

STATE OF HAWAII  
HAZARD AWARENESS PLAN FOR  
SPACE VEHICLE RE-ENTRY  
IMPACT



February 2008

## STATE OF HAWAII

### HAZARD AWARENESS PLAN FOR SPACE VEHICLE RE-ENTRY IMPACT

#### AUTHORITY.

---

Hawaii Revised Statutes, Chapter 127-128.

#### PURPOSE

---

This plan provides hazard awareness information for the protection of the public in the event an orbiting space vehicle namely U.S. Satellite NROL-21 re-enters the Earth's atmosphere and its debris is projected to impact the Hawaiian Islands.

#### SCOPE.

---

This plan is available for the general public. Portions of the plan will be translated into various languages.

#### BACKGROUND.

---

The United States and various other countries launch satellites and other space vehicles to orbit around the earth for purposes of surveillance, communication and research. Some of these vehicles and satellites, at some point in time, re-enter the earth's atmosphere, break up and spread debris in their path of descent and where they crash. The resulting space debris can vary in size from cubic centimeters to complete space laboratories with on-board nuclear reactors. While most items disintegrate and burn up entirely on re-entry, large debris has hit the Earth.

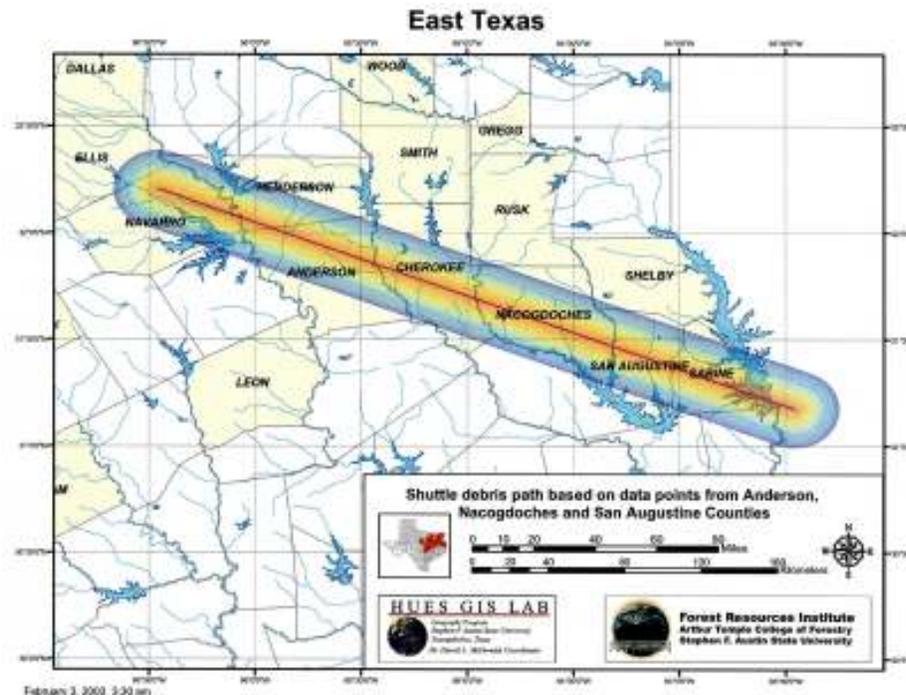
In 1978, COSMOS 954, a Soviet ocean reconnaissance satellite with on-board nuclear reactor, crashed in the Northwest Territories, Canada and scattered radioactive debris over 48,000 square miles of northwestern Canada.

The largest uncontrolled re-entry by a National Aeronautics and Space Administration (NASA) spacecraft was Skylab which fell from orbit in 1979. Fortunately, its debris dropped harmlessly into the Indian Ocean and across a remote section of Western Australia.

In 1983, COSMOS 1402, a nuclear-powered Soviet spy satellite burned through the atmosphere within sight of U. S. forces stationed in Diego Garcia about 800 miles southwest of India. The heaviest portion of the satellite weighing about four tons burned out over the Indian Ocean on January 23 after orbiting uncontrolled through the earth's atmosphere.

On February 1, 2003, the Space Shuttle Columbia disintegrated over Texas during re-entry into the Earth's atmosphere. More than 2,000 debris fields, including human remains, were

found in sparsely populated areas southeast of Dallas from Nacogdoches in East Texas, where a large amount of debris fell, to western Louisiana and the southwestern counties of Arkansas. The below map displays the extent of the debris field from the Space Shuttle Columbia



Of major concern to the public and emergency responders during a space vehicle/satellite re-entry is the anxiety it poses because of the uncertainty of the exact time and location of where the space vehicle/satellite might crash, the size and makeup of the debris and associated debris field, concerns on the exact path of descent, and the hazards posed by its fuel.

#### SITUATION:

---

The President has directed the U. S. Department of Defense (DoD) to intercept a U.S. satellite (NROL-21) projected to re-enter the earth's atmosphere between the dates of February 20, 2008 and March 16, 2008. The DoD may employ Aegis Cruisers with modified SM-3 missiles to attempt to destroy the satellite as it enters the earth's atmosphere.

The U.S. satellite was launched in December 2006 and ground controllers lost the ability to communicate with the satellite shortly after it reached orbit. Ground controllers are not able to guide the satellite and its precise re-entry time and location cannot be predetermined. This spacecraft contains no nuclear power source and contains no radioactive components.

The satellite weighs about 7,000 pounds and may be as large as a small bus. It is expected that over 2,500 pounds of debris will survive re-entry and impact the earth if the missile interception is not successful.

The satellite is powered by hydrazine fuel and there may be a considerable amount remaining in its fuel tank, if the tank survives re-entry. Hydrazine, a colorless liquid with an ammonia-like odor, is a toxic, flammable, and carcinogenic chemical that presents an inhalation, ingestion, vapor, and contact hazard. Hydrazine will cause harm to anyone who comes in close proximity to high levels or makes contact without personal protective equipment. The



*A Delta II rocket, like the one pictured here, launched the NROL-21 in December 2006.*

satellite is also reported to contain some quantity of Beryllium which may pose a toxic hazard similar to Hydrazine.

The DoD, Department of Homeland Security (DHS) and the Federal Emergency Management Agency (FEMA) will provide federal level interagency coordination of planning and reporting regarding the re-entry and/or impact of the satellite over or on the United States, its territories and possessions. This coordination includes State Civil Defense (SCD), county civil defense and emergency response agencies,

Hawaii National Guard (HING), U.S. Pacific Command (USPACOM) and its component services operating in the State of Hawaii.

NASA and the North American Air Defense Command (NORAD) can only provide a re-entry window based on the satellite's orbit and cannot determine the specific location of the satellite's re-entry into the earth's atmosphere. In view of this uncertainty, advance warning or public protective measures may not be considered feasible or practicable until there is an indication that it will fall near the State or sightings confirm debris is actually passing over or has impacted in the State.

#### ASSUMPTIONS:

---

NORAD (U. S. Strategic Command) will provide advance notice of where satellite debris is expected to impact.

NORAD may further refine the impact area to provide 2-4 hours notice to the State.

If the DoD interception mission fails to destroy the satellite, most of the satellite will burn up during re-entry, but an unknown amount of debris will reach the earth's surface.

The debris field from this re-entry could extend over multiple areas and debris could fall over the Hawaiian Islands.

Debris impact areas may not be known for several hours after re-entry.

## OBJECTIVES.

---

This plan provides:

- Public information concerning the threat posed by the hazardous materials and falling debris associated with a satellite re-entry.
- Government preparedness and response actions should satellite debris impact the Hawaiian Islands.
- Recommended public protective measures and reporting procedures.

## CONCEPT OF OPERATIONS.

---

The U.S. government will track, monitor and plan for the re-entry of this satellite. Orbital analysts at the U.S. Strategic Command will increase sensor tasking (monitoring) and begin to project a specific re-entry time and location. Starting at the 24-hour point before projected impact, the object is monitored at the highest level of scrutiny.

The FEMA Operations Center (FOC) in Washington, DC, will be in constant contact with DoD and will notify all States and interagency partners via the National Warning System with information concerning the re-entry of the satellite and debris field once it is known.

FEMA has pre-positioned a federal interagency support task force in Hawaii. The interagency support task force is comprised of an Urban Search and Rescue Task Force representative, U.S. Department of Health and Human Services (HHS) medical support personnel, Environmental Protection Agency (EPA) and U.S. Coast Guard hazardous material specialists and other emergency response team members. The task force will be immediately available to assist State and county emergency responders. Other federal assets will be on alert and prepared to respond as needed. Pre-positioned federal recovery and hydrazine response teams will be ready to deploy to impact areas.

Upon notification of the satellite's projected re-entry into the Earth's atmosphere from federal sources, SCD will initiate monitoring and coordination of the event. SCD will stay in contact with the Department of Homeland Security, FEMA, and military to maintain situational awareness of the event. Effort will be focused on determining whether the State is inside or outside of the expected impact zone. The State's response will be based on determination of the final impact projection for the satellite.

If the State is outside of the projected impact zone, SCD will issue an information statement to advise the State Civil Defense network of the impact projection and will coordinate the public information message prior to its release.

If the State is likely to be within the projected impact area, SCD will issue an Emergency Alert System Message (Watch). SCD will issue an Emergency Alert System Message (WARNING) if the Hawaiian Islands are expected to be impacted by debris.

If an actual impact occurs within the State, SCD will coordinate the State response to assist the impacted county or counties. SCD will coordinate with the FEMA regional response team and task force representatives to identify requirements and obtain federal assistance.

The Hawaii National Guard will provide helicopters to transport members of the State response team and other federal and military response teams to debris sighting areas that are inaccessible by vehicle. The 93rd Civil Support Team (CST) and other Hawaii National Guard response teams are specially trained and equipped to support hazardous materials operations and will be available to support detection and recovery activities.

The State Department of Health will provide technical expertise on health hazards and protective measures and coordinate emergency medical service response. Note: the space vehicle (NROL-21) contains no radiological components.

County civil defense agencies and the Honolulu Department of Emergency Management (DEM) will activate county Emergency Operating Centers as required.

First responders should safeguard any suspected debris until official notification by federal authorities as to the proper disposition of the debris. No debris may be removed without assessing the health hazard and coordination with the federal/military response teams. Debris should be controlled until federal authorities establish control of the scene and initiate removal operations.

#### REPORTS:

---

Reports of damage, bodily injury or contamination, believed to have been caused by the satellite re-entering the earth's atmosphere and impacting on land, should be made by dialing 9-1-1 or by contacting the appropriate county civil defense agency or Honolulu Department of Emergency Management.

Procedures for documenting information reported to civil defense are attached.

#### PUBLIC INFORMATION AND PROTECTIVE MEASURES:

---

The public will be kept informed on the satellite re-entry situation consistent with information issued by FEMA to State, county civil defense agencies and the Honolulu Department of Emergency Management.

Upon determining that the satellite re-entry poses a definite threat to the State of Hawaii, the State EAS will be activated to broadcast critical public safety information and warn against handling any of the debris.

In general, the risk to the public from possible debris impact is SLIGHT.

The following actions are suggested:

- Until advised of a potential impact in your area, continue your normal activities;
- When notified that satellite debris will impact your area, move indoors and listen to the radio/TV for further civil defense instructions. If this is not practical,

minimize time outside homes, buildings, or vehicles until further advice is received;

- Do not pick up any object which you may have seen impact. If possible, isolate a 50 yard (150 feet) diameter circle around the object;
- Have anyone injured by such debris or has come in close contact with the debris go to a hospital; and
- Report debris objects to your local police by calling 9-1-1.
- An information sheet on Hydrazine is attached at Attachment 2.
- Questions concerning this Hazard Awareness Plan should be submitted to [askcivildefense@scd.hawaii.gov](mailto:askcivildefense@scd.hawaii.gov).



A missile is launched from the Navy guided missile Cruiser USS Shiloh during a 2006 test

# SPACE VEHICLE/SATELLITE RE-ENTRY AND ON-SITE IMPACT REPORT

Date: \_\_\_\_\_ Time: \_\_\_\_\_

Person Reporting: Name \_\_\_\_\_

Agency \_\_\_\_\_ Jurisdiction \_\_\_\_\_

## A. On-Site Impact Report

1. Name \_\_\_\_\_ Telephone No. \_\_\_\_\_

Address of the person calling in the report from the site to an EOC: \_\_\_\_\_

2. Date and time of impact \_\_\_\_\_

3. Location \_\_\_\_\_  
(Nearest highway, street, intersection, building, landmark, etc)

4. Description of Debris \_\_\_\_\_  
(shiny, glittering, metallic, scorched)

Comments: \_\_\_\_\_  
(include radiological assessments, odors, observed physical reactions to debris)

## B. Complete the following only if casualties or property damage occurred:

1. Detailed Description of Casualties \_\_\_\_\_

2. Detailed Description of Property Damage \_\_\_\_\_

3. Pictures Taken By \_\_\_\_\_

4. Comments: \_\_\_\_\_  
(Include information on whether individuals were monitored for contamination and results of monitoring operations)

This fact sheet answers the most frequently asked health questions (FAQs) about hydrazine, 1,1-dimethylhydrazine, and 1,2-dimethylhydrazine. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Hydrazines are colorless liquids that are used in rocket fuels, chemical manufacturing, and as boiler water treatments. Exposure to hydrazines may cause nervous system effects, as well as liver and kidney damage. Hydrazines have been found in at least 8 of the 1,416 National Priorities List sites identified by the Environmental Protection Agency (EPA).

#### What are hydrazines?

(Pronounced hī'drə zēnz')

Hydrazines are clear, colorless liquids with an ammonia-like odor. There are many kinds of hydrazine compounds, including hydrazine, 1,1-dimethylhydrazine, and 1,2-dimethylhydrazine. Small amounts of hydrazine occur naturally in plants. Most hydrazines are manufactured for use as rocket propellants and fuels, boiler water treatments, chemical reactants, medicines, and in cancer research. Hydrazines are highly reactive and easily catch fire.

#### What happens to hydrazines when they enter the environment?

- Hydrazines can be released into the environment during their production or use, or from accidental spills.
- Hydrazines easily evaporate to the air, where they are broken down by reactions within minutes or hours.
- Hydrazines can also dissolve in water, where they usually break down into less toxic compounds within a few weeks.
- Hydrazines may build up in some fish living in contaminated water, but are not expected to remain at high levels over long periods of time.
- In soil, hydrazines may stick to particles and be changed within a few days to less harmful compounds.

#### How might I be exposed to hydrazines?

- Breathing contaminated air in or near a facility that makes, processes, or uses hydrazines.
- Eating fish contaminated with hydrazines.
- Drinking or swimming in water that has been contaminated with hydrazines.
- Touching soil contaminated with hydrazines, such as near some military bases or hazardous waste sites.
- Breathing cigarette smoke indirectly or using tobacco products may expose you to small amounts of hydrazine or 1,1-dimethylhydrazine.
- Working in greenhouses where the chemical Alar is used may result in your being exposed to small amounts of 1,2-dimethylhydrazine.

#### How can hydrazines affect my health?

Breathing hydrazines for short periods may cause coughing and irritation of the throat and lungs, convulsions, tremors, or seizures. Breathing hydrazines for long periods may cause liver and kidney damage, as well as serious effects on reproductive organs.

Eating or drinking small amounts of hydrazines may cause nausea, vomiting, uncontrolled shaking, inflammation of the nerves, drowsiness, or coma.

**ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html>**

### How likely are hydrazines to cause cancer?

Tumors have been seen in many organs of animals that were exposed to hydrazines by ingestion or breathing, but most tumors have been found in the lungs, blood vessels, or colon. 1,2-Dimethylhydrazine has caused colon cancer in laboratory animals following a single exposure.

The Department of Health and Human Services (DHHS) has determined that hydrazine and 1,1-dimethylhydrazine are known carcinogens.

The International Agency for Research on Cancer (IARC) has determined that hydrazine, 1,1-dimethylhydrazine, and 1,2-dimethylhydrazine are possible human carcinogens.

The EPA has determined that hydrazine, 1,1-dimethylhydrazine, and 1,2-dimethylhydrazine are probable human carcinogens.

The American Conference of Governmental Industrial Hygienists (ACGIH) currently lists hydrazine and 1,1-dimethylhydrazine as suspected carcinogens, but has recently recommended that the listing of hydrazine be changed to that of animal carcinogen, not likely to cause cancer to people under normal exposure conditions.

### Is there a medical test to show whether I've been exposed to hydrazines?

There are tests available to detect the presence of hydrazines or their breakdown products in the blood, urine, and feces. These tests must be done soon after exposure, before the compounds are broken down and eliminated from the body. These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment. These tests cannot be used to tell how much hydrazines you were exposed to or if any health effects will occur.

### Has the federal government made recommendations to protect human health?

The National Institute for Occupational Safety and Health (NIOSH) recommends that the levels of hydrazine and 1,1-dimethylhydrazine in workplace air not exceed 0.03 and 0.6 parts of compound per million parts of air (0.03-0.6 ppm), respectively, for a 2-hour period.

The Occupational Safety and Health Administration (OSHA) limits the amount of hydrazine and 1,1-dimethylhydrazine in workplace air to 1 and 0.5 ppm, respectively, for an 8-hour workday.

The Food and Drug Administration (FDA) has ruled that hydrazine cannot be added to water used for making steam which will contact food.

The EPA requires that spills or accidental releases into the environment of 1 pound or more of hydrazine or 1,2-dimethylhydrazine, or more than 10 pounds of 1,1-dimethylhydrazine be reported to the EPA.

### Glossary

**Carcinogen:** A substance with the ability to cause cancer.

**CAS:** Chemical Abstracts Service.

**Evaporate:** To change into a vapor or gas.

**Ingest:** To eat or drink something.

**ppm:** Parts per million.

### References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Hydrazines produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaq.html> ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

