Inspection of the spraying equipment mounted on trains – the Polish approach

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Article 8 - Inspection of equipment in use:
Directive 2009/128/WE

1. Member States shall ensure that pesticide application equipment in professional use shall be subject to inspections at regular intervals. The interval between inspections shall not exceed five years until 2020 and shall not exceed three years thereafter.

2. By 14 December 2016, Member States shall ensure that pesticide application equipment has been inspected at least once. After this date only pesticide application equipment having successfully passed inspection shall be in professional use.

3. By way of derogation ... Member States may: (a) apply different timetables and inspection intervals to PAE ... that represent a very low scale of use ... The ... pesticide application equipment shall never be considered as constituting a very low scale of use: (i) spraying equipment mounted on trains ... 

4. The inspections shall verify that PAE satisfies the relevant requirements listed in Annex II, in order to achieve a high level of protection for human health and the environment.
Implementation of 2009/128/EU

- Ministry of Agriculture and Rural Development governs the 2009/128/EU directive implementation.
- The Railway Institute (being under Ministry of Transport) was asked for the expertise on state of the art and propositions of inspection procedure – the request was partly fulfilled.
- The Research Institute of Horticulture Department of Agroengineering was requested to elaborate the methodology for the inspection of railway sprayers.
The survey at the owner place
- some questions to be asked

- Who are the railway sprayer owners?
- What kind of the equipment is used?
- Who does the treatments?
- How many treatments a year?
- The technical condition of equipment ... ?
Railways in Poland

- **One owner of the infrastructure:**
  - PKP S.A. - Polish National Railways

- **Infrastructure managers:**
  - PKP PLK S.A. - Polish Railway Lines (97% of tracks)
  - Few other IM’s (3% of tracks)

- **Passenger and cargo carriers:**
  - Few main ones and about 100 smaller ones.
Railways in Poland

- **Standard gauge railway (track gauge: 1435 mm):**
  - 37,400 km of tracks
  - To be sprayed - ca. 19,000 of ha (19,300 km of railway lines)
  - IM (PKP PLK S.A.) has ordered 185,000 l of herbicides in 2011 year
  - Spray volume: 100-200 l/km (spray width > 5 m)
  - Spray dose – ca 7.5 l/ha
  - Spray dose regulation to the driving speed - by pressure regulation
  - Driving speed on tracks of intensive passenger traffic or cargo: 30 – 40 km/h
  - Treatments in May and after 3 months

- **Broad gauge railway (track gauge: 1520 mm):**
  - 365 km (Sławków-Hrubieszów)

- **Narrow gauge railway (track gauges: 750, 1000, 600 mm):**
  - 968 km working lines

- **Tramway:**
  - 2041 km of tracks (14 urban areas / cities)
Railway sprayers in Poland

- Special spraying trains for Chemical Weed Control On the Tracks (trains CHOT)
- Sprayers similar to field crop sprayers - on the railway vehicles:
  - Specialist – brand sprayers,
  - Field crop - brand sprayers - adapted for the railway purposes
  - Self made railway sprayers
- Tractor & agricultural sprayers set on the railway vehicles
CHOT-50AM-07
Special train for Chemical Weed Control On the Tracks
(Polish abbreviation: CHOT)

- Engine room
- Tanks / cisterns
- Means of transport (eg. locomotive)
- Social room

CHOT-50AM-07
CHOT-50AM-07

- Control unit
- Workshop -social room
- Spraying unit
- Workshop -social room
- Injection unit
- Clean water tanks cysterns
- Pump unit
- Clean water tanks cysterns
CHOT 50AM-07- the pump set

Power generator

Electrically driven pump
CHOT 50AM-07 - controls
CHOT 50AM-07 – spraying unit
CHOT 50AM-07 – spraying unit
Nozzles

QuickFlat Jet  Spraying Systems Co.

Orifice diameter (mm): 1.3 – 8.4
Angle: 15, 25, 35, 40, 50°
Flow (l/min): 1.1 – 144
Pressure: 1 – 10 bar
Clean water cisterns/tanks
CHOT-50AM-11 – injection unit
Section valves
Section valves
Centrifugal pump electrically driven
Nozzles - flat fan
Brand – railway sprayer
„KRUKOWIAK - Apollo”
Brand railway sprayer
„AGROLA”

Field crop sprayer – adapted … „Kwas”
Self-made railway sprayer

ZLK Siedlce
Other

http://fotoforum.gazeta.pl/zdjecie/1334309,5,121,17979,WM10.html

http://www.wkp600mm.fora.pl/wydarzenia-aktualne,2/oprysk-torowiska-10_05_2008,50.html
Other

http://www.youtube.com/watch?v=M0DlfQ_pM&feature=endscreen

http://tpwp.pl/oprysk-na-linii-nowosolskiej
The Polish approach

- The spraying equipment is divided in two groups:
  - Sprayers similar to the field crop sprayers mounted on the trains
  - Special spraying trains for Chemical Weed Control On the Tracks
- The spray distribution will be **not checked**
- The individual nozzle flow will be checked:
  - by volume or
  - by weight (acc. to ISO 5682-2)
- The injection systems ???
- Trainings for the inspectors:
  - Up to 3 hours during 40 hours course for inspectors of the terrestrial sprayers (20 h lectures + 20 h practical)
Inspection of the railway sprayers - CHOT (examples)

Nozzles:

- **Flow rate measurement:**
  - Limited by relatively high flow rate values - up to 17 l/min.
- **Transverse distribution:**
  - Possible only on mechanical patternators.
  - High nozzle flow – higher (than 500 ml) graduated cylinders volume needed
Inspection of the railway sprayers - CHOT
(examples)

Nozzle flow measurement:
- Also mass measurement (acc. to ISO 5682-2:1997 paragraph 6.2.3.2).
- Measuring containers volume: 20 liters.
- Weighting accuracy 0.5%.
- Deviation between corresponding nozzles (left-to-right side) <15%.
- Pass over water density changes in different temperatures, conversion factor: 1 kg = 1 l (in 30 °C - 1 kg of water = 1.004 liter).
The accuracy of the injection system:

- The clean water test at the same time as the nozzle flow measurement (to save water).
- The volume of water sucked by injection pump in the unit of time is measured.
- The maximum values settings used during spraying railways are checked.
- The 10% deviation of accuracy is allowed.
The accuracy of the injection system
(proposal)

Example:
Container capacity 5.0 l
Volume A = 2 l
Volume B (Σ1...12) = 100 l
Time = 1 minute
→ Concentration 2%

Volume A
Volume B

Containers capacity 20.0 l each
The accuracy of the injection system
(proposal)

Volume A

Volume B ($\sum_{1\ldots12}$)

Example:
Time = 1 minute
Volume A = 2 l
Volume B = 100 l

→ Concentration 2%

Containers capacity 20.0 l each
The Polish approach

- Until the European standard will be elaborated, the inspection methodology will cover only the equipment existing in Poland.
- Checking the technical elements not taking direct part in the spraying (for example: a railway vehicle, electrical equipment) should not be subject to inspection and should be verified by other parties.
- Inspections should be carried out by Sprayer Inspection Station/s – an existing or a new one - working in the present system of sprayers inspection, because nobody should be a judge in his own case.
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