



## Department of Energy

Washington, DC 20585

April 28, 2000

RECEIVED  
U.S. OFFICE OF SPECIAL COUNSEL  
WASHINGTON, D.C.  
5/1/00

The Honorable Elaine Kaplan  
Special Counsel  
U.S. Office of Special Counsel  
1730 M. Street, NW  
Suite 300  
Washington, D.C. 20036-4505

Dear Ms. Kaplan:

Because I have Departmental responsibility in the areas of packaging and transportation safety, the Secretary of Energy has asked me to respond to your letter dated November 24, 1999, in which you transmitted an allegation pursuant to 5 U.S.C. 1213(c). I have reviewed the allegation and conclude that the Department of Energy (DOE) is transporting uranium hexafluoride safely. My review is enclosed.

In your letter you state that Mr. James Hutton, a Senior Fire Protection Engineer in the DOE Oak Ridge Operations Office, alleges that because no high-temperature fire tests have been conducted on cylinders in which uranium hexafluoride is transported, the DOE ships its uranium hexafluoride unsafely. Furthermore, he states that these cylinders should be placed in a protective overpack that will shield a cylinder from the effects of a fire that could be encountered in transportation.

By law our contractors are required to transport uranium hexafluoride in compliance with the requirements of the Hazardous Materials Regulations promulgated by the U.S. Department of Transportation in Title 49 of the Code of Federal Regulations (49 CFR), *Transportation*, Parts 171-180. Specifically, uranium hexafluoride must be transported in accordance with Section 173.420, Uranium hexafluoride (49 CFR 173.420). Compliance with these Regulations provides the general public, our workers, and the environment with a publicly-acceptable level of safety. These Regulations do not require the use of overpacks nor do they require that fire tests be conducted on the cylinders.

Additionally, the Hazardous Materials Regulations are based on requirements found in Safety Series No. 6, *Regulations for the Safe Transport of Radioactive Materials*, and its predecessor documents published by the International Atomic Energy Agency. These standards of safety apply to all Member States of the



International Atomic Energy Agency. Compliance with these safety standards also ensures that commerce related to radioactive materials transportation between countries is unimpeded.

The uranium hexafluoride regulations in the Hazardous Materials Regulations and Safety Series No. 6 have been developed from more than 50 years of uranium hexafluoride transportation experience. Each of these bodies of requirements has incorporated standards developed by the American National Standards Institute (ANSI) and the International Standards Organization (ISO). Furthermore, these regulations undergo constant review and revision as new data become available.

Since none of these regulations or standards requires that fire testing be conducted on the cylinders or that protective overpacks be used, we believe that Mr. Hutton's allegations are related to the safety basis for the Hazardous Materials Regulations and not to the DOE's lack of safety in shipping uranium hexafluoride.

Recently the Department of Transportation published an Advanced Notice of Proposed Rulemaking to consider adoption of the latest regulations of the International Atomic Energy Agency published in 1996 as ST-1. ST-1 identifies *inter alia* additional requirements for transporting cylinders of uranium hexafluoride, including consideration of overpacks for fire protection. Since DOE will be responding to that Notice, we will advise Mr. Hutton to make his concerns known through our internal process for responding to the Notice. Alternatively, Mr. Hutton may respond directly to the Advanced Notice as a member of the public.

Finally, in 1997 the DOE's uranium enrichment activities were transferred to the U.S. Enrichment Corporation. The resulting shift has reduced the DOE's uranium hexafluoride transportation activities. For the last two years the DOE has not transported uranium hexafluoride offsite. It is my understanding that there are no plans for such transportation for the next few years.

Based on the foregoing discussion and the enclosed report, I believe that the DOE has acted responsibly and safely in its uranium hexafluoride transportation activities. Internal DOE directives require that our contractors comply fully with the Hazardous Materials Regulations for domestic transportation of uranium hexafluoride and Safety Series No. 6 for international shipments of uranium hexafluoride. If we find that any of the DOE's transportation activities are not conducted in compliance with the Hazardous Materials Regulations, we take immediate action to rectify the noncompliance and ensure that any recurrence of the noncompliance is minimized.

If you have further questions, please contact me or have a member of your staff contact Ms. Linda Lingle, Principal Deputy Assistant Secretary, Office of Congressional and Intergovernmental Affairs, at (202) 586-5450.

Sincerely,



Carolyn L. Huntoon  
Assistant Secretary for  
Environmental Management

Enclosure

# INVESTIGATION OF ALLEGATION OF UNSAFE ACTIVITY RELATED TO THE TRANSPORTATION OF URANIUM HEXAFLUORIDE CYLINDERS

## 1. Summary of Information

On November 24, 1999, the U.S. Office Special Counsel sent a letter to the Secretary of Energy, in which Mr. James Hutton, a Senior Fire Protection Engineer with the Oak Ridge Operations Office of the Department of Energy (DOE), alleges a substantial and specific danger to public safety related to DOE's transportation of uranium hexafluoride (UF<sub>6</sub>). He states that because no high-temperature fire tests have been conducted on cylinders in which UF<sub>6</sub> is transported, especially those weighing 14 tons, the Department ships its UF<sub>6</sub> unsafely. Furthermore, he states that UF<sub>6</sub> escaping from a ruptured cylinder in a fire can react explosively with hydrocarbon fuels to create a large fireball, which can cause serious health effects to emergency responders and cause environmental contamination over a large geographical area. As a solution, he states that the DOE should be required to transport these cylinders in a protective overpack that will shield a cylinder from the effects of a fire that could be encountered in transportation.

In the letter from the Office of Special Counsel Mr. Hutton continues by challenging the regulatory basis for a fire test that is required for certain packages containing large quantities of radioactive materials. He states that the regulatory fire temperature of 1475°F is too low and should be at least 1700°F. He states that this is important because there are hydrocarbon materials that when ignited will burn at a higher temperature than the regulatory fire temperature. As a result, a cylinder containing UF<sub>6</sub> will explode in less time.

His allegations have been investigated by DOE's Office of the Inspector General, which he claims substantiated his claims, and by the DOE's Office of Environment, Safety and Health (EH), which rejected his claims. Mr. Hutton subsequently submitted his allegation to the Office of Special Counsel, which referred them to the Secretary of Energy for investigation.

## 2. Description of the Investigation

1. The investigation evaluated the following documents that were submitted with the letter by the Office of Special Counsel:
  - i. Office of Special Counsel letter detailing allegations by Hutton,
  - ii. Memorandum dated August 20, 1996 from Cooper to Goldenberg which also contained:
    - (1) Uranium hexafluoride rupture pressure evaluation
    - (2) Draft correspondence, Potential Fire Research
    - (3) Interim Abstract Report of Investigation, "Allegations Addressing Safety Issues at the Oak Ridge Operations Office," Case 18OR014

2. The investigation also evaluated the following documents that were referenced in the documents cited in 2a. above:

- i. K-25 Report entitled, "Natural Phenomena Evaluations of the K-25 Site UF<sub>6</sub> Cylinder Storage Yards,"
- ii. Conference presentation and report entitled, "Estimation of Time to Rupture in a Fire Using Fire, A Lumped Parameter UF<sub>6</sub> Cylinder Transient Heat Transfer/Stress Analysis Model,"
- iii. Conference presentation entitled, "Releases of UF<sub>6</sub> to the Atmosphere After a Potential Fire in a Cylinder Storage Yard," and
- iv. Lockheed Martin Energy Systems Engineering, Engineering Analysis entitled, "UF<sub>6</sub> Cylinder Accident Simulations (1475°F Regulatory Fire)."

3. The investigation also evaluated the following documents that provide additional information about this subject:

- i. Department of Transportation's Hazardous Materials Regulations (49 Code of Federal Regulations Parts 171-180),
- ii. Nuclear Regulatory Commission's (NRC) Requirements for Packaging and Transportation of Radioactive Materials (10 Code of Federal Regulations Part 71),
- iii. International Atomic Energy Agency's "Regulations for the Safe Transport of Radioactive Materials," Safety Series No. 6, 1985 Edition (revised 1990),
- iv. International Atomic Energy Agency's "Regulations for the Safe Transport of Radioactive Materials," ST-1, 1996 Edition,
- v. American National Standards Institute Standard, ANSI 14.1, Uranium Hexafluoride-Packaging for Transport,
- vi. U.S. Enrichment Corporation's "The UF<sub>6</sub> Manual," USEC-651, January 1999,
- vii. International Organization for Standardization Standard, ISO 7195, "Packaging of Uranium Hexafluoride (UF<sub>6</sub>) for Transport,"
- viii. Department of Transportation's "2000 North American Emergency Response Guidebook,"
- ix. Department of Transportation's Advanced Notice of Proposed Rulemaking, "Hazardous Materials Regulations; Compatibility With the Regulations of the International Atomic Energy Agency," 64 FR 72933, December 28, 1999,
- x. Standards of the National Fire Protection Association,

### 3. Summary of Evidence Obtained during the Investigation

A list of the issues that were investigated with responses is given in the following paragraphs:

1. Issue No. 1 - Are cylinders containing  $UF_6$  transported without protective overpacks?

Response - Yes, cylinders containing  $UF_6$  are often transported without protective overpacks. The Hazardous Materials Regulations in Section 173.420, "Uranium hexafluoride," do not require an overpack. Only cylinders that contain fissile quantities of  $UF_6$  are required to be overpacked pursuant to the NRC's requirements. In the past DOE has shipped fissile quantities of  $UF_6$  in overpacked cylinders as required. Conversely, DOE has not shipped nonfissile quantities materials in overpacked cylinders unless the cylinder failed to meet the requirements of 173.420. The Hazardous Materials Regulations provide a publicly-acceptable level of safety for cylinders of  $UF_6$ .

Furthermore, it should be noted that in 1997 the DOE's uranium enrichment activities were transferred to the U.S. Enrichment Corporation. The resulting shift has reduced the DOE's  $UF_6$  transportation activities. For the last two years the DOE has not transported  $UF_6$  offsite. It is my understanding that there are no plans for such transportation for the next few years.

Finally, the United States has been transporting cylinders of  $UF_6$  for more than 50 years. There is no recorded incident or accident involving a cylinder of  $UF_6$  and a fire. As a result there has not been demonstrated a need for overpacking or a change to the Hazardous Materials Regulations.

2. Issue No. 2 - Has there been actual testing on the large "unprotected"  $UF_6$  to determine their combustibility after exposure to a fire?

Response - There are no recorded fire tests of large unprotected cylinders filled with  $UF_6$ . Such tests are not required by the Hazardous Materials Regulations, the NRC's regulations, Safety Series No. 6, ANSI 14.1, ISO 7195 or USEC-651 for cylinders containing  $UF_6$ . It is reported that the French have conducted some fire tests to evaluate the structural integrity of a cylinder but not to investigate the combustibility of  $UF_6$ . However, these results have not been recorded and are not available for review.

Additionally, the Hazardous Materials Regulations do not require physical testing of any radioactive materials package. Compliance with the regulations may be demonstrated by 1) performance of tests with prototypes or samples, 2) reference to previous, satisfactory demonstration of compliance of a sufficiently similar nature, 3) performance of tests with models, and 4) calculations or reasoned evaluation. It is common practice not to demonstrate compliance through physical testing because of significant environmental and economic impacts of an actual test. In most cases, calculations or reasoned evaluation employing commonly-used computer models, which have been shown to provide conservative bounds, provide a regulatory-acceptable method for evaluating the

performance characteristics of a package.

3. Issue No. 3 - Is the regulatory fire temperature of 1475°F high enough for transportation or should a fire test that achieves a temperature of 1700°F be used for fire testing?

Response - This issue challenges the basis for the regulatory fire test. This is not a DOE issue. The regulatory fire test is a requirement of both the NRC and Safety Series No. 6 only for certain radioactive materials packages. Cylinders containing UF<sub>6</sub> are not currently subject to a fire test evaluation unless the cylinder contains a fissile quantity of UF<sub>6</sub>.

However, in ST-1 the IAEA has proposed that a fire test evaluation be applied to large cylinders containing UF<sub>6</sub>. This proposal suggests that unprotected (unoverpacked) cylinders containing UF<sub>6</sub> be subject to a fire test evaluation. As mentioned before any one of the four methods for demonstrating compliance will be acceptable.

Because of ST-1 the Department of Transportation has published for public comment, an Advanced Notice of Proposed Rulemaking related to adoption of the requirements of ST-1. In the near future DOE will be evaluating, *inter alia*, the issue of thermal requirements for cylinders containing UF<sub>6</sub> and will provide its comments to the Department of Transportation. Toward this end DOE has requested comments from each of its Operations Office. Mr. Hutton should be urged to make his concerns known to the Office of the Assistant Manager for Environment, Safety Health and Emergency Management at the DOE's Oak Ridge Operations Office. Environment, Safety, Health and Emergency Management will be compiling the comments from Oak Ridge. We have asked the Oak Ridge staff to provide a copy of the Advanced Notice to Mr. Hutton. Alternatively, Mr. Hutton may respond directly to the Advanced Notice as a member of the public.

4. Issue No. 4 - Can UF<sub>6</sub> escaping from a ruptured cylinder in a fire react explosively with hydrocarbon fuels to create a large fireball?

UF<sub>6</sub> is not flammable or explosive. It is classified as a corrosive. It will not burn and it will not support burning. There can be no fireball of the nature described in the documents submitted by the Office of Special Counsel. The allegation postulates this occurrence based on the response of small cylinders to a fire. This premise is flawed. In fire tests involving small cylinders of UF<sub>6</sub>, the cylinders violently ruptured due to a quick internal pressure buildup of gases within the cylinder. Based on the data in the documents submitted by the Office of Special Counsel, this phenomenon cannot occur in a large cylinder because cylinders can take up to 25 minutes to rupture. This rupture is not quick and violent in an explosive nature.

5. Issue No. 5 -Is a fire department required to respond to a rupture of a cylinder containing UF<sub>6</sub> in less than the fifteen-minute time interval that is required by a fire department to initiate actions to mitigate a fire?

We have not been able to find the basis for a fifteen-minute response time. We have investigated the standards of the National Fire Protection Association and cannot find a reference to this type of response.

Conversely, the 2000 North American Emergency Response Guidebook at Guide 166 provides information on fighting a fire involving cylinders of UF<sub>6</sub>. However, there is no requirement in the Guidebook that mentions a 15 minute response to a fire.

6. Issue No. 6 - Does DOE transport its cylinders of UF<sub>6</sub> unsafely?

The answer is no. DOE transport its cylinders of UF<sub>6</sub> in compliance with the Hazardous Materials Regulations. If we find that any of DOE's transportation activities are not conducted in compliance with the Hazardous Materials Regulations, we take immediate action to rectify the noncompliance and ensure that any recurrence of the noncompliance is minimized.

#### 4. Listing of Violation or Apparent Violation

The investigation did not reveal any violation or apparent violation of a law, regulation, or standard. It is DOE policy that its contractors comply fully with the Hazardous Materials Regulations for domestic transportation of UF<sub>6</sub> and Safety Series No. 6 for international shipments of UF<sub>6</sub>. No evidence to the contrary was found.

#### 5. Description of Action Taken or Planned

There is no basis for any action to be taken:

1. It is Departmental policy that our contractors comply fully with the Hazardous Materials Regulations for domestic transportation of UF<sub>6</sub> and Safety Series No. 6 for international shipments of UF<sub>6</sub>. We found no evidence to the contrary. Consequently, there is no need for a change in any of DOE rules, regulations or practices related to the transportation of UF<sub>6</sub> cylinders.
2. Restoration of an aggrieved employee is not an issue.
3. Disciplinary action against an employee is not indicated.
4. Referral to the Attorney General of any evidence of a criminal violation is not indicated.

6. Dollar Savings, Projected Savings and Management Initiatives

There are no known actual or projected dollar savings. However, extra regulatory overpacking of cylinders will actually increase the cost of transportation because of the overpack itself and because of the increased costs at the receiving site for special handling equipment.