**A9: Risk Management Scenarios- Practice Lab**

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MPH 632: Environmental and Occupational Risk Assessment

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**Part 1:**

Risk management recommendations:

1. Distance of chemical production facilities
2. Safety standards for MIC with specific guidelines for handling and storage.
	* Store smaller quantities of Methyl isocyanate, only keeping what is needed for the time
3. Raw materials and end products should have separate transport system from the public.
4. Pollution Control Technology
5. Controlled environment: Monitoring and detection alarm system (air pressure and temperature)
6. Appropriate PPE should be provided to all employees

**Part 2:**

Within 10 miles of the city center, a mid-sized Southeastern city with a population of roughly 744,000 people has several major chemical industrial facilities. One of the facilities produces carbamate pesticides from chemicals like the toxic Methyl isocyanate. This facility uses and stores a significant amount of MIC. Additionally, during the production process, high temperatures are employed, which can result in explosive and dangerous gases. The process also generates still bottoms and sludge, which must be disposed of safely. Raw materials and final products are also delivered into and out of the manufacturing facility by rail car, which also transports passenger and cargo trains throughout the day. This facility creates significant threats to public, occupational, and environmental health, which must be addressed. The epidemiologic triangle denotes the interactions that exist between the environment, the agent, and the host that offers health hazards. Breaking down the epi triad and addressing the risk associated with each aspect can dramatically lower the chance of negative outcomes. Distance between chemical manufacturing facilities, safety regulations, separate transport systems for raw materials and finished products, pollution control technologies, monitoring and detection systems, and adequate PPE are all approaches that address one or more of the epi triad elements.

There are various chemical production facilities within 10 miles of the city center. With a population of over 700,000 people, it is critical that the chemical production facility must be located at a safe distance. Pollution generated by the manufacture of dangerous carbamate pesticides, as well as the use of the toxic chemical Methyl isocyanate (MIC), endangers hundreds of thousands of people owing to the city's proximity. If possible, the facility should be moved at least 50 miles away from the nearest city. Given the facility's vicinity, significant numbers of people are in danger. The potential for chemical release is quite dangerous to adjacent cities. The facility's complete relocation will avoid the public from being exposed to MIC and other harmful chemicals.

Since the facility produces pesticides with hazardous MIC, process safety regulations must be established and enforced. The health risks associated with MIC are well documented and should be avoided at all costs by strictly adhering to process safety regulations. Furthermore, any additional hazardous substances affiliated with pesticide production should be monitored under process safety standards. These standards should be in accordance with all health regulatory organizations as well as any local, state, and federal regulations. These regulatory organizations utilized the most current data on known chemicals and should be utilized. These process safety guidelines should contain video and thorough instructions on how to safely handle all chemicals and risks connected with pesticide production and MIC. Guidelines on acceptable quantities of MIC and other hazardous chemicals in on-site storage should be specified in the process safety standards. If there is an unnecessary surplus supply of MIC or any other hazardous chemical, chemical manufacturing facilities should not keep it on hand. Limiting the amount of MIC on hand can assist reduce the risk of explosions and fires, as well as minimize the severity of potential complications due to a large supply. These standards should also cover how to manage various emergencies that may arise in order to lessen the impact of the crisis. Furthermore, the process safety standards should specify how to handle and dispose of all byproducts, including still bottoms and sludge.

Rail lines are used in the transportation of raw materials and finished products, which are also used by the public. As stated in my first recommendation, the chemical manufacturing facility should be relocated at least 50 miles away from the nearest city. As a result, any products associated with the facility should be transported separately from the general population. The use of shared transportation puts the general public at an unreasonably high risk of exposure. The chemical would not only be exposed to people in the workplace but also to bystanders and anyone outside of the facility. To reduce the likelihood of exposure as well as the risk of probable fires and explosions near the general population, these hazardous items must avoid by the general population. This method would break up the pathway of exposure by avoiding putting the public on the same path as hazardous materials.

Pollution control technology can be used to help control the environmental contamination associated with the chemical production facility. There should be a mechanism that keeps all hazardous byproducts within the facility utilizing a controlled system. The controlled system would prevent hazardous chemicals and gases from being released outside the facility. Moreover, pollution control equipment should be employed throughout the transportation of any products involved with the chemical production facility. This would ensure that all hazardous materials are transported to the appropriate location without being released into the environment.

A monitoring and detecting system that sends out an alert if something is out of range could be beneficial. This device would monitor air temperature and pressure to verify that they are within acceptable limits. Maintaining a regulated environment can aid in the prevention of explosions and fires. If anything is out of range, it will result in a prompt alert which will cease once adjusted within the safe range. Utilizing this system will help manage and mitigate risks associated with an uncontrolled environment and hazardous chemicals. This system can also be used to detect an unintentional release of gases which can pose a grave potential. Monitoring and identifying harmful circumstances will keep personnel up to date on any unsafe working conditions and enable them to be fixed immediately.

The last recommendation is that all employees should wear appropriate personal protective equipment (PPE). Given the extremely hazardous chemicals used in chemical manufacturing facilities, all employees must properly wear the necessary PPE. The usage of PPE will decrease the staff's exposure to chemicals. The employment of PPE may also aid to prevent adverse health consequences from working with such substances. Furthermore, backup and emergency PPE should be available in the event of an emergency.

Many scenarios like the one given potentially exist throughout the world. The manufacturing of dangerous chemicals and similar substances may present potentially hazardous conditions. The epidemiological triad establishes a framework that allows for approaches to each of the three factors: host, agent, and environment. Breaking the epi triangle and addressing the risk associated with each element can significantly reduce the likelihood of unfavorable consequences. Although addressing a single factor can greatly reduce the probability of an adverse outcome, addressing multiple factors has a higher impact. Ultimately, several measures should be taken to mitigate hazards, particularly in high-risk scenarios.