NOTE: This is a translation by Dorna Sports SL of the report "EFFETTUAZIONE DI ANALISI RADIOMETRICHE PRESSO LA LOCALITÀ DI MOTEGI (PREFETTURA DI TOCHIGI – GIAPPONE) - *RELAZIONE PRELIMINARE*", originally issued in Italian by *Arpa Emilia Romagna - Sezione di Piacenza - Centro Tematico Regionale Radioattività*, on July 22nd, 2011.

RADIATION MEASUREMENTS IN MOTEGI (TOCHIGI PREF. – JAPAN)
PRELIMINARY REPORT

I. INTRODUCTION

After the big earthquake that struck Japan on March, 11th, 2011 an accident happened at Fukushima Dai-ichi nuclear powerplant (consisting of six BWR reactors), and radioactivity has been released in the air and sea water. Due to the radioactivity release, countermeasures have been taken, such as the evacuation of people and food restrictions.

Considering the accident, Dorna Sports S.L. asked to perform radiation measurements in Motegi (Tochigi pref. – Japan), in order to guarantee the safety of all the people involved in the next MotoGP race scheduled at Motegi, which is located at 120km from the accident location.

As a consequence of the above it is currently under signature (confirmation by Dorna Sports S.L. on July, 8th, 2011 and resolution ARPA DC nr. 54 on the same date) a contract between ARPA Emilia Romagna and Dorna Sports S.L. with the brief of performing radiation measurements and analysis in the period from July 10th, 2011 to July 23rd, 2011, in order to assess the level of air, soil, food and beverages contamination to estimate the dose absorbed by all the people involved in the race over the period of the race event, with the collaboration of the *Centro Tematico Regionale Radioattività ambientale di ARPA Sezione provinciale di Piacenza*.

This preliminary report shows the level of air, soil, food and beverages contamination and an estimate of the absorbed dose, as a sum of:

a) Ambient radiation
b) Inhalation
c) Ingestion

over a 1-week period (duration of the stay in Japan for the people involved in the race).

II. EQUIPMENT AND PROCEDURES

Following the brief, measurements of the air radiation and air spectrometry have been made (gamma radiation evaluation) and air (particulate and gas fraction evaluation) and soil samples have been collected in order to evaluate air/soil contamination, in the area of the Motegi Twin Ring Track and the Hotel TWIN RING (TRM).

In addition to air/soil samples, people of the Mobilityland Corp. Twinring Motegi have collected food/beverage samples to evaluate the ingestion dose. Japanese production and TRM guests food samples have been preferred, namely rice (even if 2010 production), meat, milk, fish, vegetables and fruit, plus beverages, tap and bottled water, beer and tea. All the food samples have been purchased in shops located in Motegi and Utsunomiya.

Overall 100 ambient exposure and 5 on-the-field spectrometry measurements have been performed, and 20 air samples and 60 food samples have been tested.

All the samples have been spectrometry tested in a laboratory built on purpose in a room of the Motegi track facilities.

The following equipment has ben used:

1. Samples
    - Air samples (particulate and gas fraction evaluation) have been collected by two Eberline and TCR Tecora model ECHO PM pumps (airflow is about 90l/min), so that 40 to 50m³ samples have been taken over one daytime. The air particulate has been trapped by glass fiber filters, while any possible gas I131 (Iodium 131) presence have been investigated by active-carbon filter cartridges.

2. On-the-field measurements
    - An AUTOMESS 6150 AD6 dosimeter, coupled to a Scintillator Probe 6150AD-b/H plastic scintillator, positioned at about 1m from the ground, have been used for the gamma radiation measurements.
    - On-the-field gamma spectrometry measurements have been performed by a CANBERRA instrument, coupled to HpGe mod. GC2520 detector, wired to a multi-channel (DIGIDART-POSGE (NEGGE) - EG ∑ G ORTEC) analyzer and a portable laptop. The system has been calibrated in a laboratory, by an ISOTOPIC - EG ∑ G ORTEC multi-gamma source, placing the detector at 1m from the ground.

3. Laboratory measurements (room located in the paddock area)
    - Food and beverages gamma spectrometry have been performed by an hyper-pure HpGe counter detector (Mod. DETX-100-PAC-GP EG ∑ G ORTEC, 40% relative efficiency, FWHM resolution of about 2.0Kev at 1.33MeV energy), linked to a portable laptop, calibrated by a multi-gamma source and equipped with the

GAMMAVISION 6.07 – EG ∑ G ORTEC spectrum-analysis tool. Weighed and homogenized samples have been stored into "Marinelli beaker" 1l containers. Measures aquisition duration was 0,5-2,0hrs.

III. RESULTS AND RELEVANT CONSIDERATIONS

Comments to the measurements follow.

III.1 – Air dose intensity

An overall indication of the track area contamination can be obtained by the air dose intensity measurements, listed in table 1.

Table 1 – Air gamma-dose

MOTEGI TRACK				
AREA	**Point**	**Date**	**Type of soil**	**Dose (μSv/h)**
PADDOCK	1	13/07/2011	Tarmac	0.148
PADDOCK	2	13/07/2011	Tarmac	0.149
PADDOCK	3	13/07/2011	Tarmac	0.139
PADDOCK	4	13/07/2011	Tarmac	0.151
PADDOCK	5	13/07/2011	Tarmac	0.151
PADDOCK	6	13/07/2011	Tarmac	0.147
PADDOCK	7	13/07/2011	Tarmac	0.150
PADDOCK	8	13/07/2011	Tarmac	0.146
PADDOCK	9	13/07/2011	Tarmac	0.153
PADDOCK	10	13/07/2011	Tarmac	0.154
PADDOCK	11	13/07/2011	Tarmac	0.153
PADDOCK	12	13/07/2011	Tarmac	0.156
PADDOCK	13	13/07/2011	Tarmac	0.147
PADDOCK	14	13/07/2011	Tarmac	0.150
PADDOCK	15	13/07/2011	Tarmac	0.146
PADDOCK	16	13/07/2011	Tarmac	0.146
PADDOCK	17	13/07/2011	Tarmac	0.139
PADDOCK	18	13/07/2011	Tarmac	0.141
PADDOCK	19	13/07/2011	Tarmac	0.148
PADDOCK	20	13/07/2011	Tarmac	0.143
PADDOCK	21	13/07/2011	Tarmac	0.154
PADDOCK	22	13/07/2011	Tarmac	0.154
PADDOCK	23	13/07/2011	Tarmac	0.151
PADDOCK	24	13/07/2011	Tarmac	0.148

MOTEGI TRACK				
PADDOCK	25	13/07/2011	Tarmac	0.150
PADDOCK	INSIDE THE RESTAURANT	13/07/2011	Floor	0.149
PADDOCK	INSIDE EQUIPMENT DEPOSIT	13/07/2011	Concrete	0.128
TRACK ENTRANCE	CHILDREN PLAYGROUND	14/07/2011	Grass	0.125
TRACK	1	16/07/2011	Gravel	0.142
TRACK	2	16/07/2011	Tarmac	0.136
TRACK	3	16/07/2011	Tarmac	0.153
TRACK	4a	16/07/2011	Tarmac	0.144
TRACK	4b	16/07/2011	Tarmac	0.144
TRACK	5	13/07/2011	Tarmac	0.125
TRACK	6	13/07/2011	Gravel	0.146
TRACK	7	13/07/2011	Gravel	0.150
TRACK	8	13/07/2011	Tarmac	0.153
TRACK	9	13/07/2011	Grass	0.177
TRACK	10	13/07/2011	Tarmac	0.136
TRACK	11	13/07/2011	Gravel	0.149
TRACK	12	13/07/2011	Gravel	0.150
TRACK	13	13/07/2011	Tarmac	0.130
TRACK	14	13/07/2011	Grass	0.160
TRACK	15	13/07/2011	Grass	0.165
TRACK	16	13/07/2011	Gravel	0.155
TRACK	17	14/07/2011	Tarmac	0.153
TRACK	18	14/07/2011	Gravel	0.149
TRACK	19	14/07/2011	Tarmac	0.156
TRACK	20	17/07/2011	Tarmac	0.160
TRACK	21	17/07/2011	Tarmac	0.155
TRACK	22	17/07/2011	Tarmac	0.156
TRACK	23	13/07/2011	Grandstands	0.113
TRACK	24	17/07/2011	Tarmac	0.160
TRACK	25	14/07/2011	Concrete	0.112
TRACK	26	17/07/2011	Tarmac	0.160
TRACK	27	14/07/2011	Concrete	0.115
TRACK	28	17/07/2011	Tarmac	0.161
TRACK	29	13/07/2011	Grandstands	0.123
TRACK	30	17/07/2011	Tarmac	0.164
TRACK	31	13/07/2011	Grandstands	0.110
TRACK	32	13/07/2011	Grandstands	0.141
TRACK	33	17/07/2011	Tarmac	0.158
TRACK	34	17/07/2011	Tarmac	0.162
TRACK	35	17/07/2011	Tarmac	0.156
TRACK	36	14/07/2011	Grass	0.132
TRACK	37	14/07/2011	Tarmac	0.145
TRACK	38	14/07/2011	Grass	0.168

MOTEGI TRACK				
TRACK	39	14/07/2011	Tarmac	0.117
TRACK	40	14/07/2011	Gravel	0.139
TRACK	41	14/07/2011	Tarmac	0.117
TRACK	42	14/07/2011	Tarmac	0.114
TRACK	43	16/07/2011	Tarmac	0.138
TRACK	44	16/07/2011	Tarmac	0.120
TRACK	45	16/07/2011	Tarmac	0.145
TRACK	46b	16/07/2011	Grass	0.197
TRACK	46a	16/07/2011	Gravel	0.145
TRACK	47	16/07/2011	Gravel	0.151
TRACK	48	14/07/2011	Gravel	0.138
TRACK	49	14/07/2011	Tarmac	0.122
TRACK	50	14/07/2011	Grass	0.181
TRACK	51	14/07/2011	Tarmac	0.122
TRACK	52b	14/07/2011	Grass	0.147
TRACK	52a	14/07/2011	Gravel	0.140
TRACK	53	14/07/2011	/	0.144
TRACK	54	17/07/2011	Grandstands	0.131
TRACK	55a	17/07/2011	Grandstands	0.117
TRACK	55b	17/07/2011	Earth	0.172
TRACK	56	17/07/2011	Grandstands	0.133
TRACK	57	17/07/2011	Tarmac	0.153
TRACK	58	17/07/2011	Tarmac	0.153
TRACK	59	17/07/2011	Tarmac	0.165
TRACK	60	17/07/2011	Tarmac	0.167
HOTEL	1a	18/07/2011	Grass	0.151
HOTEL	1b	18/07/2011	Stone	0.140
HOTEL	2	18/07/2011	Gneiss	0.114
HOTEL	3	18/07/2011	Floor	0.132
HOTEL	4	18/07/2011	Grass	0.144
HOTEL	5	18/07/2011	Grass	0.148
HOTEL	6	18/07/2011	Grass	0.136
HOTEL	7	18/07/2011	Tarmac	0.127
HOTEL	8	18/07/2011	Tarmac	0.117
HOTEL	9	18/07/2011	Tarmac	0.125
HOTEL	10	18/07/2011	Tarmac	0.118
HOTEL ENTRANCE	INSIDE	18/07/2011	Floor	0.132
HOTEL	5th FLOOR	18/07/2011	Fitted carpet	0.145

The dose levels are pretty consistent, with an average value of 0.144µSv/h, a minimum of 0.110µSv/h and a maximum of 0.197µSv/h.

Grass values have been slightly higher than Tarmac and Gravel, probably due to the washing action of rains after the Fukushima accident.

Documents provided by the Mobilityland Corp. Twinring Motegi staff report the following numbers for Moka town (close to Motegi):
- 0.050μSv/h, on July 5th, 2011;
- 0.064μSv/h, before the accident at Fukushima powerplant.

As a reference, the gamma dose levels, as continuously measured at the Piacenza ARPA building, are in the 0.070 to 0.200μSv/h range.

III.2 Soil: on-the-field spectrometry

In some of the points where the air gamma dose has been mesured, also gamma spectrometry measures have been taken by a portable Germanium detector, on tarmac and grass left untouched from the accident date.
The resulting spectrums show only the artificial Cs137 (Cesium 137) and Cs134 (Cesium 134) radionuclides.

On-the-field spectrometry results are listed in Table 2.

Table 2 –Cs137 and Cs134 soil concentration

MOTEGI TRACK				
Date	**AREA**	**Type of ground**	**Cs137 (kBq/m²)**	**Cs134 (kBq/m²)**
13/07/2011	PADDOCK (p. 9)	Tarmac	3.86 ± 0.07	3.57 ± 0.05
14/07/2011	TR. ENTR. – CHILDREN PLAYGROUND	Grass	5.67 ± 0.07	5.39 ± 0.06
14/07/2011	TRACK (p. 18)	Grass	4.91 ± 0.08	4.71 ± 0.07
15/07/2011	TRACK (p. B)	Grass	5.59 ± 0.06	5.26 ± 0.05
16/07/2011	TRACK (p. C)	Grass	5.00 ± 0.05	3.84 ± 0.04

The Cs134 radionuclide presence leads to the conclusion that the contamination comes from Japanese powerplants and not from Chernobyl (Chernobyl Cs134 is not existing anymore).

Soil contamination data in areas close to Motegi are not available.

As a reference Cs137 contamination on wild Emila-Romagna region earth measured during an investigation on mosses and relevant soil in 1997 was in the 4 to 32kBq/m² range.

III.3 Gamma spectrometry in air particulate and gas fraction

Table 3 lists Cs137 e Cs134 concentration in air particulate.

Tab. 3 –Cs137 and Cs134 concentration in air particulate

MOTEGI TRACK				
Date	**AREA**	**Weather condition**	**Cs137 (mBq/m^3)**	**Cs134 (mBq/m^3)**
14/07/2011	PADDOCK (p. 7)	Sunny	< 47	< 39
14/07/2011	PADDOCK (p. 9)	Sunny	156 ± 15	76 ± 11
15/07/2011	TR. ENTR. – CHILD. PLAYGROUND	Sunny	86 ± 11	41 ± 9
15/07/2011	TRACK (p. B)	Sunny	10 ± 3	< 10
16/07/2011	TRACK (p. C)	Sunny	< 45	< 39
16/07/2011	HOTEL (garden)	Sunny	< 11	< 9
17/07/2011	TRACK (p. D)	Sunny	8 ± 2	< 8
17/07/2011	TRACK (p. 57)	Sunny	< 9	< 8
19/07/2011	PADDOCK (Honda pitbox)	Rainy		
19/07/2011	TRACK (VIP terrace - grandstands)	Rainy		
20/07/2011	PADDOCK (laboratory entrance)	Cloudy/rainy		
20/07/2011	TRACK (p. E)	Cloudy/rainy		

Values are close or lower than the measurable threshold with the available analytic methods, in the region of some tens of mBq/m^3 (milliBequerel per air cubic meter) referred to both Cesium radionuclides.
Traces of Cs134 e Cs137 in the atmosphere (max Cs137 concentration of about 160mBq/m^3) can be explained as coming back up from the ground.

None of the samples have ever contained the presence of any other artificial radionuclide (like I131 for instance). All the measures made on the active-carbon samples to find I131 have been below the measurable threshold.

Figures for other locations close to Motegi are not available.

As a reference the level of Cs137 contamination, measured daily in Piacenza during April 2011 after the Fukushima accident, turned out to be under the measurable threshold as well.

III.4 – Gamma spectrometry in food/beverage samples

Table 4 shows the results of gamma spectrometry (Cs137 e Cs134) in the food/beverage samples.

Tab. 4 – Concentration of Cs137 e Cs134 in food/beverage samples

Sample	Place of purchase	Origin	Sample date	Cs137 (Bq/kg-L)	Cs134 (Bq/kg-L)
COW MILK	MOTEGI	TOCHIGI	16/07/2011	< 7	< 6
COW MILK	MOTEGI	HOKKAIDO	15/07/2011	< 7	< 6
COW MILK	MOTEGI	TOCHIGI	19/07/2011	< 7	< 6
COW MILK	MOTEGI	TOCHIGI	19/07/2011	< 10	< 8
COW MILK	MOTEGI	TOCHIGI	19/07/2011	< 9	< 8
COW MEAT	MOTEGI	SAITAMA	13/07/2011	< 5	< 4
COW MEAT	MOTEGI	MIYAGI	16/07/2011	73 ± 2	54 ± 2
COW MEAT	MOTEGI	KUMAMOTO	19/07/2011	< 7	< 6
PORK MEAT	MOTEGI	AOMORI	16/07/2011	< 7	< 6
PORK MEAT	MOTEGI	TOCHIGI	14/07/2011	< 9	< 8
PORK MEAT	MOTEGI	GUNMA	19/07/2011	< 8	< 7
PORK SAUSAGE	MOTEGI	/	14/07/2011	< 8	< 7
CHICKEN	MOTEGI	IWATE	13/07/2011	< 4	< 4
CHICKEN	MOTEGI	HOKKAIDO	16/07/2011	< 7	< 6
FISH	UTSUNOMIYA	AICHI	16/07/2011	< 8	< 7
FISH	UTSUNOMIYA	OITA	15/07/2011	< 6	< 6
FISH	UTSUNOMIYA	HOKKAIDO	19/07/2011	< 22	< 19
FISH	UTSUNOMIYA	EHIME	20/07/2011	< 12	< 10
FISH	UTSUNOMIYA	THAILAND	19/07/2011	< 10	< 9
CLAMS	UTSUNOMIYA	HOKKAIDO	19/07/2011	< 22	< 19
CLAMS	UTSUNOMIYA	AOMORI	15/07/2011	< 9	< 8
CLAMS	UTSUNOMIYA	SIZUOKA	15/07/2011	< 6	< 5
CLAMS	UTSUNOMIYA	CHIBA	15/07/2011	< 17	< 15
FRUIT	MOTEGI	YAMAGATA	14/07/2011	< 7	< 6
FRUIT	MOTEGI	NAGASAKI	19/07/2011	< 11	< 9
FRUIT	MOTEGI	YAMAGATA	14/07/2011	< 7	< 6
FRUIT	MOTEGI	CHILE	14/07/2011	< 9	< 8
FRUIT	MOTEGI	AOMORI	14/07/2011	< 10	< 9
FRUIT	MOTEGI	S. AMERICA	14/07/2011	< 9	< 8
FRUIT	MOTEGI	YAMANASHI	19/07/2011	< 9	< 8
VEGETABLES	MOTEGI	TOCHIGI	16/07/2011	< 18	< 16
VEGETABLES	MOTEGI	AOMORI	15/07/2011	< 14	< 12
VEGETABLES	MOTEGI	NAGANO	19/07/2011	< 14	< 16
VEGETABLES	MOTEGI	NAGANO	19/07/2011	< 21	< 19
VEGETABLES	MOTEGI	AOMORI	14/07/2011	< 12	< 11
VEGETABLES	MOTEGI	IBARAKI	13/07/2011	< 7	< 6
VEGETABLES	MOTEGI	TOCHIGI	13/07/2011	< 5	< 5

VEGETABLES	MOTEGI	CHIBA	13/07/2011	< 9	< 8
VEGETABLES	MOTEGI	TOCHIGI	16/07/2011	< 12	< 11
VEGETABLES	MOTEGI	TOCHIGI	13/07/2011	< 9	< 8
VEGETABLES	MOTEGI	NAGASAKI	13/07/2011	< 6	< 5
VEGETABLES	MOTEGI	TOCHIGI	14/07/2011	< 6	< 5
VEGETABLES	MOTEGI	IBARAKI	14/07/2011	< 13	< 11
VEGETABLES	MOTEGI	SAITAMA	16/07/2011	< 15	< 13
VEGETABLES	MOTEGI	TOCHIGI	16/07/2011	< 9	< 8
MUSHROOMS	MOTEGI	TOCHIGI	14/07/2011	< 12	< 10
MUSHROOMS	MOTEGI	NAGANO	16/07/2011	< 9	< 8
MUSHROOMS	MOTEGI	GUMNA	19/07/2011	< 19	< 17
RICE	MOTEGI	TOCHIGI	13/07/2011	< 7	< 6
RICE	MOTEGI	TOCHIGI	15/07/2011	< 7	< 6
BREAD	MOTEGI	USA-CANADA-AUSTRALIA (*)	19/07/2011	< 25	< 23
BREAD	MOTEGI	USA-CANADA-AUSTRALIA (*)	19/07/2011	< 44	< 38
EGGS	MOTEGI	TOCHIGI	15/07/2011	< 7	< 6
EGGS	MOTEGI	TOCHIGI	19/07/2011	< 10	< 9
EGGS	MOTEGI	TOCHIGI	19/07/2011	< 10	< 9
TAP WATER	MOTEGI	MOTEGI (**)	18/07/2011	< 7	< 6
TAP WATER	MOTEGI	MOTEGI (***)	15/07/2011	< 5	< 4
BOTTLED WATER	MOTEGI	/	14/07/2011	< 5	< 4
BOTTLED WATER	MOTEGI	/	15/07/2011	< 7	< 6
BEER	MOTEGI	IBARAKI	15/07/2011	< 7	< 6
BEER	MOTEGI	/	19/07/2011	< 7	< 6
TEA	MOTEGI	/	19/07/2011	< 7	< 6

(*) flour origin

(**) Hotel TRM

(***) TRACK: Inside the Service Office

With the exception of one cow meat sample from Miyagi Pref., no food/beverage samples show Cs137 e Cs134 concentrations higher than the measurable threshold (some ten's of Bq/kg-L).

The same goes for any other artificial radionuclide like the I131 (threshold is some Bq/kg-L).

Cesium contamination (Cs134 + Cs137) in the above mentioned cow meat sample is about 127Bq/kg; for example the maximum levels set by the EC for food/beverages coming from Japan after Fukushima accident (REGOLAMENTO (UE) N. 351/2011 DELLA COMMISSIONE of April 11th, 2011) are:

Babies food:	I131: 100 Bq/kg;	Cs134 + Cs137: 200 Bq/kg.
Dairy products:	I131: 300 Bq/kg;	Cs134 + Cs137: 200 Bq/kg.
Other foods (not liquid):	I131: 2000 Bq/kg;	Cs134 + Cs137: 500 Bq/kg.
Other liquid foods:	I131: 300 Bq/kg;	Cs134 + Cs137: 200 Bq/kg.
Food for animals:	I131: 2000 Bq/kg;	Cs134 + Cs137: 500 Bq/kg.

These are the temporary Euratom n. 3954/87 regulations limits to ensure coherence with the actions currently taken in Japan.

IV. CONCLUSIONS AND ABSORBED DOSE ESTIMATE

The measures analysis shows the presence of radioactivity contamination due to the Fukushima accident in the Motegi Twin Ring track areas, as it was expected.
The on-field-spectrometry analysis on soils shows in fact the presence of the Cs134 radionuclide released during the accident: air gamma intensity is higher than what it was in areas close to Motegi before the accident (acording to data coming from the Mobilityland Corp. Twinring Motegi technical staff).

Based on the measures taken it is possible to estimate the individual absorbed dose during the race event, in the assumption that the event duration will be one week and the ambient situation will stay the same until the race date.

The estimate is based on the measures for the ambient and inhalation gamma dose, while calculations have been made for the ingestion dose, considering the average Italian diet and food/beverages delivered in the TRM (rice, for instance, is still 2010 production and some foods like bread, pasta, oil, cheeses and some fruit are imported) and safely considering the minimum measurable concentrations of Cs134 e Cs137 as positive values.

Based on the experimental data the average air gamma dose (0.144μSv/h) resulting from the sum of the Cesium fallen on the ground after the Fukushima accident plus the natural radioactivity of the Motegi area, the gamma radiation dose estimate for one week, not considering any shield factor, can be 24μSv, and this figure can be considered normal. It is worth to remind here that the levels are in line with ambient values measure in other towns (e.g. Piacenza =0.0090μSv/h, Roma = 0.330μSv/h, Madrid = 0.190μSv/h).

The inhalation estimate dose for one week is less than one tenth of μSv, safely considering the maximum Cesium level (Cs134 e Cs137) as measured just once in the paddock area (Cs134 and Cs137 concentrations respectively 80 and 160mBq/m³).

The ingestion estimate dose for one week is less than some μSv, calculated as above said.

Table 5 summarizes our estimates.

Table 5 – Dose estimate for adult people in one week

	Motegi
INHALATION	< 0.1μSv
INGESTION	< 5μSv
RADIATION	about 24μSv
TOTAL DOSE	**< 30μSv**

The above mentioned weekly dose is in line with the average world natural sources dose of about 46μSv, obtained by the yearly average dose of 2.4mSv (Unscear 2000).

Based on the estimate dose it can be said by no doubt that the radiation risk during the race event is negligible.

Written in Motegi on July 22nd, 2011.