Hazards Analysis Summary

Title: **Heat Plate Test**	No.: **SMS-171-HA**	Page: **1 of 4**
Reference: **SMS-171-TM, Rev 0 (07 June 2016)**	Rev: **0**	Date: **6 JUL 2016**

A hazards analysis has been completed for the work identified above. The analysis is based on the referenced SMS procedure and an on-site evaluation of operations and equipment. Based on the complexity of the work, a determination was made by the hazards analysts that the Failure Modes and Effects Analysis (FMEA) methodology would be used to identify potential failures and existing design safety features. Recommendations identified in the analysis have been properly addressed and are documented in the safeguards column.

X	X
Troy A. Gardner, PE, CSP Testing and Classifications Manager	Robert P. Dykstra Hazards Analyst

NOT VALID UNLESS BEARING BOTH UNIQUE DIGITAL SIGNATURES

MIL-STD-882E Risk Assessment Summary Table

SEVERITY ► PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	0	0	0	0
Probable (B)	0	0	0	0
Occasional (C)	0	0	2	0
Remote (D)	2	0	16	3
Improbable (E)	38	1	0	1
Eliminated (F)	0	0	0	0

SUMMARY OF POTENTIAL HAZARDS

Energetic Materials	Health Considerations	Physical Exposure	Exertion
☒ **Primary explosive**	☒ Toxic	☐ Entanglement	☐ Heavy/ awkward
☒ **HME/ IED materials**	☒ Carcinogen	☐ Shearing/ cutting	☐ Lifting/ lowering
☐ Mass explosion	☒ Poison	☐ Equipment collapse	☐ Pushing/ pulling
☐ Fragmentation	☒ Irritant	☐ Restricted access/ egress	☐ Carrying/ dragging
☐ Pressure vessel	☒ Noise	**Stored Energy**	☐ Turning/ twisting
☐ Propulsive	☒ Emissions/ fumes/ dust	☒ High voltage	☐ Repetition
☒ Fireball or firebrands	☐ Oxygen deficient atmosphere	☒ Working near live power	**Slips, Trips, Falls**
☒ Out of place material/ spill	☐ Other:	☐ Fluids under pressure	☐ Cables, hoses, pipes
☐ Other:	☐ Other:	☐ Falls/ drops from heights	☐ Uneven/ slippery surfaces
☐ Other:			☐ Obstacles in the way

SUMMARY OF POTENTIAL HAZARDS (CONT.)	
Main Potential Hazards	**Risk Mitigating Measure**
Operator can build up charge during handling of energetic substances	The operator handling the test substance shall be electrically connected to ground with a resistance of >2 MΩ and <1 GΩ to prevent charge build-up
Liquid flows off of plate to underside, possibly ejecting plate during reaction	Lip present on the heat plate
Electrocution	The operator performing the test shall be protected with a resistance of >2 MΩ and <1 GΩ to ground to prevent electrocution hazards
Insufficient wait time following completion of the test	Thermocouple with readout and cooling container

COMPLIANCE WITH 29 CFR §1910.119(e)	
Required Element	**Corresponding Reference**
The hazards of the process	FMEA “Potential Effects” column
Identification of any previous incident which had a likely potential for catastrophic consequences	See potential catastrophic incident section below
Engineering and administrative controls applicable to the hazards and their interrelationships	FMEA “Safeguards” column
Consequences of failure of engineering and administrative controls	FMEA “Potential Effects” column
Facility siting	See approved site plan for the test site and specific considerations in FMEA “Facility Design and Siting” section
Human factors	FMEA “Human factors” failure scenarios
A qualitative evaluation of a range of the possible safety and health effects of failure of controls	FMEA “Haz Cat” columns, with rankings assigned in accordance with MIL-STD-882E Tables 1 - 2
Hazard analysis team includes at least one with experience specific to the process and one knowledgeable in the hazard analysis methodology	Testing managers have experience with the operation; hazards analysts have experience with the analysis methodology
System to promptly address the team's findings and recommendations	SMS SAR tracking system documents recommendations, completion schedule, actions taken, and communication of actions to affected personnel

PREVIOUS INCIDENTS WITH LIKELY POTENTIAL FOR CATASTROPHIC CONSEQUENCES
1. None

Table 1. Failure Modes and Effects Analysis

LINE NO.	OPERATION/ ITEM	FAILURE MODE	FAILURE CAUSE	POTENTIAL EFFECTS	SAFEGUARDS	HAZ CAT	RECOMMENDATIONS
Normal Operations							
1A	General Operations	Propagation of reaction to another test or personnel	Site or test limits exceeded Improper spacing to other tests or facilities	Potential for propagation of reaction to another test, article, facility, or personnel Equipment/ facility damage Operator injury or fatality	The test site has a daily startup meeting discussing test plans for the day Specific test areas and where personnel can be during the day are discussed during the meeting The heat plate is a small scale (30mg), bench top test	3D	None
1B	General Operations	Physical exposure	Inadequate or blocked egress	Restricted access/ egress Severe injury or loss of life	Dual egress is provided in the test bay where these heat plate tests will be performed The heat plate is a small scale (30mg), bench top test	1E	None
1C	General Operations	Physical exposure	Uneven/ slippery surfaces	Injury from slips, trips, or falls	The heat plate is a small scale (30mg), bench top test that will be performed in the lab. Strict housekeeping standards are kept The floor in the lab is flat	4D	None
1D	General Operations	Physical exposure	Obstacles are in the way	Injury from slips, trips, or falls	The hot plate test is performed in the lab on a bench top in an area free from clutter The test area should be left clean and orderly for the next day per Section 14 of SMS-171-TM.	4D	None
1.0 Scope							
2A	1.0 Scope	Human factors	Improperly applying the test method	Personnel injury	Lines in Section 1 (SMS-171-TM) clearly delineate the substances that can be used Sample size of materials should not exceed 30 mg per section 9.4, Sample Preparation (SMS-171-TM)	2D	None
2.0 Requirements							
3A	2.0 Requirements	Human factors	Operator is not adequately trained	Personnel injury	Section 2 (SMS-171-TM) states that the test must be conducted by trained individuals and the record of training is properly documented	3D	None
3B	2.0 Requirements	Human factors	Operator does not follow the procedure	Personnel injury	The procedure is made available at the testing area per Section 2 (SMS-171-TM) Training is required that includes a review of the procedure or training module	3C	None
3.0 Applicable Documents							

Remaining pages not included here.

Please contact Safety Management Services, Inc. at 801-567-0456 or at admin@smsenergetics.com for further information.