

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS  
WASHINGTON, D.C. 20555-0001

August 10, 1998

NRC INFORMATION NOTICE 97-91, SUPPLEMENT 1: RECENT FAILURES OF CONTROL  
CABLES USED ON AMERSHAM  
MODEL 660 POSILOCK  
RADIOGRAPHY SYSTEMS

Addressees:

All industrial radiography licensees.

Purpose:

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) to alert addressees to the results and recommendations arising from a special inspection of source disconnects resulting from the failure of control (drive) cables used in industrial radiography systems. It is expected that recipients will review this information for applicability to their industrial radiography equipment and maintenance programs and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this IN are not NRC requirements; therefore, no specific action nor written response is required.

Background:

NRC issued IN 97-91 to alert licensees to recent events where the drive cable of industrial radiography systems broke during routine radiographic operations, resulting in separation of both the radiography source assembly and male connector from the drive cable assembly. In each case, this resulted in the source assembly being left in the exposed position. Since several failures occurred under similar circumstances within a relatively short period of time, it appeared that the causes of these events could have been generic.

Description of Circumstances:

Because of the apparent generic nature of these failures, the potential for substantial radiation exposure to radiography personnel, and the fact that similar failures had occurred in the past, within several Agreement States, and in NRC jurisdiction, NRC elected to charter a special inspection team (SIT) to investigate these failures. The SIT charter was formally established in coordination with several Agreement States including the Commonwealth of Massachusetts, the State of Louisiana, and the State of Texas. Inspection activities began in December 1997 and were completed in March 1998. The involved Agreement States assumed the lead role for inspection activities in their respective states, with NRC staff participating in all phases of the special inspection.

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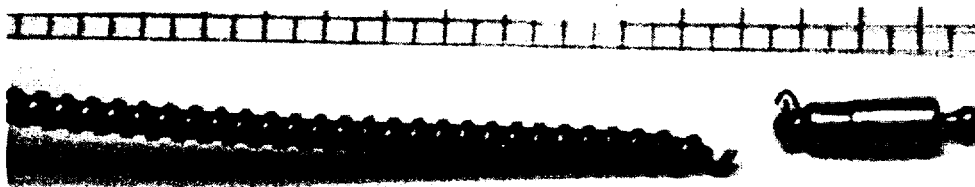
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The findings, conclusions, and recommendations of the SIT were reviewed by the Office of Nuclear Material Safety and Safeguards and by the Committee for the Review of Generic Requirements, and have been published in NUREG-1631, "Source Disconnects Resulting from Drive Cable Failures." (June 1998) All NRC and Agreement State industrial radiography licensees will be provided with a copy of this document. This document may also be found in the Reference Library within NRC's web site at [www.nrc.gov](http://www.nrc.gov).

Discussion:

An analysis, including metallurgical analysis by one of the radiography equipment manufacturers, of six drive cable failures that occurred since 1995, concluded that the failures were caused by a combination of wear, corrosion, and lack of lubrication. In all the drive cable failures reviewed by the SIT, the drive cable failed within 0.33 to 1.25 centimeter (0.125 - 0.5 inch) *behind* the male connector (see the example of a failed drive cable in the figure below). None of the drive cable failures reviewed by the SIT involved failure of the male connector or the source assembly.



**Drive Cable Failure Behind Male Connector**

Almost all radiography systems manufactured and used in the United States utilizing a drive cable use the same type of cable. In addition, only one manufacturer currently makes and supplies this cable to the radiography industry. Based on the fact that the drive cable is a common component to almost all radiography systems used in the United States, and that the failures were not limited to one manufacturer's radiography system, the SIT concluded that this type failure is not the result of a manufacturing defect of any of the radiography systems in use, but is a function of the manner in which the cable is used in the radiography industry. NUREG-1631 documents several significant concerns regarding drive cable maintenance practices and identified several root causes, secondary causes, and contributing factors that were identified during the special inspection. In addition, based on the findings of the inspection, several recommendations regarding industrial radiography drive cables for the cable manufacturer, manufacturers of radiography equipment, radiography licensees, and agencies licensing the use of radioactive materials for radiography were included in Section 7 of NUREG-1631.

In summary, the SIT concluded that the following were root causes for the radiography drive cable failures:

- **The cable is not designed for use in industrial radiography.**

The cable is designed for use in the aerospace, marine, and other industries, as a component in cable control systems. These systems are specifically designed for their intended operating environment and use conditions, which are markedly different from those of the industrial radiography industry. These control systems are generally sealed and as a result protect the cable from harsh environmental conditions.

- **The importance of radiography drive cables is not sufficiently emphasized.**

Manufacturers, the radiography industry, and regulatory agencies have not adequately emphasized the importance of observing and evaluating the condition of radiography drive cables. As a result, opportunities to detect precursor events may have been missed because of incomplete or ineffective visual examinations during daily drive cable inspections. Failure to maintain radiography control cables and/or poor maintenance practices may also have resulted in the degradation and eventual failure of the control cables.

Although the SIT concluded that the cable was not designed for use in the industrial radiography industry, it did not recommend discontinuance of its use. However, use of this cable for industrial radiographic operations, requires careful monitoring of its condition and proper maintenance for safe use.

Use in typical industrial radiography environments generally requires frequent cleaning and lubrication of the control cables. This contrasts with other applications of this cable that, for the most part, require no maintenance of the cable. Information about the proper methods for cleaning and lubricating the cable is not widely available throughout the radiography industry. As a result, NUREG-1631 recommends that the various manufacturers and users of radiography drive cable assemblies jointly develop a set of guidelines, for adoption by the radiography industry, on the proper use and care of drive cables. Various representatives of the radiography industry have reacted favorably to this recommendation. The findings, results, and recommendations in NUREG-1631 will be presented to the American Society of Non-Destructive Testing meeting on October 20, 1998, in Nashville, Tennessee. A half-day workshop has been scheduled as part of the Non-Destructive Testing Management Association meeting in Las Vegas, Nevada, in the spring of 1999, to further discuss the development and adoption of standard industry guidelines for cleaning and lubricating radiography drive cables.

Appendix F of NUREG-1631 describes suggested drive cable cleaning and lubrication procedures developed by NRC, in coordination with the cable manufacturer. The methods described in Appendix F are intended to serve as *interim* cleaning procedures for use until the radiography industry develops and publishes appropriate industry standards. Licensees should review these suggested procedures, as well as the other information in NUREG-1631, and review the content and the implementation of their own cable inspection and maintenance programs, and consider making any changes that may be appropriate.

This information notice requires no specific action nor written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate regional office.

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**LIST OF RECENTLY ISSUED  
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<b>Information Notice No.</b>	<b>Subject</b>	<b>Date of Issuance</b>	<b>Issued to</b>
98-20	Problems With Emergency Preparedness Respiratory Protection Programs	6/3/98	All holders of operating licenses for nuclear power reactors; non-power reactors; all fuel cycle and material licensees required to have an NRC-approved emergency plan.
98-18	Recent Contamination Incidences Resulting from Failure to Perform Adequate Surveys	5/13/98	Part 35 Medical Licensees
98-17	Federal Bureau of Investigations (FBI) Awareness of National Security Issues and Responses (ANSIR) Program	5/7/98	All U.S. Nuclear Regulatory Commission fuel cycle and power and non-power reactor licensees
98-16	Inadequate Operational Checks of Alarm Ratemeters	4/30/98	All Industrial Radiography Licensees
98-12	Licensees' Responsibilities Regarding Reporting and Follow-up Requirements for Nuclear-Powered Pacemakers	4/3/1998	All U.S. Nuclear Regulatory Commission nuclear pacemaker licensees
98-10	Probable Misadministrations Occurring During Intravascular Brachytherapy With The Novoste Beta-Cath System	4/3/98	All Medical Licensees
98-09	Collapse of an Isocam II, Dual-Headed Nuclear Medicine Gamma Camera	3/5/98	All medical licensees
98-08	Information Likely to be Requested if an Emergency is Declared	3/3/98	All parts 30, 40, 70, 72 and 76 licensees and certificate holders required to have a Nuclear Regulatory Commission approved Emergency plan.

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<b>Information Notice No.</b>	<b>Subject</b>	<b>Date of Issuance</b>	<b>Issued to</b>
98-29	Predicted increase in Fuel Rod Cladding Oxidation	8/3/98	All holders of operating licenses for nuclear power reactors, except those licensees who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.
98-28	Development of Systematic Sample Plan for Operator Licensing Examinations	8/3/98	All holders of operating licenses for nuclear power plants
98-27	Steam Generator Tube End Cracking	7/24/98	All holders of operating licenses for pressurized-water reactors except those who have permanently ceased operation and have certified that fuel has been permanently removed for the reactor vessel
96-48, Sup. 1	Motor-Operated Valve Performance Issues	7/24/98	All holders of operating licenses for nuclear power reactors except those who have permanently ceased operation and have certified that fuel has been permanently removed from the reactor vessel.
98-26	Settlement Monitoring and Inspection of Plant Structures affected by Degradation of Porous Concrete Subfoundations	7/24/98	All holders of operating licenses for nuclear power reactors; all of or applicants for licenses to operate Independent Spent Fuel Storage Installations; and designers and fabricators of Independent Spent Fuel Storage Installations.

OL = Operating License  
 CP = Construction Permit