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Target Audience

All FOD Inspectors dealing with Agriculture
Specialist Group Inspectors (Construction)

FREE-STANDING FEED BINS AND SLURRY STORES - POTENTIAL FOR CATASTROPHIC COLLAPSE

This SIM informs inspectors of the risks of catastrophic collapse of old free- standing feed bins and slurry stores and what they should look for and require during inspection.

BACKGROUND

1 In December 2000 a feed delivery driver was killed when a free-standing wooden 'Summit' feed bin he was filling collapsed trapping him between a side panel from the bin and the rear wheel of his vehicle. He was asphyxiated.

2 In March 2001 another feed delivery driver was trapped and injured when a free-standing metal feed bin collapsed during filling when a split in a welded seam appeared and the support legs collapsed.

3 In April 2001 a concrete section slurry store collapsed which caused structural damage to nearby buildings but caused no injuries.

4 The above structures were all over 20 years old and, in view of the number of these structures still in use on farms, the Sector wishes to raise awareness to the need for examination of old free-standing structures such as feed bins, slurry stores, tower silos etc by a competent person to determine their continuing structural integrity.

DISCUSSION

5 Firstly it should be appreciated that the potential for injury is made more significant as the most likely time for such structures to collapse from structural deterioration is during filling when an operator is likely to be standing next to the structure. This applies in particular to feed bins.

6 In the first accident the wooden hexagonal feed bin was about 20 years old. It was made by Summit Agricultural Equipment Ltd, Tarleton, Preston, Lancashire. The Company ceased trading in 1981. The bin was designed to hold 10 tonnes of feed. It was 7 m high, each side being 1.2 m wide. Old sales literature claimed the bin was constructed with pressure treated timber which inhibited condensation on the inner wall to give maximum protection to the contents whatever the outside temperature and that the bin 'required no maintenance'. There have been no 'reported' previous incidents involving these bins though

unsubstantiated collapses are rumoured to have occurred.

7 These hexagonal bins have wooden legs at each of their 6 corners. Reinforcement for the 6 side panels comprise of a series of horizontal timbers which encircled the bin. Each horizontal timber is secured by a steel bolt passed through the end of one timber at an angle, through a vertical leg timber and secured into the end of the next horizontal timber, and so on round the bin. The bin in question had 9 such 'hoops'. This bin and others on site showed signs of splitting around the ends of the horizontal timbers and signs of severe corrosion to the bolts.

8 In this accident the possibility of over pressurisation by the delivery vehicle's compressed air discharge system was discounted as the exhaust vent was more than adequate. It is considered that the bin collapsed due to poor structural condition and that a split end timber of a horizontal 'hoop' support gave way which then led to other hoops breaking in a similar manner. Four of the six support legs failed. One side panel broke away trapping the delivery driver against his vehicle and the weight of escaping feed pushing against the panel prevented him from breathing causing asphyxiation.

9 The second accident involved a free standing metal feed bin supported on four metal legs. The bin started to split creating a small leak when being filled. A farm worker was involved in blocking the leak of grain from the split when the bin collapsed. The farm worker was emerging from the bin's hatch at the time and was thrown onto an adjoining roof. The delivery driver was on the ground and was trapped between the collapsed structure and an adjoining building. It is likely that deterioration had led to a weakening of the structure which eventually resulted in it collapsing during refilling, aided by the added weight of the worker in the bin. This was an old feed bin but the exact age and make are not known.

10 The third incident involved an above ground Reco slurry store of 200,000 gallon capacity which was approximately 25 years old. It was 16m in diameter and 4m high. It was constructed of concrete sections which were held together by steel hoops around the outside. The store was nearly full and was being agitated by a PTO driven stirrer. The operator had left the stirrer running and did not witness the actual collapse but this demolished part of a building 12 m away before flowing across a yard and into a stream. If a person had been caught up in the escaping slurry, a serious or fatal accident could have resulted. Due to the foot-and-mouth epidemic the concrete sections have not been examined in detail but it seems most likely that deterioration in one or more of these panels was the cause. It is likely to have been a sudden catastrophic failure of one panel which resulted in extra strain on others which then gave way. It is claimed that no leaks had been seen prior to the event which, if true, shows that to be rely on being forewarned of deterioration by leaks is not a reliable indicator of problems. The steel hoops were all in excellent condition. Any examination of these structures must be done when empty as one likely cause of failure will be corrosion of the steel reinforcing in a concrete section arising from damage to the inner surface of the concrete sections, eg by pumping or agitation equipment. NB: Internal examination when empty can involve risk from gasses especially as it can be difficult to fully empty some of these structures and gasses can be released due to a person moving through shallow slurry. Appropriate precautions for entry should be taken and if necessary breathing equipment used.

11 Being struck by vehicles is another causes of damage, particularly to free-standing feed bins. Also, where blockages or bridging occur in a feed bin, operators will often attempt to free up the flow by hitting the lower part of the bin with a heavy object and, where this is excessive, it could put a strain on welded seams or joins. Evidence of this will be seen by dents at the base of the bins. Agitators can be fitted to overcome this problem.

12 Common visual causes of structural deterioration are split timbers, bowing panels, excessive deflection of structural members, deformed legs/joints, corroded bars/threads/bolts, spalling (flaking) concrete or exposed steel reinforcing in concrete sections. Construction materials used for feed bins include wood, fibreglass or metal sheet. Slurry stores and tower silos are usually constructed of concrete with steel bands or of steel panels which are bolted and/or welded together.

ACTION BY INSPECTORS

13 Inspectors should enquire into the age of free-standing feed bins, slurry stores and tower silos in use and the date of the last inspection for structural integrity if any. Inspection can give an indication of any obvious signs of structural damage or deterioration but where age and/or condition justify it, inspectors should advise on examination by competent persons. Where there are obvious concerns specialist group advice should be sought and, if necessary, a notice should be served to prohibit refilling until an examination has been carried out and any work deemed essential is effected. Where a notice is served inspectors should take into account welfare problems in relation to feeding any stock which might be affected.

14 Inspectors are encouraged to raise awareness to this problem locally, in particular by contacting local feed suppliers and warning them of the danger to their drivers and the need for them to monitor the state of customers bins.

15 Inspectors should remind those involved that entry to a feed bin should never take place when feed is present. There are two specific risks to this. Firstly there is the danger of the feed having 'bridged' and a person's added weight causing this to collapse with likely asphyxiation. Secondly there can be very rapid suction down into the grain/feed if the outlet is switched on by another person or by an automated feed system. Such suction can amount to one tonne downward pull once grain is only up to knee level and again result in asphyxiation.

16 Where thorough examination of slurry stores is recommended inspectors should ensure that their advice or requirements include a warning of the dangers from toxic gasses and the need for a safe system of work to be used for entry, if necessary including the use of breathing equipment.

17 Feed bins, and in many cases slurry stores and tower silos, can be considered as being in scope of the Provision and Use of Work Equipment Regulations 1998 (PUWER 98) reg.6 (2). Inspection under this regulation deals specifically with 'conditions causing deterioration which is likely to lead to dangerous situations'. Solicitor's advice may be needed in individual circumstances if enforcement is being considered. The use of PUWER 98 or the Management of Health and Safety at Work Regulations 1999 and/or HSW Act ss.2 and 3 may depend to what extent the structure has its own machinery and is integrated into a feed or processing system as opposed to being a structure on its own foundations and with no fixed machinery being part of its system.

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