Operational Policy Division

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Principal Inspector
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Dear Sir

TAGADA EJECTION FORCES

If you have heard me talking at any of the recent ADIPS events you will know that I was awaiting the publication of a Health and Safety Laboratory (HSL) report on the passenger ejection forces created by these machines. This has now been published and I enclose for your information a copy of the Report.

There have been a number of Studies conducted on these machines in the past to try to find out why they are involved in so many incidents and the conclusion has generally been that it is a combination of factors normally involving passenger and operator behaviour. Following two recent high profile ejection incidents it was decided that further work would be of use to identify the cause of these and suggest remedies, hence the Report.

As you will see it identifies a force that BS EN 13814 regards as being one that can eject a passenger and as such, containment with interlocking is called for. This force is created when a rider is approaching the top of the fully inclined bowl at speed at the same time as the bowl suddenly drops away from them, effectively leaving them travelling in open air.

The Report suggests 3 solutions to this;

- Fit the interlocked containment system suggested in BS EN 13814. It is not believed that this is a reasonably practicable solution. The machine doesn't carry the infrastructure for this so it would require hugely expensive work, even if the work were possible.
- Slow the drum down. This will reduce the speed the rider is travelling upwards at when the bowl drops away. This will give them a better chance of staying in their seat. It will however generally reduce the centrifugal force (which is) needed to keep them in the seat. This may well create other safety issues and so without further research and testing it is probable that this option would not be suitable.
- Reduce the speed at which the rams can move. This would have the double benefit of reducing the speed the drum can be moved up and down whilst the drum is rotating at speed

creating the ejection risk and also in reducing the risk of passengers being thrown in to the drum centre when the operator bounces a slow moving drum.

It is obviously up to the Controller which of these methods he chooses to adopt or he can come up with another way of achieving the same ends. In either case the machine must be made physically incapable of producing forces which create a risk of passenger ejection.

The purpose of this letter is to inform you that, given the machine's accident history and the benefit of knowledge of the results of the recent HSL Study, HSE now believes it would be inappropriate for any new Declaration of Compliance (DOC) to be issued to a Tagada machine Controller if their machine can create a force that can eject a passenger, unless it has been fitted with a containment system in accordance with BS EN 13814. If conducting an inspection of a machine without containment you should ensure as part of your test that the machine is not physically capable of generating such forces and this will probably require you to use accelerometers to check the forces of ejection at a variety of rotational positions and speeds. It is stressed that these tests must be conducted to take account of the maximum forces the machine is actually capable of generating, not those that the operator claims to limit it and himself to. Accelerometers are commercially available for quite modest sums and NAFLIC have circulated details to all IB's.

Ride controllers have recently received a letter explaining that HSE will require these tests to be conducted as soon as possible and that HSE interventions during the coming year will check that these machines cannot generate ejection forces. Such interventions will probably involve cost recovery against Controllers and IB's. You are advised to contact Controllers of machines you have tested in the previous 12 months to advise them about the tests that should be done and details of any remedial work that may be required.

It may be necessary to make adjustments to the machine to ensure it cannot produce these forces and this may be considered a modification to the ride needing a Design Review. You are strongly advised not to issue a DOC until you are certain this work has been satisfactorily completed.

Any HSE investigation involving unseated riders on a Tagada machine will inevitably consider the possibility that the situation arose because the rams were moving the drum at a speed that could cause riders to leave their seats. It is further probable that the investigation will then look at why the machine controller was issued a DOC for a machine which could generate passenger ejection forces without an appropriate restraint/containment system being fitted. From April 2012, if it is decided during such an investigation that a material breach of the law has occurred, HSE will seek to recover the cost of the investigation from the relevant parties at the current rate, currently £124 per hour.

You are consequently strongly advised to keep evidence that the necessary tests were conducted on these machines and that you gave advice to the ride controller about work required to their machines to eliminate the ejection forces. You are also advised to retain details of any work and subsequent tests conducted prior to your issue of a DOC.

Yours faithfully

M Sandell
HM Inspector of Health and Safety
Entertainments