Client: Conoco Phillips

Document: Radiation Awareness Training Storyboard

Version No.	Author	Date	Remarks
001	Anjuman Deodhar	August 05, 2024	Storyboard creation
002	Sheetal Mehta	October 25, 2024	Storyboard updation
003	Anjuman Deodhar	November 06, 2024	Storyboard review

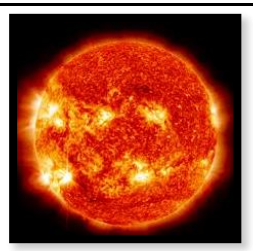
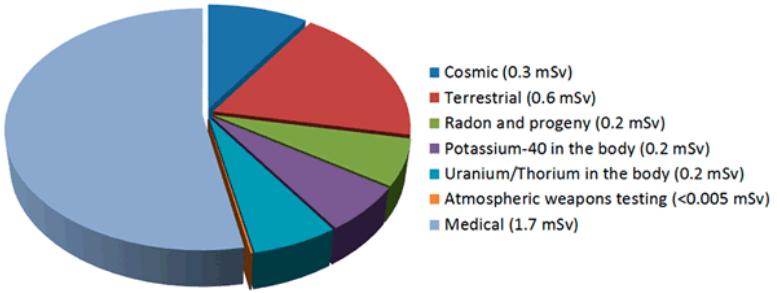
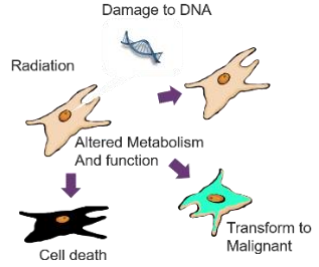
Developer notes:

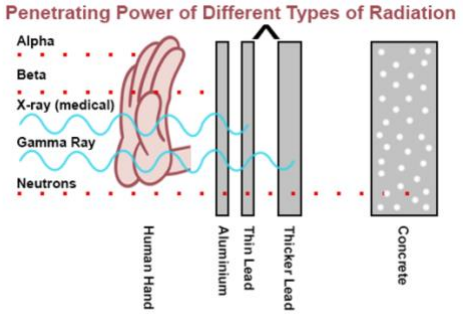
- Please refer to *Presentation - NORMS Presentation Internal COPI.pptx*, *Radiation Safety Awareness (1).ppt* and Hg & BTEX CBT Notes.docx for reference images, graphics and tables
- Unless specified, all slides will auto-forward
- Strictly adhere to Conoco Phillips style guide during the design phase

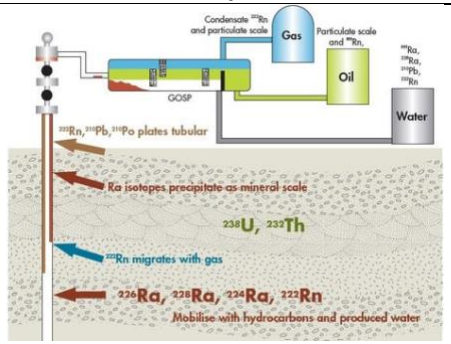
Topic	Radiation Awareness Training		Screen type	
Screen Title	*<splash screen>*		Screen label	010
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Welcome to the Conoco Phillips Radiation Awareness training.	**Radiation Awareness Training**	*Create a splash screen.*  *2445690325*	
2.	Click on the start button to begin.	START		

Topic	Radiation Awareness Training		Screen type	
Screen Title	*Learning Objectives*		Screen label	020
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	By the end of this training, you will be able to: 1. Describe what NORM, or naturally occurring radioactive material, is 2. Recognise the effects of exposure to NORM 3. Identify sources of NORM in your work environment 4. Outline measures to monitor NORM 5. Take proactive measures for safe handling of NORM contaminated material to mitigate exposure 6. Understand the Properties of Mercury and Benzene 7. Identify sources of Mercury and Benzene 8. Comprehend the Health Effects of Mercury and Benzene Exposure 9. Realise the Impact of Mercury and Benzene on Equipment and Processes 10. Implement Safe Work Practices in Mercury and Benzene Contaminated Environments	Learning Objectives 1. Describe what NORM is 2. Identify sources of NORM in your work environment 3. Recognise the effects of exposure to NORM 4. Outline measures to monitor NORM 5. Take proactive measures to mitigate NORM exposure 6. Understand the properties of Mercury and Benzene 7. Identify sources of Mercury and Benzene 8. Comprehend the health effects of Mercury and Benzene exposure 9. Realise the impact of Mercury and Benzene on equipment and processes 10. Implement safe work practices in Mercury and Benzene contaminated environments	*Design LOs screen*	
			<click next to continue>	

Topic	Radiation Awareness Training		Screen type	
Screen Title			Screen label	020A
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	This training is divided into three sections. • NORM Awareness • Mercury Awareness • Benzene Awareness *Select each section to learn more.*	**Radiation Awareness Training** • NORM Awareness (Go to 030) • Mercury Awareness (Go to 080) • Benzene Awareness (Go to 090) *Select each section to learn more.*	*Tab Activity* *Earlier screen is refreshed.* *This is the landing screen with an interactivity.* *Display OST in sync with VO as tabs.* *When learner clicks a tab, they are taken to a new screen (IN the bracket of bullet points OST) with corresponding information.* *The learner has to click on each tab before this topic is completed.* *Note: Text in the bracket not to be displayed on the screen*	
			<click next to continue>	

Topic	NORM Awareness		Screen type	
Screen Title	*Introduction*		Screen label	030
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Let us begin by understanding what naturally occurring radioactive material, or NORM, is. NORM is the term used to describe radiation emitting, or radioactive materials that exist in the environment we inhabit.	**N**aturally **O**ccurring **R**adioactive **M**aterial	*Show NORM first and then animate it to expand it into its full form.*	
3.	Such radioactive materials are referred to as radionuclides. The sun, the earth, x-ray machines, and surprisingly, even bananas are a source of radiation.	Radionuclides	    *Radiation Safety Awareness (1).ppt Sl. 2*	
4.	The measurement unit of such radiation is called a Sievert, expressed as Sv and may also be presented in milli-Sieverts (mSv) or micro-Sieverts (uSv)	Radiation Exposure	 *Radiation Safety Awareness (1).ppt Sl. 3*	
5.	When human tissue is exposed to radiation, it can cause damage to the cells in the body through a process called Ionisation.	Ionisation		

			Presentation - NORMS Presentation Internal COPI.pptx Sl. 7
6.	But not all radiation has the same penetrating power, as displayed in this graphic.		 *Presentation - NORMS Presentation Internal COPI.pptx Sl. 6*
7.	So, with adequate precautions, we can minimise or even prevent radiation exposure.		 *2185077957*
			<click next to continue>

Topic	NORM Awareness		Screen type	
Screen Title	*Sources of NORM in the work environment*		Screen label	040
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	The concentration of NORM in most natural substances of earth is quite low. But it may become concentrated during the extraction and processing of materials from earth. Radionuclides can be transported to the surface during oil and gas production.		 *Presentation - NORMS Presentation Internal COPI.pptx Sl. 3*	
2.	Materials such as scale, sand, or sludge may contain elevated levels of radionuclides.		  *Presentation - NORMS Presentation Internal COPI.pptx Sl. 4*	
3.	There are two ways in which personnel can be exposed to radiation emitted by such radioactive material: • External exposure, due to irradiation, and • Internal exposure, due to contamination	NORM exposure • External (Irradiation) • Internal (Contamination)	 *Radiation Safety Awareness (1).ppt Sl. 5*	

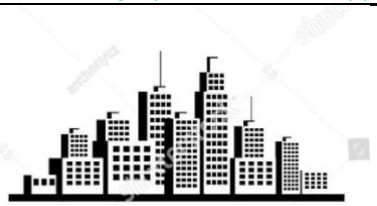
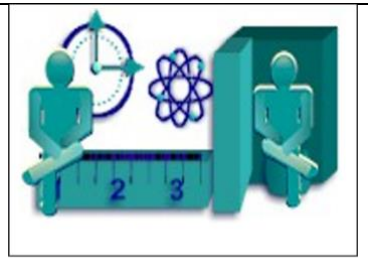
4.	So, it is imperative that all possible sources of radiation are identified and managed to ensure that exposure remains below the prescribed guidelines.		 *Radiation Safety Awareness (1).ppt Sl. 6*
			<click next to continue>

Topic	NORM Awareness	Screen type	
Screen Title	*Minimising exposure*	Screen label	050

No.	Audio/VO	OST	Visuals and Development instructions
1.	First, let us look at safe radiation exposure limits		

	Occupational / Designated Radiation Workers #	Non-radiation workers	Public
Definition	A radiation worker who has the potential to exceed 1 mSv/y. Personal radiation dose monitoring must be performed.	Persons exposed to radiation in their workplace that do not have direct involvement with radiation sources during the course of their work	Persons exposed to radiation from a workplace in which they are not working.
Effective Dose Limits*	20 mSv/y (20,000µSv)	1 mSv/y (1000µSv)	1 mSv/y (1000µSv)
Single year max dose	50 mSv/y (50,000µSv)	5 mSv/y (5,000µSv)	5 mSv/y (5,000µSv)

Radiation Safety Awareness (1).ppt Sl. 9

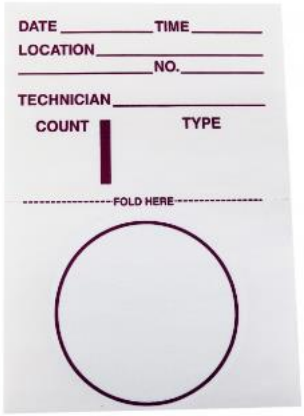
2.	To put this in context, the average Australian is exposed to approximately 1.5mSv per year from natural sources. A single CT scan exposes the patient to 10-15mSvand 100mSvper year is the lowest level of exposure that can cause a documented increase in cancer risk.	 Average background radiation – 2-3 mSv/yr *325592363*	 CT scan – 10-15 mSv *2354152787*	 Lowest level causing increased cancer risk – 100 mSv/yr *2340218195*
3.				
4.	The three best practices that can help us limit radiation exposure are: Time Distance, and Shielding Minimising time spent in proximity of a source of radiation will minimise exposure. Maximising the distance from a source of radiation will also minimise exposure. Doubling the distance can decrease the exposure four times.	Minimum Time Maximum Distance Adequate Shielding (Drill Cores Sample Trays)	 Source: US EPA *Radiation Safety Awareness (1).ppt Sl. 8*	

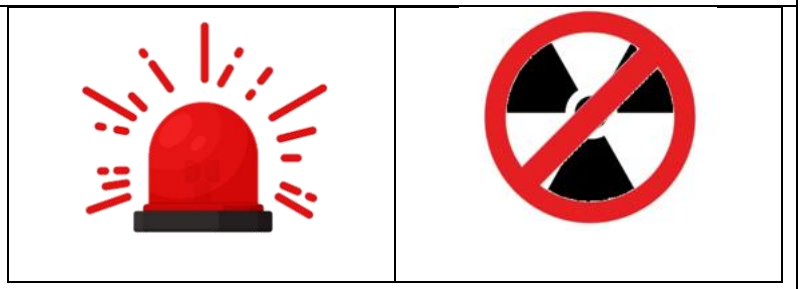
	And finally, using some sort of shielding, such as thick plastic or a metal barrier. Although, it should be noted that shielding is the least practical method of reducing radiation exposure.		*Show only the OST in black first, in sync with the bullet points of the VO. Add yellow highlighted OST in sync with relevant VO, later.* *Add the OST in brackets next to the radiation symbol.*
			<click next to continue>

Topic	NORM Awareness		Screen type	
Screen Title	*Managing NORM waste*		Screen label	060
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Now, let us look at why it is so critical to manage NORM waste.		 *Presentation - NORMS Presentation Internal COPI.pptx Sl. 4*	
2.	Apart from the aforementioned human health impacts, Incorrect management and disposal of NORM waste can potentially lead to • Environmental damage NORM waste can cause environment pollution and potentially impact flora and fauna • Added operational costs Failure to identify NORM waste can cause disposal delays for facilities and increases in storage costs, along with expensive remedial operations • Risks to ConocoPhillips' regulatory license to operate Incorrect disposal can open up COP to the risk of prosecution, reviews of licences and approvals with more stringent conditions, and an increased focus on audits. • Risks to COP's social license to operate Incorrect management and disposal would mean COP wouldn't be able to meet the expectations of the community and its shareholders. It could also impact the relationship with stakeholders and the government, which in turn could impact future project approvals, and ultimately, COP's reputation.	Why manage NORMs • Human health impacts • Environmental damage • Added operational costs • Risks to COP's regulatory license to operate • Risks to COP's social license to operate	*Let OST appear in sync with the VO. Add icons for each bullet point.*	
			<click next to continue>	

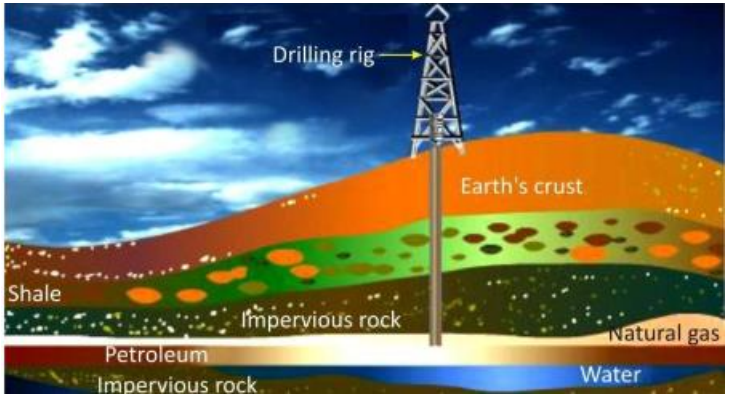
Topic	NORM Awareness		Screen type	
Screen Title	*NORM monitoring and control*		Screen label	070
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	So how do we ensure that we minimise the risk posed by NORM waste? The answer to that lies in effective monitoring and control.	NORM monitoring and control	*Typography*	
2.	First, let us learn about monitoring. You must remember the two Ws and the one H: When Where, and How Click on each element to know more	NORM monitoring • When • Where • How Click on each element to know more	*Create a clickable infographic. OST will appear on the same screen.*	
		WHEN		
2a.		• Periodically, during operations • Campaign-based, during shutdowns, maintenance and intrusive work • A risk assessment has identified that NORM may be present		
		WHERE		
2b.	Radon gas is known to be present in the feed gas as it arrives at the APLNG plant. The radon comes from radioactive decay of radium, present in the reservoir formation rocks, which is generated by minor quantities of uranium in the rock Historical surveys and monitoring have identified locations where NORM may exists however this is not an exhaustive list. Locations Include the inlet receiver gas filter, MP fuel gas filter, Wet gas flare knock-out drum A and the mercury removal beds.	• Historical surveys provide valuable information on locations where NORM is likely to exist • These locations could include Vessels, filters, heat exchangers, pipework, separators	*See images in folder for locations on site map* 	
		HOW		

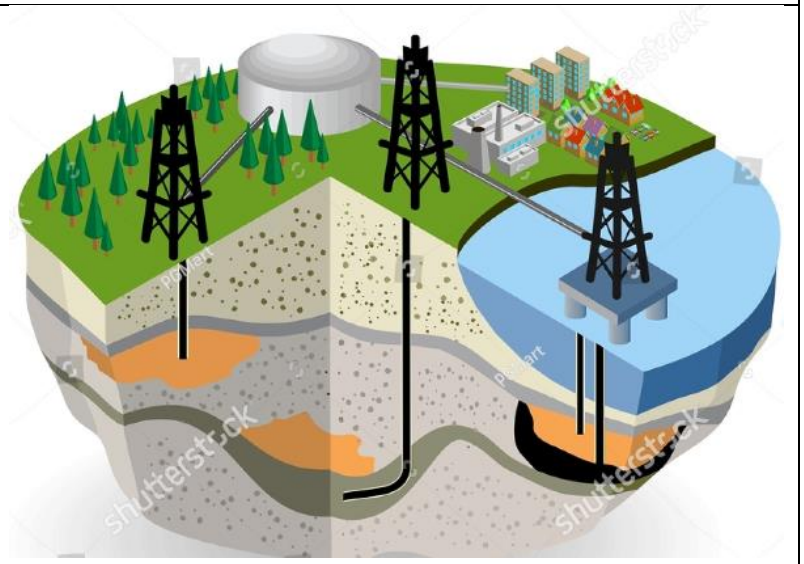
2c.		• External Monitoring – Gamma Surveys • Internal Monitoring – Contamination Surveys • Sample collection and analysis	
3.	Next, let us look at a prescribed process flow to identify likely exposure points that may exist where NORM has been identified as potentially being present.	1. Vessel process inventory drained, ready for campaign a. Setup clean/dirty station, PPE collection, etc. b. Baseline surveys 2. Vessel isolated from process 3. Isolation boundary is N2 purged 4. Once isolated & N2 purged, spacers removed, blinds installed for positive isolations for CSE a. Any positive isolations (spec. blinds etc.) have potential to expose contaminated surfaces b. Opening of lines may allow contamination to fall out c. Opening of lines may cause release of Radon gas (normal hydrocarbon gas safety procedures deal with this) d. Contamination potential of PPE 5. Vessel cleaned and flushed ready for inspections (sludge removed and wash water utilised to clean vessel internals) a. Potential exposure during connections/release of lines b. Gamma exposure potential for sludge storage c. Contaminated PPE checking and collection 6. Sludge and wash-water will be collected separately and staged for testing a. Sample collection and send for analysis b. Contaminated PPE checking and collection 7. Once cleaned and cleared from any contaminants (NORMS, Hg, BTEX), the vessel inspection campaign will be carried out a. Clearance inspections – contamination potential of PPE 8. On completion of inspections, approvals signed to de-isolated CSE Isolation. CSE isolation is removed, blinds removed and spacers replaced. a. Clearance inspections of equipment 9. Pre-startup reviews are completed, approvals to de-isolate, N2 purging/O2 free stage completed, vessel de-isolated, vessel returned to service *Create an animated process flow diagram using the OST*	
4.	Here are some examples of instruments that can be used to monitor for NORM		

5.	For external testing of Gamma radiation, this instrument measures radiation exposure dose rate for protection levels and requirements. To test internal surface contamination, a different sensor measures the amount of radioactive contamination of surfaces, and the results of which are compared to the surface action levels for PPE and protection.		 *Presentation - NORMS Presentation Internal COPI.pptx Sl. 15*
	Another method of external testing of radiation are Rad-wipe smears. These wipes can be used to conveniently sample a surface contaminated with radioactivity which is then sent to a laboratory for analysis.		
6.	PED's (personal exposure dosimeters) for whole body gamma radiation dose monitoring and recording may be required. OSL (optically stimulated luminescence) badges may also be required to be worn based on the nature of work being carried out.		 *Radiation Safety Awareness (1).ppt Sl. 14*

7.	Another important consideration is contamination clearances of possible internal surface contamination. Here are some must-dos: • No radioactive material may be transported offsite • Everything leaving site that is potentially contaminated must be cleaned and checked for contamination • Contaminated waste needs to be segregated, packaged and labelled appropriately, and ready for disposal as radioactive material once approved. • At end of work activities, everything is checked. • If any indication of contamination is found, rewash and recheck or segregate appropriately • Clearance certificates have to be produced for everything leaving site	Contamination clearances: • No radioactive material may be transported offsite • Everything leaving site has to be cleaned and checked for contamination • Contaminated waste needs to be segregated, packaged and labelled appropriately, and ready for disposal as radioactive material once approved. • At end of work activities, everything is checked. • If any indication of contamination is found, rewash and recheck or segregate appropriately • Clearance certificates have to be produced for everything leaving site	 *Radiation Safety Awareness (1).ppt Sl. 14*
8.	And, in the event of an emergency incident, there are some protocols to follow: • In an emergency the primary concern is to prevent severe injury to site personnel. If immediate medical treatment is required to save a life, decontamination must be delayed until the victim is stabilized. To this end, potential NORM exposure is NOT a safety hazard during an emergency. • Do not take remedial action to correct the fault, if there is no immediate hazard and the situation is stable. Exposure dose assessment may be more difficult if the fault is corrected • The first rule is to preserve life. Render assistance to any injured person, and call the appropriate emergency services, if required. But always ensure own safety first.	Emergency protocols: • In an emergency the primary concern is to prevent severe injury to site personnel. If immediate medical treatment is required to save a life, decontamination must be delayed until the victim is stabilized. To this end, potential NORM exposure is NOT a safety hazard during an emergency. • Do not take remedial action to correct the fault, if there is no immediate hazard and the situation is stable. Exposure	 *Radiation Safety Awareness (1).ppt Sl. 19* *Use graphics as embellishments to OST*

	• Notify the RSO, or the Supervisor, or the Health and Safety Officer. • Evacuate personnel to a safe area. • Cordon off or prevent entry to area. Put up 'Do not use/Do not enter'.	dose assessment may be more difficult if the fault is corrected • The first rule is to preserve life. Render assistance to any injured person, and call the appropriate emergency services, if required. But always ensure own safety first. • Notify the RSO, or the Supervisor, or the Health and Safety Officer. • Evacuate personnel to a safe area. • Cordon off or prevent entry to area. Put up 'Do not use/Do not enter'.	
9.	Some additional precautions you should take are: • Where possible, keep all NORM waste wet • Use respiratory protection withparticulate filters • Ensure you have been trained on the use of respiratory protection and have a current respirator fit test for the respirator worn. • Follow stringent personal hygiene		

Topic	Mercury Awareness		Screen type	
Screen Title	*Introduction*		Screen label	080
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Now, let's look at Mercury. Mercury is classified as a hazardous substance according to WorkSafe criteria	Mercury	 *2188142631* *Animate till VO gets over.*	
2.	It originates from the earth's crust and, through heat and pressure, migrates as a vapor into hydrocarbon reservoirs. It can spread throughout hydrocarbon production, processing, and transportation systems.	• Originates in the earth's crust • Migrates into hydrocarbon reservoirs • Can spread throughout hydrocarbon production, processing, and transportation	*Fade out OST.*  *Reference image* *Recreate the image without the text.* *Show OST in sync with VO. Show* Hydrocarbon Reservoirs *in place of Impervious rock in the reference image.*	
2.5	Mercury usually occurs in two forms: Elemental Mercury, and Inorganic Mercury	• Elemental Mercury • Inorganic Mercury	*Typography*	

3.	Elemental mercury typically exists as a silvery liquid that easily turns into vapor, which is heavier than air. It can adsorb on metallic components such as pipes and vessels, as well as suspended wax, sand, and other solid materials in liquids. It is soluble in hydrocarbon liquids up to a few parts per million (ppm) and can evaporate even at room temperature, forming an odourless, toxic vapor.	Elemental Mercury • Silvery liquid • Easily turns into vapor • Heavier than air • Adsorbs on metallic components • Soluble in hydrocarbon liquids up to a few ppm • Evaporates at room temperature • Forms an odourless, toxic vapor	 *For reference only* *Using the above image as reference, create an infographic.*
4.	Inorganic, or ionic mercury is mercury combined with elements like chlorine, sulphur, and oxygen to form inorganic compounds or ‘salts’.	Inorganic Mercury • Combined with elements like chlorine, sulphur, and oxygen	*Typography*
5.	In natural gas fields, mercury concentrations can range from 0.01 µg/m³ to 5,000 µg/m³.	0.01 µg/m³ to 5,000 µg/m³	 *224807320*
6.	Over time, mercury levels in gas processing operations increase as it is absorbed on surfaces and reacts with	Mercury levels in gas processing operations increase over time	*Retain the image.*

	metal corrosion products. It can be concentrated from inlet liquid feeds through filtration or centrifugation. Separation and processing can cause mercury to “drop out” inside vessels and pipes, particularly in glycol and produced water systems.		
			<click next to continue>

Topic	Mercury Awareness		Screen type	
Screen Title	*Exposure*		Screen label	080A
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Now, let's look at the sources of Mercury exposure.	Sources of Mercury Exposure:	*Show OST in sync with VO.*	
2.	Mercury exposure can occur in various locations and through different sources during processing activities. These include amine systems (filters, flash tanks, and reboilers), glycol dehydrators (reboiler vapor condensers), heat exchangers, propane/butane fractionators and storage, mercury removal systems, pigging facilities (traps and sumps), separators, sumps, and wastewater treatment plants (settling tanks).	Processing Activities • Amine Systems: Filters, Flash Tanks & Reboilers • Glycol Dehydrators: Reboiler Vapor Condensers • Heat Exchangers • Propane/Butane Fractionators & Storage • Mercury Removal Systems • Pigging Facilities: Traps & Sumps • Separators • Sumps • Wastewater Treatment Plants: Settling Tanks	*Retain OST.* *Show OST in sync with VO using infographic.*	
2a.	Let's look at some effects of mercury on equipment and processes. Select each quadrant to know more.	Damage | Contamination Accumulation | Concentration *Select each quadrant to know more.*	*Show four effects in a quadrant, where each quadrant is clickable.* *When a quadrant is clicked, it expands to open into a pop-up box with a close (X) button on the top-right corner.*	
Damage				
3.		Mercury can damage equipment by precipitating and pooling as condensate cools during processing, and depositing in cryogenic equipment, which can cause cracking of welded aluminium heat exchangers. Cold box failures have been documented in older gas processing plants due to mercury contamination.		

Contamination			
4.		Contamination from mercury affects treatment processes like • Molecular sieve • Glycol dehydration • Amine acid gas removal	
Accumulation			
5.		Mercury can accumulate in sludge from water treatment systems, separators, desalters, and heat exchangers, creating a hazardous waste stream. It can dissolve into liquid glycol inside dehydrators, with a portion being removed during regeneration.	
Concentration			
6.		Mercury may also concentrate on amine filters, in propane and butane, and settle at the bottom of cargo tanks, accumulating in residual sludge and sediment.	
Activity ends			
7.	There are several job activities that may lead to mercury exposure. *Click each activity to learn more.*	Job activities leading to mercury exposure: • Confined space entry • Handling contaminated treatment media • Hot work • Other activities *Click each activity to learn more.*	*Display the OST as the title and the four texts in the form of flashcards.*  *2309615281*

			 *1647167944*  *2189611751*  *2239662157*
Confined space entry			
8.		• Mercury may absorb onto surfaces of vessels and equipment	*Flip the cards to show the information of each activity on the other side.*

		• Enclosed atmospheres with mercury may reach vapor levels >20,000 µg/m^3
		• Enter in accordance with confined space procedure. Test for atmospheric hazards in this order:
		  • Oxygen
		  • Combustible gases (e.g., LEL)
		  • Toxic gases (e.g., mercury, H_2S, CO)	

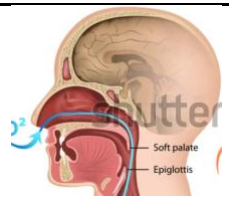
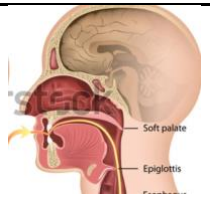
Handling contaminated treatment media			
9.		• Handling contaminated treatment media, such as glycol, amine, and mercury, requires considering equipment as “mercury contaminated” • Clean contaminated equipment before removal	
Hot work			
10.		• Mercury may react with steel corrosion products to form a “mercury rich” layer during hot work • Welding, torch cutting, etc. can vaporize elemental mercury	
Other activities			
11.		Other activities that pose exposure risks: • Gas sampling • Pigging operations • Removal of wax & sludge from process equipment • Venting gas lines • Tank cleaning	

Activity ends			
12.			*<click next to continue>*

Topic	Mercury Awareness	Screen type	
Screen Title	*Exposure Effects*	Screen label	080B

No.	Audio/VO	OST	Visuals and Development instructions
1.	Before we understand the effects of exposure to Mercury, first, let us look at workplace exposure standards.		

(1) Chemical name	Synonym	(2) CAS No.	(3) TWA (ppm)	TWA (mg/m^3)	(4) STEL (ppm)	STEL (mg/m^3)	(5) Advisory carcinogen category	(6) Other advisory information	Notes
Mercury, alkyl compounds (as Hg)			-	0.01	-	0.03	-	Sk	
Mercury, aryl compounds (as Hg)			-	0.1	-	-	-	Sk	
Mercury, elemental vapour (as Hg)		7439-97-6	0.003	0.025	-	-		-	
Mercury, inorganic divalent compounds (as Hg)			0.003	0.025	-	-	-	-	
Mercury, inorganic monovalent compounds (as Hg)			-	0.1	-	-	-	Sk	

2.	Understanding the routes of exposure and the potential health impacts is crucial for workplace safety. Mercury can enter the body through three main routes: inhalation, skin absorption, and ingestion. *Click each route to learn more.*	Routes of Exposure • Inhalation • Skin absorption • Ingestion *Click each route to learn more.*	 *1309334299* *Don't use text*  *2147130545*  *1309334299* *Don't use text* *Show above images along with their respective OST.* *Clicking on each image will open a popup with a close button.*
	Inhalation		
3.	Inhalation is primary route of exposure where approximately 80% of inhaled mercury enters the bloodstream. This mercury is slowly oxidized, allowing it to distribute into body tissues over time.	• Primary route of exposure • Approximately 80% of inhaled mercury enters the bloodstream, where it is slowly oxidized, allowing it to distribute into body tissues	
	Skin absorption		
4.	Skin absorption occurs at a much lower rate compared to inhalation, but vapor levels exceeding 130 µg/m^3 can lead to direct absorption through the skin from the air.	• Absorbed through the skin at a much lower rate than inhalation	

		• Vapor levels >130 µg/m³ can cause direct skin absorption from the air	
Ingestion			
5.	Ingestion is another route, particularly if a worker's hands, face, or clothing are contaminated with mercury while eating, drinking, or using tobacco products. Additionally, diets high in fish can contribute significantly to mercury exposure, potentially affecting biological monitoring programs by causing an overestimation of occupational exposure based on blood analysis.	• Can occur if a worker's hands, face, or clothing is contaminated with mercury while eating, drinking, or using tobacco products • Major contributing dose for diets containing a high percentage of fish • High fish diets can affect biological monitoring programs based on blood analysis	
Activity Ends			
6.	Exposure to mercury can lead to long-term health problems. *Move the slider to each exposure to learn more.*	• Chronic exposure at low levels • Acute exposure • Chronic exposure *Move the slider to each exposure to learn more.*	*Slider interactivity.* *As the learner clicks on the bullet points, content is revealed.*
Chronic exposure at low levels			
7.	Mercury can disrupt vital physiological processes in the human body and cross tissue barriers, including the blood-brain barrier, causing neurological impairment, cognitive and motor dysfunction. It can also damage the kidneys, liver, lungs, and digestive system, and cause developmental issues, especially in unborn children.	• Disrupt vital physiological processes, cross tissue barriers, including the blood-brain barrier in the human body • Cause neurological impairment, cognitive and motor dysfunction • Damage the kidneys, liver, lungs, and digestive system	

		• Cause developmental issues especially in unborn children	
Acute exposure			
8.	Acute exposure to mercury may result in symptoms such as chills, nausea, general malaise, tightness in the chest, shortness of breath, cough, inflammation of the mucous membranes, salivation, and diarrhea. It may also compromise kidney function.	• Cause chills, nausea, general malaise, tightness in the chest, shortness of breath, cough, inflammation of the mucous membranes, salivation, and diarrhea • Compromise kidney function	
Chronic exposure			
9.	Chronic exposure can lead to weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbances. Tremors may develop, starting with the fingers, eyelids, and lips, and potentially progressing to the entire body. Behavioral and personality changes, such as increased excitability, memory loss, insomnia, and depression, may also occur. The skin might show abnormal blushing, red lines and welts, excessive sweating, and irregular rashes. Severe salivation and gingivitis are also characteristic of chronic mercury toxicity.	• Cause weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbances • Develop tremors starting with the fingers, eyelids, and lips, and potentially progressing to the entire body • Lead to behavioural and personality changes, such as increased excitability, memory loss, insomnia, and depression • Cause abnormal blushing of skin, red lines and welts, excessive sweating, and irregular rashes Develop severe salivation and gingivitis	
Activity ends			
10.			*<click next to continue>*

Topic	Mercury Awareness		Screen type	
Screen Title	*Monitoring and Control*		Screen label	080C
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Monitoring mercury levels in the workplace involves using specific methods to ensure accurate detection and analysis.		 *2527341419*	
2.	These methods are used for comprehensive and reliable monitoring of benzene levels at the facility. *Click on each method to know more.*	**SKC Passive Sampler for Elemental Mercury** **Nippon EMP-2 Portable Mercury Analyser** *Click on each method to know more.*	*Tab activity* *Display OST in sync with VO as Tab.* *When the learner clicks a tab, display the popup.*	
SKC Passive Sampler for Elemental Mercury				
3.		SKC Passive Sampler for Elemental Mercury badges capture airborne mercury and are then sent to an accredited laboratory for analysis. It's important to note that these badges have a detection limit of 0.01 µg and must be placed in the breathing zone to be effective.		
Nippon EMP – 2 Portable Mercury Analyser				
4.		Nippon EMP-2 Portable Mercury Analyser features an on-board pump. This device is used		

		according to the ABUE-450-HS-N05-C-00032 Portable Gas Monitor Procedure, providing a reliable way to monitor mercury levels on-site.	
Activity Ends			
5.	To control mercury exposure in the workplace several measures are essential.	Some recommended measures to control benzene exposure include:	*Show OST in sync with VO.*
6.	Engineering controls involve using equipment to prevent or minimize workers' exposure to mercury. Ventilation and purging are often standard practices, but it's important not to assume that purging alone has reduced mercury concentrations to acceptable levels. Mercury evaporates slowly and can generate significant concentrations even after purging has ceased. If mercury precipitation or condensation produces pools of mercury, purging alone will not be sufficient to reduce vapors to safe levels. Enclosure or isolation and remote operations, such as using bore scopes, are also effective engineering controls.	• Sampling (Prior to entry and ongoing) • Purging and Cleaning • Ventilation • Decontamination • Barricading	*Retain OST> Show OST in sync with VO.*
7.	Personal protective equipment (PPE) is crucial for minimizing potential exposure to mercury.	Personal Protective Equipment (PPE)	*Refresh the screen. Show OST in sync with VO.*
8.	Respiratory protection includes air-purifying respirators and Supplied air respirators. *Click on each flip card to know more.*	Respiratory Protection: • Air-purifying respirators • Supplied air respirators *Click on each flip card to know more.*	*Display the OST as the title and the two respirators bullet points in the form of flashcards.*
	Air-purifying respirators		
9.		• Air-purifying respirators with ABEK + Hg P3 filters use impregnated, activated carbon to scavenge	. *Flip the cards to show the information on the other side.*

		elemental mercury from the air • Cartridge respirators not effective when mercury vapor concentrations exceed 1.25 mg/m³ • Depending on exposure levels, filter lifetime and breakthrough must be assessed, and manufacturer must be consulted for appropriate filter change out	
Supplied air respirators			
10.		• Supplied air respirators use a full-face mask and a hose that supplies breathing quality air to the mask • Source of the breathing air can either be a bottle or breathing air compressor • Required when concentrations are higher than can be controlled by air purifying respirators	
Activity ends			
11.	Chemical protective clothing, such as safety goggles or full-face masks, impervious body coverings, gloves, and boots, should be used to prevent dermal absorption of elemental mercury or gross contamination from mercury particulates.	Chemical Protective Clothing: • Safety goggles or full-face masks • Impervious body coverings, gloves, and boots	*Show OST in sync with VO.* *A note icon will be shown at the end.* *The user will be able to click that icon to see the information below:* Note: If clothing becomes contaminated, workers should change into uncontaminated clothing immediately.

<table>
<tr>
<td>12.</td>
<td>The selection of respiratory protection depends on airborne mercury concentration:

• For concentrations less than 1.25 mg/m³, use a full-face respirator with ABEK HgP3 filters, nitrile or PVC gloves, PVC boots, and Type C or F Tychem body coverings if dermal contact is possible.
• For concentrations between 1.25 and 10 mg/m³, use supplied air respirators, nitrile or PVC gloves, PVC boots, and Type C or F Tychem body coverings.
• For concentrations greater than 10 mg/m³, contact local Health, Safety, and Environment (HSE) authorities</td>
<td></td>
<td>Create a flowchart in sync with VO.
<table>
<tr><th>Exposure</th><th>Recommended PPE</th></tr>
<tr><td>< 1.25 mg/m³</td><td>Use full face respirator & ABEKP3 filter
nitrile or PVC gloves
PVC boots
Type C or F Tychem body coverings if dermal contact is possible</td></tr>
<tr><td>1.25 - 10 mg/m³</td><td>Use supplied air respirators

Wear nitrile or PVC gloves

Wear PVC boots

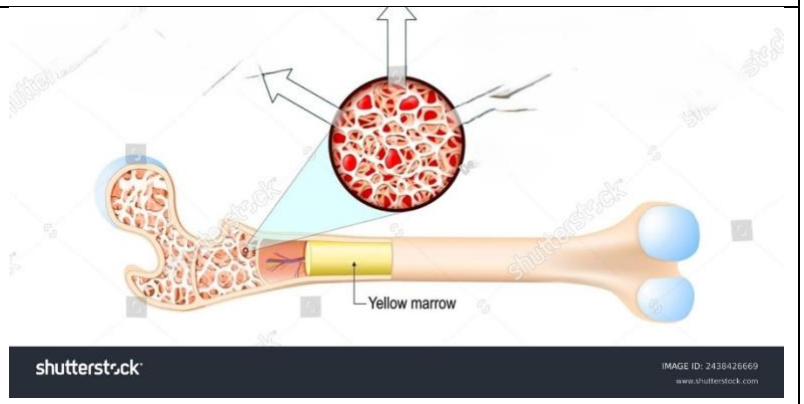
Use Type C or F Tychem body coverings</td></tr>
<tr><td>> 10 mg/m³</td><td>contact local Health, Safety, and Environment (HSE) authorities</td></tr>
</table></td>
</tr>
<tr>
<td>13.</td>
<td>Personal hygiene activities are also important. Workers should wash their hands and face regularly, treat contaminated clothing, including gloves, as contaminated waste, and wash goggles and respiratory protection with mild soap and water. Establishing a site decontamination area can help avoid the spread of mercury.</td>
<td>Workers should
• Wash hands and face regularly
• Treat contaminated clothing as waste
• Wash goggles and respiratory protection with mild soap water
• Establish a site decontamination area to prevent mercury spread</td>
<td>Show OST on the right side of the image.
 
2030716835</td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td></td>
<td><Go to 020A></td>
</tr>
</table>

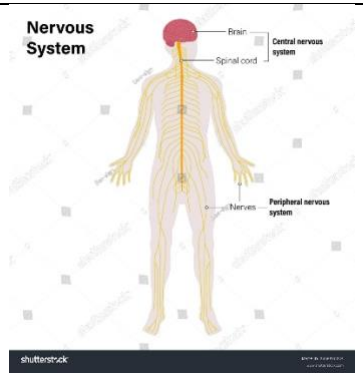
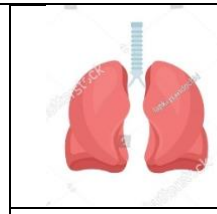
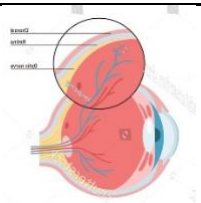
Topic	Benzene Awareness		Screen type	
Screen Title	*Introduction*		Screen label	090
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Next, we look at Benzene. Benzene, along with toluene, ethyl benzene, and xylenes, is an aromatic hydrocarbon, and together they are referred to as BTEX.	Benzene Toluene Ethyl Benzene Xylenes BTEX	 *For reference* *Show 'BTEX' in the centre and other OST around it.*	
2.	Benzene is a significant component in various industrial processes.		 *1662498565* *Retain OST 'Benzene' with this background.*	
3.	It is a colourless, nonpolar liquid with a sweet odour. Its vapor is heavier than air. It easily liberates vapor and classified as Class 3- flammable liquid. It is highly flammable with a lower explosive limit (LEL) of 1.2% and an upper explosive limit (UEL) of 7.8%.	Colourless Nonpolar liquid Sweet odour Vapor is heavier than air Class 3- flammable liquid LEL of 1.2% and UEL of 7.8%.	*Retain OST and image.* *Typography*	
4.	Benzene is a known carcinogen, mutagen, and toxic substance.	Carcinogen Mutagen Toxic		

			2319882281  *2368611075*  *2504639283*
5.			*<click next to continue>*

Topic	Benzene Awareness		Screen type	
Screen Title	*Sources*		Screen label	090A
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Now, let's look at the sources of Benzene.	Sources of Benzene:	*Show OST in sync with VO.*	
2.	It naturally occurs in gas streams and is prevalent across all segments of oil and gas production operations. The highest concentrations of benzene are typically found in areas where more volatile hydrocarbons are present.	• Gas streams • Oil and gas production operations • Areas with volatile hydrocarbons	*Retain OST* *Show OST in sync with VO.* *Also add a note icon on screen. The text below will appear in a pop-up with a close button.* Note: In Australia, oil and gas extraction stands as the largest industrial source of benzene.	
3.	Additionally, benzene is also widely used as a solvent in the manufacturing of paints, varnishes, lacquer thinners, and gasoline.	• Used as a solvent in manufacturing, paints, varnishes, lacquer thinners, and gasoline	*Retain OST* *Show OST in sync with VO.*	
4.	Benzene can be encountered in several specific activities and locations such as working with pig receivers, handling process line breaks, cleaning or entering vessels, gauging tanks, performing maintenance on valves, pumps, and filters, changing out molecular sieves, replacing filters, and working with Natural Gas Recovery Units (NRU) and methane cold boxes.	Activities and Locations • Pig Receiver • Process line breaks • Vessel cleaning / Entry • Gauging tanks • Maintenance on valves, pumps, filters • Molecular Sieve Change out • Filter Changes • NRU & Methane Cold boxes	*Infographic*	

5.	Each of these activities can pose a risk of benzene exposure, making it crucial for workers to follow safety protocols to minimize health risks.		 *2382379583*
6.			*<click next to continue>*

Topic	Benzene Awareness		Screen type	
Screen Title	*Exposure Effects*		Screen label	090B
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	Benzene exposure in the workplace is regulated by specific standards like Time-Weighted Average (TWA) is set at 1 ppm (parts per million) or 3.2 mg/m³ to ensure safety.	Benzene workplace exposure standards: • TWA (ppm) 1 • TWA (mg/m³) 3.2	*Typography*	
2.	Exposure to benzene can lead to both acute and chronic health effects.	Benzene workplace exposure: Acute and chronic health effects	*Typography*	
3.	The routes of exposure include skin absorption, inhalation of vapours, and ingestion, often due to poor hygiene practices.	• Skin absorption • Inhalation • Ingestion	*Typography*	
5.	Benzene targets several organs and systems in the body. In the blood or bone marrow, exposure can cause bone marrow depression, leading to conditions such as anaemia, leukopenia, thrombocytopenia, pancytopenia, or aplastic anaemia. It is also associated with an increased risk of leukemia, particularly acute myeloid leukemia, and possibly non-Hodgkin's lymphoma and multiple myeloma.		 *2438426669* *Have erased part of the original image. Only show what is seen on screen without arrows and text*	

6.	In the central nervous system, exposure can result in solvent intoxication with symptoms like headache, nausea, vomiting, dizziness, slurred speech, euphoria, fatigue, unsteady gait, incoordination, weakness, irritability, disorientation, confusion, loss of consciousness, or death. Exposure can also result in acute CNS depression with symptoms like drowsiness, dizziness, headaches, vomiting, chronic solvent neurotoxicity. Exposure to very high levels (500 to 1000 ppm) can result in severe effects such as narcosis, unconsciousness, coma, and death.		 *2496810245* *Show image without text and arrows*
7.	In the respiratory system, skin, and eyes, Benzene can cause irritation.		   *2451113485* *2484893467* *2209889737* *Show only parts of these images as seen above. Delete all text.*
			<click next to continue>

Topic	Benzene Awareness		Screen type	
Screen Title	*Monitoring and Control*		Screen label	090C
No.	**Audio/VO**	**OST**	**Visuals and Development instructions**	
1.	It's crucial for workers to monitor benzene levels.		 *2176083977*	
1a.	Several sampling techniques are used at the APLNG facility. Benzene can be detected using direct reading instruments. Laboratory analysis is conducted through exposure sampling techniques.		 *2176083977*	
2.	These methods are used for comprehensive and reliable monitoring of benzene levels at the facility. *Click on each method to know more.*	SKC Passive Sampler for Organic Vapours badges Dräger X-AM 8000 PID and Dräger Multi-PID 2 devices	*Flip card activity.*	

		Click on each method to know more.	
SKC Passive Sampler for Organic Vapours badges			
3.		SKC Passive Sampler for Organic Vapours badges capture airborne BTEX compounds and must be placed in the breathing zone of workers. Once the sampling is complete, the badges are sent to an accredited laboratory for analysis.	
Dräger X-AM 8000 PID and Dräger Multi-PID 2 devices			
4.		Dräger X-AM 8000 PID and Dräger Multi-PID 2 devices are used for monitoring benzene and other volatile organic compounds (VOCs) according to the ABUE-450-HS-N05-C-00032 Portable Gas Monitor Procedure, ensuring comprehensive and reliable monitoring of benzene levels at the facility.	
Activity Ends			
5.	To control benzene exposure effectively, several measures are recommended.	Some recommended measures to control benzene exposure include:	*Show OST in sync with VO.*
6.	These include sampling both prior to entry and on an ongoing basis to monitor benzene levels. Purging and cleaning of equipment and areas help to remove benzene residues. Adequate ventilation is crucial to disperse benzene vapours, while decontamination procedures ensure that any benzene present is safely removed. Barricading areas where benzene is present can prevent unauthorized access and reduce exposure risks.		*Retain OST.* *Show images using infographic* 

			2113793759  1916903621  *1859299492*  1660785880  2003976917
7.	Personal Protective Equipment (PPE) is essential for protecting workers from benzene exposure. Recommended PPE includes splash-proof safety goggles, nitrile or Viton gloves, boots, and Tyvek coveralls.	Personal Protective Equipment (PPE): • Splash proof safety goggles • Nitrile or Viton gloves • Boots	*Show OST with icons.*

<table>
<tr><td></td><td></td><td>• Tyvek Coveralls</td><td></td></tr>
<tr><td>8.</td><td>The selection of respiratory protection depends on the level of benzene exposure:
• For exposures between 0 and 0.25 ppm, no respiratory protection is required.
• For exposures between 0.25 and 12.5 ppm, a full-face respirator with an ABEKP3 filter is recommended.
• For exposures between 12.5 and 25 ppm, a Self-Contained Breathing Apparatus (SCBA) or Longline Breathing Apparatus (BA) with backup personnel is necessary.
• For exposures above 25 ppm, an SCBA or Longline BA with an Emergency Life Support Apparatus (ELSA) is required, with backup personnel ready to respond using similar equipment.</td><td><table><tr><th>Exposure</th><th>Recommended PPE</th></tr><tr><td>0 – 0.25ppm</td><td>No respiratory protection required</td></tr><tr><td>0.25 – 12.5ppm</td><td>Full face respirator & ABEKP3 filter</td></tr><tr><td>12.5 – 25ppm</td><td>SCBA or Longline BA with backup personnel</td></tr><tr><td>>25ppm</td><td>SCBA or Longline BA with an ELSA. Backup personnel ready to respond with SCBA or Longline BA with an ELSA.</td></tr></table></td><td>Create a table layout for the given OST.</td></tr>
<tr><td></td><td></td><td></td><td><Go to 020A></td></tr>
</table>