

SECTION 6 - TECHNOLOGY SAFETY DATA SHEET

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HOUDINI

SECTION 1: TECHNOLOGY IDENTITY	
<p>Manufacturer's Name and Address:</p> <p>RedZone Robotics, Inc. 2425 Liberty Avenue Pittsburgh, PA 15222-4639</p>	<p>Emergency Contact:</p> <p>Adam Slifko 412-765-3069</p> <hr/> <p>Information Contact:</p> <p>Adam Slifko 412-765-3069 Warren Whittaker, 412-201-7250</p> <hr/> <p>Date Prepared: February 2001</p>
<p>Other Names:</p> <p>none</p>	<p>Signature of Preparer:</p> <p>Operating Engineers National Hazmat Program 1293 Airport Road, Beaver, WV 25813, phone 304-253-8674, fax 304-253-1384</p> <p>Under cooperative agreement DE-FC21-95MC32260</p>

SECTION 2: PROCESS DESCRIPTION

The Houdini robot system has several key components. The unit is a mobile base that has a robot arm attached. The arm, called Predator™, is manufactured by Kraft TeleRobotics, Inc. located at 11667 West 90th Street, Overland Park, Kansas (913-894-9022). According to the manual for the unit, the Predator™ is a general purpose, teleoperated manipulator system designed for service in hostile environments including full immersion in sea water. An operator introduces movements at a master control arm which are duplicated by the slave manipulator allowing an operator to perform complex work tasks from a safe remote location. With optional force feedback, the forces acting upon the distant manipulator are reflected back to the operator through a force-reflecting master. One end effector that Houdini can operate is an off-the-shelf “jaws of life” tool called the Power Hawk® P-16 built by Curtiss-Wright. The unit had a mount welded on it that allowed the end effector on Predator™ to pick it up through remote direction. The unit has a 70 degree swivel head and runs on a 12 volt DC power pack. The unit is all electric, with no hydraulics. Houdini can also operate high pressure water blasting units and oxyacetylene cutters.

SECTION 3: TECHNOLOGY PHOTOS



**Houdini with Power Hawk[®] end effector
inside containment.**



Power Hawk[®] end effector.

SECTION 4: CONTAMINANTS AND MEDIA

The Houdini can be used to cut up a metal structure that may be contaminated with lead or radioactive particles. These will need to be identified by the site characterization prior to the beginning of the job. A monitoring plan will need to be developed on a site-by-site job-by-job basis. The HOUDINI blasting media used with the high pressure water blaster is Andrite garnet which has no explosive limit but may cause acute respiratory disorders and permanent eye damage.

SECTION 5: ASSOCIATED SAFETY HAZARDS

Probability of Occurrence of Hazard:

- 1 Hazard may be present but not expected over background level
- 2 Some level of hazard above background level known to be present
- 3 High hazard potential
- 4 Potential for imminent danger to life and health

A. ELECTRICAL (LOCKOUT/TAGOUT)**RISK RATING: 2**

The technology has the potential to present electrical hazards. Assure proper grounding and the use of ground fault circuit interrupters on all equipment. Compliance with applicable electrical standards and codes and lockout/tagout procedures must be followed to assure the safety of personnel.

B. FIRE AND EXPLOSION**RISK RATING: 1**

Normal fire and explosion hazards exist in association with electrical powered equipment. The equipment is not intrinsically safe and could not be used in a potentially explosive atmosphere.

C. CONFINED SPACE ENTRY**RISK RATING: 2**

Houdini has been used in tanks to clean sludge but with its remote operation, should pose no risk to workers, unless emergency repair or maintenance is required.

D. MECHANICAL HAZARDS**RISK RATING: 3**

The Predator Arm has considerable reach and flexibility and may cause severe injury if it strikes a worker. Administrative controls and training are essential to prevent problems.

E. PRESSURE HAZARDS**RISK RATING: 2**

The hydraulic lines and particularly the high pressure water lines present a potential struck by hazard if they were to rupture or disconnect.

SECTION 5: ASSOCIATED SAFETY HAZARDS (CONTINUED)	
F. TRIPPING AND FALLING	RISK RATING: 3
The water lines, electrical lines, and hydraulic lines present tripping hazards in the area they are being used.	
G. LADDERS AND PLATFORMS	RISK RATING: N/A
Not part of this technology.	
H. MOVING VEHICLES	RISK RATING: 2
The presence of multiple pieces of mobile equipment (which may be needed to unload and load technology) in relationship to a small area of operation may pose a significant danger. Sufficient warning devices such as horns, bells, lights, and backup alarms should be utilized. Personnel should be trained to work with and around moving equipment.	
I. BURIED UTILITIES, DRUMS, AND TANKS	RISK RATING: N/A
Not part of this technology.	
J. PROTRUDING OBJECTS	RISK RATING: 2
The Predator Arm does not have to move to strike a worker. If the base is moving forward with the arm extended, workers can be hurt.	
K. GAS CYLINDERS	RISK RATING: N/A
Not part of this technology.	
L. TRENCHING AND EXCAVATIONS	RISK RATING: N/A
Not part of this technology.	
M. OVERHEAD LIFTS	RISK RATING: 2
Unloading and loading of technology may require overhead lifts or the use of a forklift. Proper precautions should be taken.	
N. OVERHEAD HAZARDS	RISK RATING: 2
Overhead hazards would only be present if a crane were required to unload or load equipment.	

SECTION 6: ASSOCIATED HEALTH HAZARDS	
Probability of Occurrence of Hazard:	
1	Hazard may be present but not expected over background level
2	Some level of hazard above background level known to be present
3	High hazard potential
4	Potential for imminent danger to life and health
A. INHALATION HAZARD	RISK RATING: 3
Lead dust and radioactive particle exposure is possible during the operation but should not pose a problem because of the remotely operated potential of the unit. Additionally, the unit has been shown, through sampling, not to generate much airborne dust.	

SECTION 6: ASSOCIATED HEALTH HAZARDS (CONTINUED)	
B. SKIN ABSORPTION	RISK RATING: 2
The dust from the blasting media may be a skin irritant but workers should not be exposed.	
C. HEAT STRESS	RISK RATING: 2
The use of a robotic device removes the need to wear PPE inside the containment area. Emergency repair of the unit may generate risks if the workers must enter containment.	
D. NOISE	RISK RATING: 2
Noise exposure is excessive during the operation of Houdini while conducting water blasting. Noise monitoring has shown values in excess of the OSHA PEL and ACGIH TLV inside containment. The levels are not serious for the operator, however, if he or she is placed at sufficient distance.	
E. NON-IONIZING RADIATION	RISK RATING: N/A
Not part of this technology.	
F. IONIZING RADIATION	RISK RATING: 2
Houdini has been used with radioactive wastes and although it operates remotely, worker exposure could be a concern during decontamination of the unit.	
G. COLD STRESS	RISK RATING: 1
Technology does not produce a hazard, but ambient conditions need to be considered.	
H. ERGONOMIC HAZARDS	RISK RATING: 1
The master controller for Houdini is ergonomically well designed and should not pose much stress for the operator.	
I. OTHER	RISK RATING: N/A
None.	

SECTION 7: PHASE ANALYSIS	
A. CONSTRUCTION/START-UP	
The setup/start-up phase presents several hazards including struck by/caught between hazards, pinch points, slips/trips/falls, muscular/back injury, and electrical hazards.	
B. OPERATION	
The operational phase presents several hazards including exposure to contaminants, noise hazards, hazards associated with air lines, muscular/back injury, and electrical hazards.	

SECTION 7: PHASE ANALYSIS (CONTINUED)
C. MAINTENANCE
The maintenance phase presents several hazards including pinch points, slips/trips/falls, struck by/caught between, muscular/back injury, electrical hazards, exposure to contaminants, and accidental activation of moving parts.
D. DECOMMISSIONING
The decommissioning phase presents several hazards including exposure to contaminants, pinch points, slips/trips/falls, and muscular/back injury.

SECTION 8: HEALTH AND SAFETY PLAN REQUIRED ELEMENTS
A. AIR MONITORING
Operation of the Houdini should generate limited dust. An Air Monitoring Plan will need to be developed, however, if radioactive particles are the concern. Noise generated during operation of the Houdini is not excessive but further measurements may be warranted.
B. WORKER TRAINING
Training that would apply in this case may include but not be limited to: <ul style="list-style-type: none"> ▪ HAZWOPER ▪ HAZCOM ▪ Respiratory Protection ▪ Hearing Conservation ▪ Personal Protective Equipment ▪ Electrical Safety ▪ Lockout/Tagout ▪ Job-specific training for equipment operation ▪ Ergonomics (proper lifting, bending, stooping, kneeling, and static postures, etc.) ▪ Heat stress (learning to recognize signs and symptoms) ▪ CPR/First Aid/Emergency Response/Blood-borne Pathogens ▪ Hand Signal Communication ▪ Construction Safety (OSHA 500) and or General Industry Safety (OSHA 501)
C. EMERGENCY RESPONSE
Emergency response planning for a site needs to assure adequate coverage for hazards described in the TSDS. Having at least one worker per shift trained in CPR and first aid is recommended.
D. MEDICAL SURVEILLANCE
A medical surveillance evaluation of personnel's general health with emphasis on the back and cardiovascular/respiratory system, as required by the OSHA standards, needs to be conducted. This includes initial and annual audiograms.
E. INFORMATIONAL PROGRAM
Workers must be trained in specific operation of equipment before use.

SECTION 9: COMMENTS AND SPECIAL CONSIDERATIONS

Only personnel who have been adequately trained in the operation of Houdini as well as associated hazards should be permitted to operate the system.