SERVICE BULLETIN

Purpose:

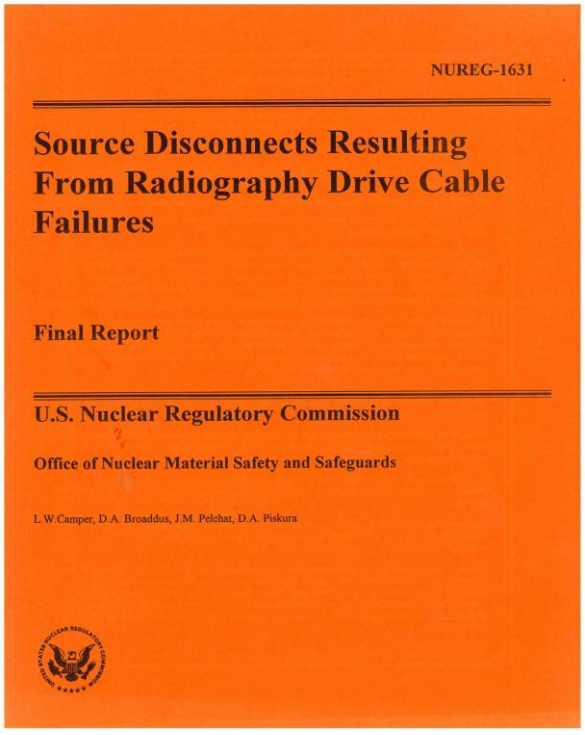
Revisit the lubrication and inspection requirements for remote control drive cables used in QSA Global, Inc. isotope radiography systems.

Background:

In August of 1998, the U.S. Nuclear Regulatory Commission (USNRC) distributed **Information Notice no. 97-91**, **S-1**, describing five failures of remote control drive cables that resulted in disconnected sources, during the timeframe of November through December 1997.

Because of the similarities of the drive cable breaks, the USNRC chartered a special inspection team (SIT) to investigate the failures during the timeframe of December 1997 through March 1998.

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)



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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.

Corrective / Preventative measures:

Manufacturers have provided updated manuals or bulletins that include detailed inspections and recommended maintenance to detect and prevent remote control drive cable failures. QSA Global, Inc. manuals also detail the daily inspections and the periodic maintenance instructions for the *specific* inspections, *specific* cleaning and *specific* lubrication of radiography drive cables.

The radiography industry has since implemented increased enhancements to their existing inspection and maintenance programs that include detailed daily inspections and performing formal maintenance at intervals that take into account the environmental conditions the equipment is being used.

The USNRC hosted a radiography drive cable workshop during the February 1999 NDTMA conference to make industry management aware of the problem and the remedies to prevent recurrence of drive cable failures. The panel consisting of the USNRC, the radiography industry and the USA based manufacturers provided a listing of solvents and lubricants that were suggested based on attendee comments.

QSA Global, Inc. clarifications on recommended solvents and lubrication:

Recommended solvents:
In the majority of QSA Global, Inc. Operating and Maintenance manuals, recommended solvents for cleaning and degreasing operations are limited to clean mineral spirits (Follow manufacturer's safety precautions for use, handling, storage and disposal). The clean mineral spirits are compatible for cleaning and degreasing the drive cables, the remote control sheaths and source guide tubes. The cleaned components (drive cables, source guide tubes and remote control conduits) should be completely dried (internally and externally when applicable) before lubrication and the reassembly steps in maintenance.

The use of other solvents, such as acetone or penetrating oils, should not be used for flushing or cleaning of source guide tubes (projection sheaths, head hoses) or remote control sheaths. The consideration is that some solvents may be absorbed into the protective waterproof materials of source guide tubes and remote control conduits and could cause swelling, softening or degradation and cracking of the materials. Cracking or softening of the waterproofing materials may lead to fatigue or tearing near the swaged metal fittings. If mineral spirits cannot be used, use solvents that dry residue-free and be sure to test the solvent on an area away from swaged metal fittings to determine if the solvent will "attack" the source guide tube or remote control housing materials.

Water based solvents that are environmental-friendly and nonflammable can be used, but should be removed immediately after degreasing and cleaning procedures. The drive cable must be thoroughly dried using a jet of compressed air to prevent "hidden" corrosion.

The remote control housings for the drive cable are usually lined with Teflon® materials that are generally resistant to chemical degradation. However, they must be internally dried using a compressed air-hose to prevent dilution of freshly lubricated drive cables that will be installed into the control housings.

Recommended lubricants:
QSA manuals reference the use of Mil-spec grease MIL-G-23827B (or C), MIL-PRF-23827C, (or an equivalent radiation resistant grease authorized by QSA Global, Inc.). These butter consistency greases are available under the brand names of AeroShell 7, AeroShell 33, Texaco Unitemp. A suitable equivalent is Dow Corning Molykote 33 silicon-based grease. These butter consistency greases, when properly applied, will migrate to the core of a drive cable to prevent internal corrosion. The greases also provide a protective barrier against moisture and are resistant to chemical changes as a result of the high doses of radiation emitted from radiography sources.

QSA Global *does not* support the use of quench oils as part of the maintenance of drive cables used in radiography remote controls. It's believed that the low viscosity (liquid) oil will more readily soak into the inner core of the drive cable providing protection of the carbon steel before applying the butter consistency grease on the exterior of the drive cable. Quenching oil baths are used in the manufacture of the steel drive cable and is used to rapidly dissipate heat and introduce a 2 micron depth oxide layer to harden the steel and to prevent corrosion effects on the outer helical windings of the drive cable. Quench oils are sensitive to moisture common to industrial radiography environments and would only serve to displace or dilute the greases recommended for lubrication and protection.

The use of **WD-40™** or **Black Beauty™** *are not suitable* lubricants for radiography drive cables. As one example, WD-40™ that is exposed to high doses of radiation will undergo chemical changes, initially transforming into a tar and if exposed to higher doses, will turn into a black glass. Another example is Black Beauty™, that undergoes chemical changes from exposure to radiation, will result in the loss of its lubricating qualities and can actually accelerate wear of metal to metal components of the radiography system.

The use of all substitute greases is strongly discouraged due to the fact the greases that are recommended by QSA Global, Inc. have been used successfully for decades and do not undergo chemical changes with the sealed sources typically used for isotope radiography.

If additional information is required, please contact a Technical Manager at our Baton Rouge, Louisiana, La Porte, Texas or Burlington, Massachusetts offices.

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