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Subject Yellow Alert- Lever-Arm Chain Binders

Title: Yellow Alert- Personnel Safety Concerns Involving Lever-Arm Chain Binders

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Lesson Learned Statement- Training, better administrative controls, alternative devices, and possibly engineering fixes are recommended actions that can help to reduce the number of injuries caused by improper chain binder installation or removal. Training should be required for anyone who may ever have to install or remove a lever-arm chain binder.

Discussion of Activities- Summary Ten actual DOE injury incidents and their corrective actions (taken to help prevent recurrence) are summarized in this document. The consequences of these events ranged from lacerations to broken bones, and could have been worse had individuals had their faces turned in a slightly different direction. The use of "cheater bars" was shown to be a significant contributor to the overall problem, in that their use enables more energy to be stored in the binder than would have been possible by using only the binder's handle. Training is one of the elements most needed to help reduce the number of injuries from chain binders and should possibly be considered for a broader audience. Additional controls on those bringing loads on-site may also be needed. Alternative hardware may also be appropriate; such as the use of ratchet type binders or nylon slings with built in tensioning devices. The ultimate responsibility for chain binder safety, however, rests in the hands of the user. Lever-arm type chain binders, sometimes referred to as load binders, are mechanical devices used to tension the chains used to secure equipment or materials being transported on flat bed or lowboy trailers. This type of chain binder, by design, can contain a considerable stored energy in its lever arm (i.e., handle) when it is closed or near closed. If this energy is suddenly released, the chain binder handle can arc violently towards the open position and cause severe personnel injury to anyone that may be in its path. Chain binder installation and removal is typically not a subject that is covered in written procedures or taught using formal training; but neither is it a true "skill of the trade". The latter is true because there is no one trade that uses these devices exclusively. Commercial drivers, equipment operators, and riggers are the most likely "trades" to use chain binders, but it is also possible for laborers or those from other crafts (e.g., fitters) to be asked to help unload a trailer, which may require having to remove a chain binder. The removal of chain binders by those with little familiarity with them, can be a dangerous endeavor.

Analysis- A search of reports from DOE's Computerized Accident/Incident Report System (CAIRS) for the period 1990-1999, identified ten (10) incidents involving personnel injury during the installation (4) or removal (6) of chain binders. While most of these injuries did not result in lost work days, one incident at the INEEL, in which an equipment operator injured his wrist, did result in 20 lost work days. Another incident at the Bechtel Nevada site resulted in 237 lost work days when a truck driver broke his hand while trying to install a chain binder. Seven of these 10 injuries involved the use of a cheater bar. These devices were typically short (3-4 foot) lengths of pipe that are slipped over the chain binder's handle in order to gain additional

leverage while trying to open or close it. Most such devices are not designed specifically for this purpose however, and, if poorly sized, they can easily slip off the handle just at the point when the most force is being applied to it. The results can be painful or worse. In addition to the two injuries mentioned above, the other eight incidents included the following types of injuries

- lacerations (facial and leg),
- contusions (forearm and wrist),
- broken dentures/teeth,
- knocked out teeth, and
- fractures (nose and facial bones).

NOTE- Many of the above injuries required stitches/sutures and some required multiple surgeries. Some of the factors that contributed to these incidents included

- failure to position ones body/body parts out of the path of the cheater bar/binder handle.
- the use of unapproved mechanical aids (i.e., cheater bars).
- the tension on binders was higher than expected due to a load shift or excessive force being applied during installation.
- a lack of training/experience on binder installation/removal.
- wet or slippery equipment, hands, and/or footing.

Recommended Actions- The number of chain binder injuries reported in CAIRS is likely only a fraction of the total number of injuries or near-misses that have been experienced throughout the DOE complex; but they serve to illustrate the importance of providing applicable personnel with training and/or other appropriate resources. The following is a compilation of the corrective actions that were implemented by management as a result of the ten CAIRS incidents.

- Initiated a policy of not permitting the use of cheater bars. NOTE This approach may be unrealistic given that an incoming load may be tensioned so tightly that a cheater has to be used to loosen it.

- Required more comprehensive training on chain binder installation/removal (e.g., instructions on keeping clear of the area in which the bar/handle could swing rapidly open). NOTE Using two hands on a bar/handle almost guarantees that your body will be in the way of the bar/handle.

- Encouraged the use of ratchet type binders or nylon straps with a built-in ratchet device. NOTE There are inherent safety concerns associated with the use of any type of tie-down device. Even the ratchet type binders and the nylon straps with built-in ratchet mechanisms can cause injuries. However, due to their design, injuries caused by these devices should be less severe and probably limited to the hand or wrist.

- Instructed personnel to try to place chains such that they would have a open place to stand while installing the binders.

- Initiated a policy of not permitting site personnel to remove chain binders from a vendor's trailer.

- Required load tensioning to be done only in specific locations, so driver's actions could be monitored (e.g., to ensure that they were not using unapproved cheaters or excessive force).

- Used the details of the incident to develop a lessons learned to be presented to other applicable site personnel. NOTE Not included in the above list of corrective actions is an almost obvious omission. Engineering fixes rather than administrative controls should be developed when appropriate - they are almost always more effective.

Two final "rules" to remember concerning chain binders are 1) always tie down chain binder handles so that they will not come loose while in transit and 2) never use a cheater bar to close a binder's handle more than the last 45 degrees of its travel. The installation and removal of lever-arm chain binders is a dangerous task for even the seasoned veteran. Personnel must be constantly aware of where they are positioned in relation to where the bar/handle will travel if it were to suddenly break loose - Expect the unexpected and be careful.

Priority Descriptor YELLOW

DOE Functional Categories Conduct of Operations, Construction, Design, Hoisting/Rigging ,Maintenance ,Operations, Packaging and Transportation, Safety, Training and Qualification

User Functional Categories Conduct of Operations, Construction, Design, Hoisting/Rigging ,Maintenance ,Operations, Packaging and Transportation, , Safety, Training and Qualification

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References DOE CAIRS reports concerning chain binders