to enable regulatory agencies to provide more effective oversight;
 - d. Facilitate the development of an information and data sharing system among state, local and federal agencies to include information about inspections, compliance, injuries, emissions, and enforcement activity as well as the means to collect information identified in reports, a process for timely flow of information and a process for public dissemination; and,
- 1.2 Designate a "Refinery Information Officer" to provide a state-level, single point of contact for the public regarding the regulation and safety of refineries in California. The Refinery Information Officer will be a catalyst for improved public participation, education and outreach about refinery emissions and releases, safety metrics, regulatory compliance status, emergency planning and response, and the roles of various agencies. The Refinery Information Officer will be a member of the Interagency Refinery Task Force and will work with local, state and federal regulatory agencies to coordinate public participation efforts by the various regulatory programs, including regularly scheduled public updates to communities surrounding refineries.
- 1.3 Establish forums in northern and southern California for ongoing dialogue among industry, labor, community, environmental groups and regulators. These "Refinery Safety Forums" should focus, among other things, on joint learning, sharing of good process safety practices among California refineries, examination of performance metrics, root cause analysis of incidents, and other issues proposed in this report for further evaluation .

- 1.4 Continue the more technically-oriented “Contra Costa County Community Awareness Emergency Response Group Safety Summits”. These meetings currently bring government agencies, industry and labor together on a regular basis to discuss more detailed issues about prevention of refinery hazards and incidents. Similar meetings should be set up for southern California.

The Working Group will estimate the costs to implement the Task Force program and identify mechanisms for covering these costs. Costs should be funded through fees on refineries operating in California.

2. Emergency Response and Preparedness

The Working Group found broad-based consensus for strengthening existing protocols for refinery-specific emergency response systems, particularly the need for increased communication and coordination efforts.

Emergency preparedness and response activities should continue to be led by Cal OES, with ongoing delegation of emergency functions related to hazardous materials and oil spills to Cal/EPA. These agencies will work together, with the CUPAs and other state and local agencies, to implement the following recommendations by January 2014.

The Working Group recommends the following measures:

1.1 Improved Area Plans

Cal OES should require counties with refineries to develop a specific element in their Hazardous Materials Area Plan for refinery response. These refinery-specific elements must, at a minimum, include the elements described below:

a. Alignment of Radio Communications between Response Officials

Federal Communications Commission (FCC) Rule 90.523 allows a nongovernmental fire department to operate on the same radio frequency band as a governmental fire agency when they are supporting each other.

Cal OES will ensure that local Area Plans require that refineries, and other facilities that could be subject to fire or explosion, obtain approval for joint operations with local fire departments on each other’s

Recommendations on Emergency Response and Preparedness: An Overview

Better coordinated and more effective emergency response will require Cal OES to:

- 1. Work with CUPAs to create refinery-specific elements in Hazardous Material Area Plans*
- 2. Clarify reporting thresholds during hazardous materials release or threatened release*

Additionally, the Air Resources Board and California Air Pollution Control Officers Association are developing a plan to improve toxic air contaminant monitoring.

communications systems. In addition, Area Plans should include protocols for those joint operations and communication.

In the interim, or in the absence of such approval, responders should leverage existing communications systems that provide interoperability in the area (e.g. East Bay Regional 700 MHz P25 Trunked Radio Communications System). Such systems should be incorporated into Area Plans as a back-up communications system that will work for all responders.

In addition, Cal OES should require the CUPAs to establish operation protocols and procedures with agency fire department communications centers for refinery incidents and establish periodic testing of the communications systems between agencies to keep staff current on operations and to identify issues with the systems that may require repair or service.

b. Establishment of a Unified Incident Command and Joint Operation Center

Area Plans must include clearer criteria for the scale and scope of an incident that requires establishment of a Unified Incident Command. In general, any incident that requires significant communication with the public, the media, and medical facilities should trigger establishment of a Unified Incident Command and Joint Operation Center. The Joint Operation Center should be responsible for supporting the Incident Command and would deal with off-site consequences and recovery. It should include the county and city as well as regional and state representatives. Additionally, a Joint Information Center, controlled by a public agency, should be located in the Joint Operation Center to ensure that communications with the public are accurate and timely. A health officer should oversee the release of health-related information.

c. Plans and Protocols to Protect Persons Outside of a Refinery

Area Plans must be enhanced to include provisions for how to evaluate, manage, and communicate with entities that may need to act to protect groups of people. Specific consideration should be directed toward plans for working with public transit agencies, railroads, utilities and other employers that may have workers in the field, and locations (such as malls) where people congregate.

d. Drills and Exercises

Area Plans must include adequate and specific requirements for training and exercise schedules. Additionally, public response agencies and the refinery fire department should be required to train together and conduct at least annually an on-site exercise to assure that all systems work, and that the participants know how to use those systems and how to work with one another to implement the response plan.

e. Preparation for Airborne Releases

The ARB and local Air Quality Management Districts should be involved in the technical evaluation of Area Plans and in ongoing partnerships with CUPA programs, especially in areas where there are refineries or other potential major sources of toxic air releases. The partnership should include Area Plan design, technical review, cross-training, preparedness exercises, coordination and communication.

1.2 Assessment Plan for Monitoring of Toxic Air Contaminants

ARB, in collaboration with CAPCOA, has prepared a project plan to identify, evaluate and recommend improvements to state and local air monitoring practices and define statewide best practices in the event of a refinery accident involving the release of toxic air contaminants (a copy of the plan will be released shortly). The project will include expert and public involvement, and will examine opportunities to use atmospheric modeling and monitoring programs for two purposes: (1) provide the public with information about potential exposures in the event of an unplanned release; and (2) provide local agencies with exposure estimates to help alert the public during an incident. This effort is scheduled for completion by October 1, 2014.

1.3 Early Notification of Release or Threatened Release of a Hazardous Material

The Business Plan requirements applicable to refineries currently require “immediate” reporting of a hazardous materials release or threatened release. Cal OES should consider regulations to clarify key terminology in Health & Safety Code 25504(a), specifying criteria for reporting thresholds and a clearer definition of “immediate.” A significant vapor cloud release, such as in the Chevron incident, would certainly be defined as a release of hazardous material, as would any leak that requires the refinery fire department to respond, or a leak that occurs on specific high risk units.

3. Safety and Prevention of Hazardous Events

In light of the input from stakeholders and the analysis of existing programs, the Working Group identified a set of immediate actions that should be taken, and several longer-term issues for investigation, in order to improve safety and prevention of hazardous events. Ultimately, some safety approaches, such as the safety case model, may hold promise but require careful evaluation to assure likelihood of success in California. For the near-term, the Working Group evaluated ways to improve existing regulations, guidelines and activities designed to reduce risks and improve safety at refineries. The recommended actions could be implemented through regulation or statute. For example, enforceable requirements for inherently safer systems could be incorporated into the CalARP and PSM programs, or they could be required in legislation adopting major components of the Contra Costa County ISO into California law.

Immediate Actions

3.1 Strengthen PSM Programs

Five state-of-the-art prevention strategies must be incorporated into the CalARP and Cal/OSHA PSM programs and made enforceable statewide. These strategies include: (1) the adoption of inherently safer systems, (2) use of safety culture assessments, (3) incorporation of damage mechanism hazard reviews, (4) root cause analyses requirements, and (5) required consideration of human factors. The Working Group further identified some additional necessary changes to the CalARP program.

Finally, several changes are needed to strengthen agency enforcement authorities and provide agencies with additional information to improve oversight. These actions are described in more detail below.

a. Require Refineries to Implement Inherently Safer Systems

The intent of inherently safer system requirements is to ensure that refineries incorporate the greatest degree of hazard reduction, to the maximum extent feasible, in order to avoid major accidents or releases. The focus is on adopting measures that are permanent and inseparable from the production process, as opposed to adding on equipment or installing external layers of protection. For example, had an inherently safer system approach been in place at its Richmond refinery, Chevron would have been forced to demonstrate why continuing to use low-silicon metal susceptible to corrosion was the best solution, given other inherently safer options. Under the requirements of this program, refineries would be required to report the methodologies, documented findings, rationale, and conclusions used to select particular systems, during PHA as well as during rebuilds, repairs, corrective action, and incident investigation. This can be done by strengthening current Cal/OSHA PSM requirements and CalARP RMP requirements through either rulemaking or legislation.

b. Require Refineries to Perform Periodic Safety Culture Assessments

An organization's safety culture is reflected in the way risk is perceived, specific incidents and situations are addressed, and priorities are adjusted during day-to-day decision making. Safety culture for any organization is difficult to assess. Nonetheless, assessments of safety culture can help increase safety orientation and decrease incidents. Safety culture assessments can also help regulators evaluate whether the refinery's focus on safety remains at a high level over time, and provide facility operators the opportunity to address deficient practices. Refineries should be required to conduct safety culture

5 Prevention Strategies for Statewide Programs

Existing State prevention programs should be strengthened to require refineries to:

- 1. Implement inherently safer systems*
- 2. Perform periodic safety culture assessments*
- 3. Conduct damage mechanism hazard reviews*
- 4. Conduct a root cause analysis after significant accidents or releases*
- 5. Explicitly account for human factors*

assessments at least every three years. Such a requirement can be done by strengthening current Cal/OSHA PSM requirements and CalARP RMP requirements through either rulemaking or legislation.

c. Require Refineries to Conduct Damage Mechanism Hazard Reviews

Current PSM and CalARP programs require facilities to include a Mechanical Integrity Process Safety element. The Mechanical Integrity element requires facilities to ensure the mechanical integrity of processes through purchasing of new or replacement equipment, performing inspections, and other actions. But current regulation does not require that a type of analysis known as damage mechanism hazard review be conducted at refineries. This review analyzes risks presented by all process failure mechanisms at refineries, including corrosion, stress cracking, damage from high temperatures, and mechanical or metallurgical assisted degradation, and should be included as part of the Mechanical Integrity element.

In addition, the results of the damage mechanism hazard reviews, as well as other Mechanic Integrity reviews currently required, should be explicitly incorporated in the information provided to Process Hazard Analysis teams at refineries. Current regulation (both the Contra Costa County ISO and Title 8 PSM regulations) requires that these results be used by Process Hazard Analysis teams at refineries, and it is critical that these teams have the expertise to understand this information.

d. Require Root Cause Analysis After Significant Accidents or Releases

When accidents occur, it is necessary to know why they happened so that similar accidents may be prevented in the future. Incident investigation procedure under current state and federal law require facilities to document findings and recommendations, and identify contributing causes. However, understanding root causes, or “why” an incident occurred, is recognized by industry safety experts as necessary to address the fundamental underlying problems and prevent recurrences. Facilities that fall under Contra Costa County’s ISO are required to perform a root cause analysis as part of their incident investigations for major chemical accidents or releases, and to submit the root cause analysis report to Contra Costa Health Services. The root cause analysis reports are made available to the public. These requirements are broader than those currently existing at the federal or state level and should be established statewide. The CalARP and PSM Incident Investigation procedures must be strengthened to require a root cause analysis for significant chemical accidents or releases. This should be done by amending current PSM and CalARP programs through either rulemaking or legislation.

e. Require Refineries to Explicitly Account for Human Factors

Human limitations and needs must be considered to manage and reduce error. The outcome of a certain activity or task can be strongly affected by the operational procedure followed, the performance level or skill required, and existing safeguards. Two approaches can help address this issue: (1)

Management of Change processes should include personnel change, such as how a new operator within a unit, or altered shift schedules for inspectors, may affect emergency response, and (2) human factors analysis should provide a better understanding of the very real human element in facility operations and incident prevention. Federal and state regulations require human factors to be considered during Process Hazard Analysis. However, these factors are not a required consideration in any other processes under the PSM or the CalARP programs.

The Contra Costa County ISO requires that Management of Change procedures encompass staffing changes, including reorganization in operations, maintenance, health and safety, or emergency response. The ISO also requires a human factors program to be conducted for all covered facilities. California's PSM and CalARP regulation should be amended so that its requirements for human factors and Management of Change are substantially equivalent to that of the Contra Costa County ISO. This should be done by amending current PSM and CalARP regulations through either rulemaking or legislation.

3.2 Strengthen the CalARP Program

The CalARP program must be strengthened in the following additional ways: (1) refineries should conduct an annual compliance audit and provide the audit to the CUPA, and (2) CUPAs should evaluate the CalARP RMP at a refinery and perform an inspection at least annually.

3.3 Strengthen Enforcement Capacity

There are several actions that should be taken to strengthen the enforcement capabilities of regulatory agencies: (1) increase the maximum penalty amounts for violations of health, safety and environmental requirements so they provide a stronger incentive for compliance; (2) provide agencies with sufficient resources to carry out effective regulatory oversight of refineries. This year's budget directs Cal/OSHA to use its existing fee authority to fund an additional 15 positions for inspectors in the PSM program, which is a very helpful start; and (3) require refineries to provide regulatory agencies with timely information about operations critical to effective oversight and monitoring, including inspection reports, certain testing reports, and turnaround work plans and schedules, with appropriate safeguards to ensure confidentiality.

Recommendations for Further Study

The Working Group recommends that the Interagency Refinery Task Force review the following areas for future action.

3.4 Process Safety Leading and Lagging Indicators

Indicators are a standard method of measuring and evaluating performance over time, and they can help identify actions to improve performance and reduce hazards. Indicators can also provide insight into a factor that is more difficult to measure directly, such as safety. Designing strong “leading” and “lagging” indicators can potentially drive continuous process improvement at refineries. Leading indicators are predictive and used to identify potential weakness in safety systems early on to allow potential corrective action (e.g., whether various activities have been completed on schedule, number of open incident investigations, etc.), while lagging indicators are retrospective and may indicate the potential for recurring problems (, e.g., number of PSM incidents that have occurred, number of injuries or releases). The Interagency Refinery Task Force will review literature and guidance on leading and lagging indicators currently existing internationally and in the U.S., and in consultation with the Refinery Safety Forums, develop recommendations for appropriate indicators and how they should be used.

3.5 Worker Involvement

The Interagency Refinery Task Force will convene a labor-management committee to identify effective methods to fully involve workers in investigating hazards, recommending corrective actions, and providing input in the risk management decision making process, while considering current employee participation requirements under CalARP regulation. One approach to consider is the “Triangle of Prevention” strategy developed by the United Steelworkers to report and investigate incidents and near misses, analyze root causes, recommend and track solutions based on a hierarchy of controls, and learn and share lessons. The committee should also identify stronger methods to prevent retaliation against workers who report unsafe conditions to either management or government agencies, or who exercise their rights under company safety programs to shut down unsafe operations.

3.6 Safety Case Approach

Several countries have adopted the “safety case model” to reduce risks in complex industrial processes such as refineries. Under this model, government agencies license and permit the operation of a facility based on a comprehensive safety plan (the employer’s “safety case”) covering all aspects of the operation, which is evaluated by government regulators. The safety case model relies on industry expertise in self-policing, but it may also allow workers to participate more fully in safety decisions. The experience of the countries where the safety case model has been established indicates several prerequisites for success, including:

- A designated unit dedicated to enforcement at complex facilities and a large number of inspectors to conduct the initial licensing evaluation and periodic audits;
- A specialized skill set and a high competence level among inspectors, including chemical and mechanical engineers, process plant operators and social science experts able to evaluate human factors, training effectiveness, safety culture, and other factors;
- Salaries and benefits that typically are higher than other regulatory compliance officers in order to hire and retain highly qualified inspectors;
- A dedicated funding source (general fee, licensing or certification fees, fees for service) paid by the industry; and,
- A substantial change in the regulatory framework to allow regulators to require refinery operators to adopt policies and practices beyond what is required by existing law.

Because the safety case approach represents a paradigm shift from the traditional deterrence-based enforcement approach, and because of the significant resources and changes to the regulatory framework it entails, consideration of adopting this approach will take time. In other countries, the safety case approach typically has been developed in a multi-year, three-part effort involving government agencies, industry, and workers and their unions. In consultation with the Refinery Safety Forums, the Task Force will study the safety case approach, including review of relevant literature and the experience of other jurisdictions, evaluation of its benefits and costs in California, and the steps that would be necessary for its adoption here.

4. Community Education and Alerts

Members of local communities and the public should have consistent, accessible, adequate and timely information about refinery emissions and safety risks, preventive measures, and emergency procedures. There should be an easy mechanism for community participation in emergency planning and preparedness.

The following steps should be taken:

4.1 Improve Emergency Alerts and Public Education

Cal OES will work with other state and local agencies to ensure that systems to alert residents during an emergency are timely and operational. For example, the

Recommendations on Community Education and Alerts: An Overview

Improving the current system of public involvement, information-sharing, and understanding of emergencies can be accomplished if agencies:

1. *Improve existing alert systems and create a more comprehensive system to notify local residents*
2. *Increase public involvement in emergency planning processes*
3. *Increase public involvement in air monitoring*

Federal Emergency Management Agency (FEMA) now has the capability to broadcast tailored text messages county-wide to all cell phone users, and this should be incorporated into Area Plans and deployed in major incidents from now on. Cal OES will also work with FEMA to reduce the area that can be targeted by these warnings, so that only the affected community is warned. Land-line telephone calls are not reliable in emergencies, but remain valuable because some people (such as elderly residents) may not have cell phones; counties should identify a reliable provider and back-up provider and test the system at least annually to assure it works rapidly and effectively. Additional alert mechanisms include email, Twitter, social media, and local Community Warning System alerts. The latter exist in many California communities, and could benefit from additional outreach to increase the percentage of participating residents. Finally, emergency outreach and warning systems should be designed to alert people and provide information in all major languages spoken in a community. Provisions requiring multilingual emergency communications to the public should be added to all Area Plans.

Cal OES must also work with other state and local agencies and refineries to improve public education and outreach in communities near refineries about what to expect and what to do in the event of a release of toxic chemicals or fire. This may help the public better understand refinery safety risks, preventative measures, emergency procedures, and the different roles and responsibilities of agencies.

4.2 Increase Public Involvement in Emergency Planning

Cal OES, with other state and local agencies, will evaluate ways to improve the use of the State Emergency Response Commission and LEPCs include the public in the emergency planning process. Cal OES will also ensure that California's emergency management systems are more closely aligned with federal EPCRA requirements for emergency response planning. One option is to align the geographic scope of the LEPCs with the CUPAs. The more compact, local scale of the 83 CUPAs make them more appropriate for community participation as compared to the large geographic scale of the current six LEPCs. The LEPCs could provide a forum for community participation, unified with the CUPAs current preparedness and community right-to-know functions.

4.3 Improve Public Involvement in Air Monitoring

ARB and CAPCOA should consider the following elements in their project plan¹⁰ to improve state and local air monitoring practices as possible program improvements: increase the availability of air monitoring data on local and state websites; develop user applications and other electronic tools to make data more accessible; and, local town hall meetings for community education.

¹⁰ See Recommendation 2.2

4.4 Review of the California Air Response Planning Alliance (CARPA)

Cal/EPA and ARB will reach out to the California Air Response Planning Alliance to determine its current capabilities and how it can be used to improve emergency preparedness for future refinery accidents and emergencies.

G. Conclusion

Improving refinery safety is a goal strongly shared by industry and stakeholders. As this report details, refinery safety in California can and must be improved. Government agencies and industry can work together to develop and implement stronger accident prevention and hazard reduction measures. Government agencies can improve interagency coordination, emergency response procedures, and communication and outreach to the public. Over the long term, more fundamental changes in the current regulatory framework may be needed. The Interagency Refinery Task Force established as a result of the report will guide the efforts of government, industry, labor, community and environmental stakeholders to help achieve the highest possible level of safety and prevention.

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Digital copies of documents in the Appendix can be found at:

RAND Corporation Memo: "Refinery Process Safety Performance and Models of Government-Industry Relations."

http://www.rand.org/content/dam/rand/pubs/testimonies/CT300/CT392/RAND_CT392.pdf

Cal/OSHA Citations:

<http://www.dir.ca.gov/DOSH/citation.html>

CSB Recommendations to the Governor and Legislature:

<http://www.csb.gov/chevron-refinery-fire/>

Chemical Safety Board Interim Investigation Report:

http://www.csb.gov/assets/1/19/Chevron_Interim_Report_Final_2013-04-17.pdf

Chevron Incident Investigation Report:

http://richmond.chevron.com/Files/richmond/Investigation_Report.pdf

Congressional Testimony of U.S. OSHA:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=TESTIMONIES&p_id=1182

Labor Occupational Health Program: "Refinery Safety in California: Labor Community and Fire Agency Views."

http://lohp.org/docs/LOHP_RefinerySafetyReport_2013.pdf