1.0 PURPOSE

The purpose of this procedure is to establish uniform practices and outline the requirements for invasive work. This includes invasive work identification, risk assessment and hazard mitigation.

2.0 SCOPE

These rules apply to all invasive work conducted at the Michigan Refining Division that is not governed by other operating or safety procedures.

3.0 PROCEDURE

3.1 RESPONSIBILITIES

3.1.1 Owning Department Supervision

3.1.1.1 Ensure that the invasive work standard practice including use of the Risk Assessment Matrix are being used correctly.

3.1.2 Owning Department Personnel (Operators and Ops/ PC)

3.1.2.1 It is the responsibility of the Operations and Product Control departments to safely control all invasive work activities carried out in their respective units or areas. This requires the proper hazard identification, risk assessment, and mitigation requirements to execute the invasive work in a safe manner. In addition, this responsibility includes dictation of precautions and conditions under which any maintenance or contract workers will be performing invasive work.

3.1.2.2 Identify hazards and assess risks for invasive work not covered under a procedure, guideline or fresh air/mitigation list using the Risk Assessment Matrix (RAM) prior to equipment preparation, any invasive work performed by operations and prior to invasive work performed by a servicing group.

3.1.2.3 Identify and communicate any remaining hazards associated with the invasive work and the actions required to safely execute the work to the servicing group performing invasive work during the JJSV and document the mitigations on the Safe Work Permit.

3.1.2.4 Determine the appropriate mitigations for the proper level of mitigation called for on the RAM and ensure all mitigations are documented on the permit.

3.1.3 Employees/Contractors Performing Invasive Work

3.1.3.1 Verify that invasive work has been Risk Ranked using the Risk Assessment Matrix (RAM) if no procedure, guideline or fresh air/mitigation list applies to the task.

3.1.3.2 Participate in the JJSV to be aware of the remaining hazards and the required mitigation.

3.1.3.3 Use the appropriate mitigations for the proper level of mitigation called for on the RAM.

3.1.3.4 If the invasive work conditions change such that it could impact the safety of the worker, stop the work and contact the owning department to re-evaluate the task using the RAM.

3.2 Invasive Work/Risk Assessment Matrix (RAM) Process

3.2.1 When invasive work is to be conducted, either by the owning department or a servicing group, the task must be assessed by the owning department using the RAM unless there is a procedure, guideline or fresh air/mitigation list that outlines invasive work hazard mitigation requirements. Known mitigation levels are also located in Appendix A of this procedure. The RAM will assist with identifying mitigation techniques to help ensure the task is conducted safely.

3.2.1.1 When a servicing group will conduct invasive work, the RAM may need to be conducted 2 or more times, once for operations to prepare the equipment (if preparation involves invasive work) and again to assess the task after proper isolation/decontamination.

3.2.1.1.1 It could be expected that the Exposure Volume Value and the Exposure Impact Value could/should decrease after preparation/decontamination.

3.2.2 To conduct the RAM, the Owning Department will:

3.2.2.1 Determine whether a task meets the definition of invasive work.

3.2.2.2 Determine the Exposure Concern Value

3.2.2.2.1 Select the appropriate value for the most significant hazard (1 being the biggest concern) based on what is or was contained in the piping or equipment.

3.2.2.2.2 NOTE: This number will not change, even once the equipment has been prepared for the servicing group.

3.2.2.3 Determine the Exposure Volume Value

3.2.2.3.1 Select the appropriate value for the volume of the potential exposure.

3.2.2.3.2 NOTE: Volume refers to the volume of product that the person performing the invasive work could potentially be exposed to. For example: if a pump is connected to a vessel but has been properly isolated, the person performing the work would potentially be exposed to the volume of the pump only and not the vessel.

3.2.2.4 Determine the Exposure Impact Value

3.2.2.4.1 Select the appropriate value for the impact of the potential exposure.

3.2.2.4.2 Potential impacts could include: personnel injury, exposure to chemicals or corrosives, H2S hits, unit evacuation or shut down, fire, etc.

3.2.2.5 Determine the Level of Mitigation by multiplying the three values together.

3.2.3 Once the level of mitigation is determined, the owning department will implement the applicable necessary mitigation techniques (for example, PPE) based on the hazard presented.

3.2.3.1 The owning department must also use their equipment knowledge, training, and past experiences/incidents, to determine if the mitigation proposed by the RAM is appropriate. When in doubt, a higher level of mitigation may always be used. Protective measures may vary based on situational conditions.

3.2.3.1.1 In the event that the operator performing the RAM does not feel that the mitigation level is appropriate for the task they must discuss proper mitigation with their supervisor and/or safety professional before deviating from the protective measures given by the RAM.

3.2.3.2 In the event that the mitigation techniques at the determined level are unavailable or unable to be utilized the next highest level must be used.

3.2.3.3 The use of the RAM does not supersede operation procedures or guidelines or safety procedures (including the fresh air/mitigation lists). If existing procedures are more restrictive, those requirements must be followed.

3.2.4 When the RAM is used the owning department may document the RAM score on Appendix D: RSW-SAF-070-Form10-DT RAM Score Tracking Log located in the control room.

3.2.5 The RAM score and any mitigation requirements associated with it must be documented on the Safe Work Permit for the servicing group**.**

3.3 RAM Exposure Categories

3.3.1 Exposure Concerns

Value	Exposure Concerns (Equipment or piping than CONTAINS or CONTAINED:	
1	Unknown Atmospheres/	Material that is potentially immediately dangerous to life and health or unknown atmospheres, streams with

	IDLH Material/ H2S /CO>25 ppm	any level of H2S or potentially high CO
	Materials Above Auto Ignition	Equipment or piping systems that contain or contained material that will auto-ignite upon contact with the atmosphere.
2	Hydrocarbons, SO2, NH3, or Other Hazardous Contaminants below IDLH	Material that contains hazardous contaminants below IDLH (reference SAF-025 for Contaminant Thresholds or contact safety)
	Flammable Material	Flammable material with potential for LEL
	Corrosive Material	Material with a high (≥12) or low (≤2) pH (e.g. Caustic, Acid, KOH, Amine)
3	Hot Service	Equipment or piping systems that contain or contained material that is above 130°F under normal operation
10	Other Material Verified	Any stream that does not meet any of the exposure concerns listed above

3.3.2 Exposure Volume

Value	Exposure Volume	
1	"Live" Equipment	Any equipment or piping circuit that is still in service or not completely isolated
1	Large Volume	e.g. towers, vessels, receivers, and large bore piping circuits
2	Medium Volume	e.g. knock-out drums, pumps, compressors, and piping systems
3	Small Volume	e.g. transmitter impulse lines, sight glass assemblies, sample stations and small bore piping
4	Low Volume	Volumes that have been quantifiably decontaminated or bleeder volume
6	No Volume	Verified at a low point by operations to be free of any volume

3.3.3 Exposure Impact

Value	Exposure Impact	
1	Large Impact	Could have off-site impact.
2	Medium Impact	Could have a refinery wide impact.
3	Small Impact	Could have an impact contained to the local unit.
4	Low/Localized Impact	Could have a localized impact at the invasive work site.
10	No Impact	Could have no impact, safe isolation per energy isolation procedure, equipment and material below 130°F**, AND checked and verified free of volume and H_2S/vapors. NOTE: MUST MEET ALL OF THESE CONDITIONS

3.4 Mitigation Categories

3.4.1 Level 1 Mitigations

Level 1 Mitigations

Inhalation Hazard Mitigation • Breathing Air Corrosive Material Hazard Mitigation • Chemical Resistant PVC Suit • Chemical Gloves • Face Shield • Goggles • Chemical Boots Hot Service • Safe Line Breaking Procedures • Thermal PPE – consult safety department	Fire Hazard Mitigation • Bunker Gear • Appropriate Gloves and Boots • Helmet w/ Face Shield • Continuous LEL Monitoring • Non-Sparking Tools/ • Cold Cutting • Additional Fire Watch/ • Extinguisher Material Above Auto-Ignition • Verify isolations and cool down below auto-ignition temperature before doing invasive work

3.4.2 Level 2 Mitigations

Level 2 Mitigations	
Inhalation Hazard Mitigation • Air Moving Device AND/ OR • Air Purifying Respirator* AND/OR • Route potential source to safe location using tubing or pipe. *NOTE: Personal H2S monitors are required to be worn for APR use. If equipment/process contains potential for SO2, consider the use of personal SO2 monitors as well. Hot Service • Safe Line Breaking Procedures • Thermal PPE – consult safety	Corrosive Material Hazard Mitigation • Chemical Resistant PVC Apron and Sleeves • Chemical Face Shield or Goggles • Chemical Gloves Fire Hazard/LEL Mitigation (non-confined space) • Non-Sparking Tools/ • Cold Cutting • Additional Fire Watch/ • Extinguisher • Also Consider Continuous LEL Monitoring

3.4.3 Level 3 Mitigations

Level 3 Mitigations
• Normal Refinery PPE • Normal refinery Standard Work Practices **NOTE: If the job task will involve reheating the equipment (e.g. welding, grinding, heat treating, steaming to reheat, etc.), the potential for liberating H2S or SO2 must be considered, and Level 2 mitigation must be used if these chemicals were present in the process/equipment.

3.4.4 Risk Assessment Scoring

1-12 Level 1 Mitigation
14-46 Level 2 Mitigation
>46 Level 3 Mitigation

3.5 Barricading of Invasive Work

3.5.1 The owning department and/or servicing group may utilize Appendix C: RSW-SAF-078-Form01-DT Invasive Work Barricade to assist with determining appropriate barricading distances.

3.5.2 The following requirements shall be followed for barricading invasive work where the equipment cannot be verified as de-energized:

3.5.2.1 The owning department shall establish a perimeter barricade around the work site to protect personnel from exposure to hydrocarbons or hazardous materials greater than 140°F during the initial line break.

3.5.2.2 Notes:

3.5.2.2.1 Owning Department supervision (Day Foreman, Shift Foreman/001 or designee) and Maintenance supervision (foreman or designee) must sign the work permit to designate their approval of the perimeter barricade, as well as the other precautions being implemented (e.g., unit evacuation of non-essential personnel during invasive work).

3.5.2.2.1.1 For services that have H2S levels above the PEL or that are elevated in temperature (>140°F), the perimeter barricade shall be established based on the impacted area (considering wind direction, gas test results, etc.) plus an additional 25 feet.

3.5.2.2.1.2 For all other services if gas test results show contaminant levels above the PEL/TLV limits in Appendix B, the perimeter barricade shall be based on the gas test results and wind direction.

3.5.2.2.2 Only personnel in the proper level of PPE, as designated on the safe work permit, shall be allowed within the established perimeter barricade during invasive work.

3.5.2.2.3 The perimeter barricade shall be demarcated with a physical barricade and signs/tags on all sides.

3.5.2.2.4 The owning department shall monitor the initial line break and adjust the perimeter barricade as necessary. The same level of PPE as required within the barricaded area shall be worn by the operator(s) while conducting gas testing near the barricades.

3.5.2.2.5 Note: The requirements in this section are not required during turnarounds once the unit is verified to be perimeter blinded, de-pressured and decontaminated.

4.0 Definitions

4.1 Invasive Work – Any task that could expose personnel to the materials or atmosphere normally contained inside of any process equipment, piping or utility systems.
Examples include; shutdown / startup activities, dewatering, obtaining samples, blowing down transmitters, line breaking, etc.

4.2 IDLH – Immediately dangerous to life and health. Examples are H_2S levels of 100 PPM or above, toxic chemicals above their IDLH or inert atmospheres. An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

4.3 LEL – Lower explosive limit (No hot work can be done above 10% outside of a confined space. Hot work in a confined space must be 0% LEL.)

4.4 PEL – Permissible Exposure Limit-defined as an 8 hour time-weighted average (TWA)

4.5 STEL – Short term Exposure Limit-An exposure averaged over 15 minutes which should not be exceeded at any time during a workday even if the 8-hour TWA is within the 8-hour TWA limit. Exposures above the TWA up to the STEL should not be longer than 15 minutes and should not occur more than 4 times per day. There should be at least 60 minutes between successive exposures in this range.

4.6 OEL- Occupational Exposure Limit- A Marathon Petroleum Company identified exposure limit derived from the MIOSHA Permissible Exposure Limit(PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), or other sources of exposure criteria developed for the purpose of protecting the health and safety of workers. Numerous regulatory agencies have also established OELs and components must use the most stringent of the two limits, the Marathon limit or the regulatory limit with jurisdiction at a particular location

4.7 Auto-Ignition – Any material or substance that is above the temperature at which it will ignite upon contact with the atmosphere.
4.8 Corrosives – any equipment or piping systems that contain caustic, acid, KOH, or amine.
4.9 Live Equipment – Any equipment or piping circuit that is still in service or not completely isolated.
4.10 Hot Service – Any equipment or piping circuit that contains material above 130°F.
4.11 Other material – Utilities such as air or water that are low temperature and low pressure.

5.0 References

5.1 Safe Equipment Preparation Guidelines SOP 105-01
5.2 RSW-SAF-070-Form04-DT Fresh Air/Mitigation List - Complex 1
5.3 RSW-SAF-070-Form05-DT Fresh Air/Mitigation List - Complex 2
5.4 RSW-SAF-070-Form06-DT Fresh Air/Mitigation List - Complex 3
5.5 RSW-SAF-070-Form07-DT Fresh Air/Mitigation List - Complex 4
5.6 RSW-SAF-070-Form08-DT Fresh Air/Mitigation List - Complex 5
5.7 RSW-SAF-070-Form09-DT Fresh Air/Mitigation List - Complex 6
5.8 RSW-SAF-078-Form10-DT RAM Score Tracking Log

6.0 Appendices

6.1 Appendix A: Known Mitigation Levels
6.2 Appendix B: RSW-SAF-078-P001-DT Risk Assessment Matrix Poster
6.3 Appendix C: RSW-SAF-078-Form01-DT Invasive Work Barricade Tool
6.4 Appendix D: RSW-SAF-078-Form10-DT RAM Score Tracking Log

7.0 Revision History

Revision number	Description of change	Written by	Checked by	Effective date
11	Added link to RAM poster	E. Neubauer	J. Rabideau	09/02/16
12	Updated RAM table to reflect matrix updates	E. Neubauer	J. Rabideau	04/19/18
13	Added barricading language per SWP RSP and controlled barricade tool	E. Neubauer	J. Rabideau	07/25/18
14	Scheduled review, no updates	E. Neubauer	A. Morales	02/27/20
15	Adjusted the RAM for Clarification and to include Hot Service Mitigation, updated procedure to reflect changes	E. Neubauer	A. Morales	06/01/2020

Appendix A

Known Mitigation Levels

Level 3	Changing lube oil on a pump that is in normal working condition.