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Database System for Monitoring Chain of Custody of Samples in Doping Analysis

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Introduction

Starting from 2011, WADA requires that accredited laboratory must analyze at least 3000 samples/year. A Local Area Network (LAN) system and a powerful relational database are necessary to fully control the custody of the samples, from the sample reception to the final results (1,2). The database working on Windows operating system (*e.g.* Microsoft Access), can be used for monitoring chain of custody of the sample. There must be secured access to each piece of information: distribution, sample analysis, results, reporting and retrieval of data to generate documents such as chain of custody form. The system is designed to cover all aspects of tests related to the World Anti-Doping Code, International Standard for Laboratories (3). The system is based on the various functions carried out by personnel in the laboratory and is designed to be very simple to use and flexible.

System organization

The system is divided into three modules. The first module is the sample information such as sample reception information and pre-analysis results. The second module is the sample action such as sample distribution, storage, analytical results. The third module is reporting and sample disposal. The modules are designed as entity relationship model (one-to-one and one-to-many) to optimize the performance of the system (Figure 1).

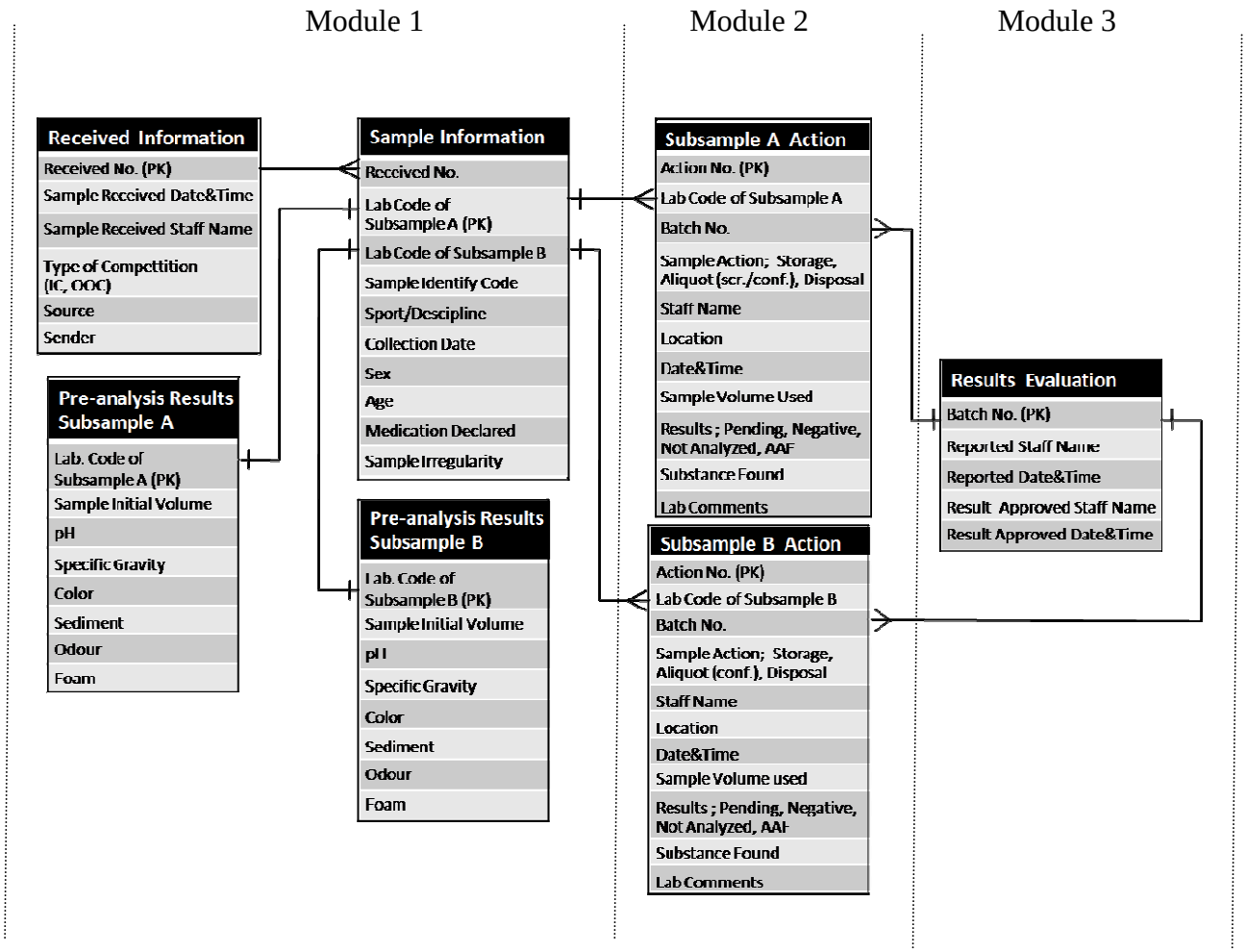
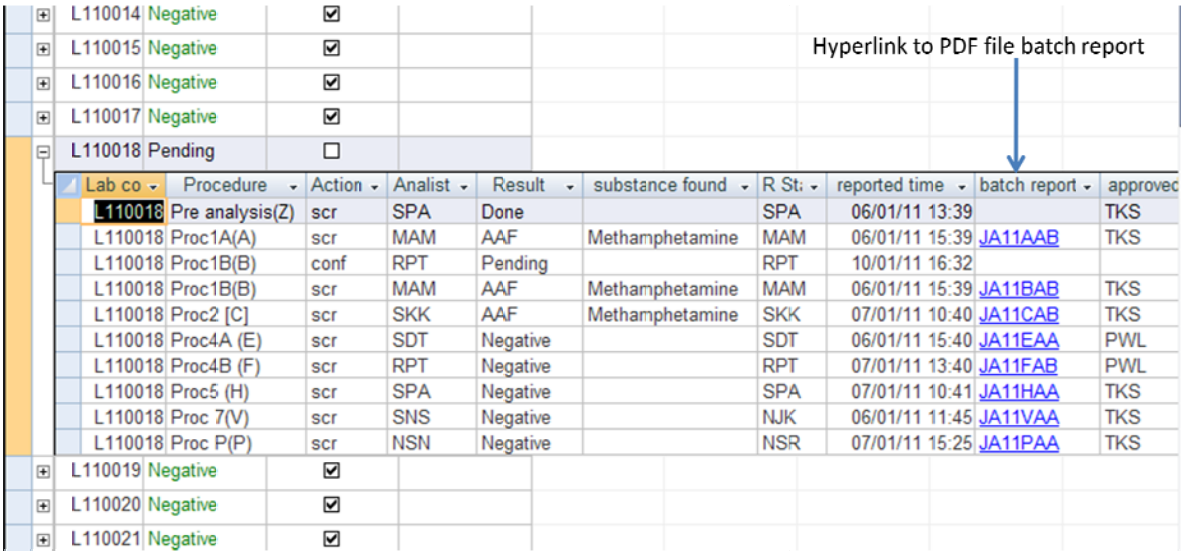


Figure 1 Entity-Relationship model for monitoring chain of custody of samples in doping Analysis

Evaluation (by procedure) and results summary (by sample)

The person responsible for each analytical procedure sends the results to the system on line by using secure password access. The alphanumerical and graphic data obtained from each analysis shall be sent to the system. The results shall be integrated and summarized to the final result by hierarchical action and result. Certifying scientist shall review the results of all procedures for a sample on screen (Figure 2). Any adverse analytical finding shall be reviewed by two certifying scientists. The final drafted report prepared by the laboratory director/certifying scientist shall be submitted to the Director/Director Assigned Scientist for authorization and report. (Figure 3).



Lab co	Procedure	Action	Analist	Result	substance found	R St:	reported time	batch report	approvec
L110018	Pre analysis(Z)	scr	SPA	Done		SPA	06/01/11 13:39		TKS
L110018	Proc1A(A)	scr	MAM	AAF	Methamphetamine	MAM	06/01/11 15:39	JA11AAB	TKS
L110018	Proc1B(B)	conf	RPT	Pending		RPT	10/01/11 16:32		
L110018	Proc1B(B)	scr	MAM	AAF	Methamphetamine	MAM	06/01/11 15:39	JA11BAB	TKS
L110018	Proc2 [C]	scr	SKK	AAF	Methamphetamine	SKK	07/01/11 10:40	JA11CAB	TKS
L110018	Proc4A (E)	scr	SDT	Negative		SDT	06/01/11 15:40	JA11EAA	PWL
L110018	Proc4B (F)	scr	RPT	Negative		RPT	07/01/11 13:40	JA11FAB	PWL
L110018	Proc5 (H)	scr	SPA	Negative		SPA	07/01/11 10:41	JA11HAA	TKS
L110018	Proc 7(V)	scr	SNS	Negative		NJK	06/01/11 11:45	JA11VAA	TKS
L110018	Proc P(P)	scr	NSN	Negative		NSR	07/01/11 15:25	JA11PAA	TKS

Figure 2 System screen showing the results of all procedures for a sample.

Offcial Analytical Report of Subsample : A

Receiving No : 11/002 *Receiving date time :* 04-01-11 14:43 *Report No :* L11/099 *Date :* 19-01-11

Source : IC 39th THAILAND NATIONAL GAMES

Sender : Sports Science Department, Sports Authority of Thailand

Procedure analysis : 1A, 1B, 2, 4A, 4B, 5, 7, Corticosteroid,THG,Gestrinon

Test result: AAF
Lab code : L110018
Bottle ID : (A) A999923
Sex : M
Specimen : Urine
Event/Sport : Weightlifting
pH : 6.7
Specific Gravity : 1.02

Results :
The analysis of the sample has shown the presence of :
Amphetamine, d-Methamphetamine

Report by _____ *Date* _____
(Prapin Wilairat, Ph.D.)
Certifying Scientist

Figure 3. The final report

Exploration of results

Once a sample has been completely analyzed in the laboratory, any information can be retrieved subsequently. The identification of any person that has participated (reception, distribution, storage, sample preparation, data evaluation, validation) may be retrieved. An example of a documents that can be generated (the chain of custody form) is shown in Figure 4.

Internal Chain of Custody Record by Sample

Receiving date/time : 4/01/11 14:43 Receiving No 11/002
Competition type : IC Source: Sports Science Department, Sports Authority of Thailand
Sende Sports Science Department, Sports Authority of Thailand
Lab code : L110018 Bottle ID (A) A999923
Initial Vol (ml) : 40

Proc./ Action	Used vol(ml)	Operator	Room	Date time
Distribution / Aliquot(scr)	0.0	SDT	DC230	05/01/11 07:04
Proc4B (F) / scr	2.5	RPT	ND608	05/01/11 08:00
Proc4A (E) / scr	2.5	SDT	ND608	05/01/11 08:15
Proc P(P) / scr	2.5	NSN	ND608	05/01/11 08:30
Pre analysis / scr	2.5	SPA	ND607	05/01/11 09:00
Proc5 (H) / scr	2.5	SPA	ND606	05/01/11 09:00
Proc1A(A) / scr	0.0	MAM	ND606	05/01/11 09:10
Proc1B(B) / scr	5.0	MAM	ND606	05/01/11 09:10
Proc 7(V) / scr	1.0	SNS	ND608	05/01/11 09:10
Proc2 [C] / scr	5.0	SKK	ND606	05/01/11 09:30
Distribution / Aliquot(conf)	0.0	SPA	DC230	09/01/11 09:04
Proc1B(B) / conf	5.0	RPT	ND606	09/01/11 10:30

Used vol.: 28.5 ml Remaining vol.: 11.5 ml

Figure 4 Chain of custody record by sample showing the data corresponding to a sample re-extracted for confirmation by procedure1B

Conclusion

The affordable software (*e.g.* Microsoft Access) is used for monitoring chain of custody of sample in doping analysis. The system provides full information on the custody of the sample (from the sample reception to the final evaluation and validation) and it is designed to cover all aspects of tests related to the World Anti-Doping Code, International Standard for Laboratories.

References

1 J.A. Pascal, Rob R. Ewin and J. Segura. Automated Control of Doping Samples and their Analyses Preparing for Barcelona '92. Part I. Development or a new Laboratory Information Management System(LIMS) for Doping Control. In: M. Donike, H. Geyer, A. Gotzmann, U. Mareck-Engelke, S. Rauth(eds.), 10th Cologne Workshop on Doping Analysis. Sport and Buch Strauβ, Köln (1993) 345-367.

2 Rob R. Ewin , J.A. Pascal and J. Segura. Automated Control of Doping Samples and their Analyses Preparing for Barcelona '92. Part II. Automating, Reporting and the Local Area Network. In: M. Donike, H. Geyer, A. Gotzmann, U. Mareck-Engelke, S. Rauth(eds.), 10th Cologne Workshop on Doping Analysis. Sport and Buch Strauβ, Köln (1993) 369-387.

3 The World Anti-Doping Code, International Standard for Laboratories. Version 1.0, 1 Jan 2009, 5.2 Analytical and Technical Processes.