

# JASPAS

JAPAN SUPPORT PROGRAMME FOR AGENCY SAFEGUARDS

TASK No. : JD-8 (E-160)

TITLE : *Surveillance System Using  
the CCTV at the Fuel  
Transfer Pond R0108*

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## 使用済燃料移動プールR 0 1 0 8における C C T Vを用いた監視システム

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### 要 旨

東海再処理工場の使用済燃料移動プール（FTP）R 0 1 0 8 内にある使用済燃料は，C C T Vを用いた監視システムにより監視される。この監視システムは，カメラ，ランプ，V T R，タイマー，T Vモニター，及び異常検出装置から成っている。それらは，連続的な無人監視のために改良された。I A E Aによるデモンストレーションとフィールドテストは，問題なく終了した。J D - 8タスクは，最終報告書で終了する。日本とI A E A間で，第8回J A S P A S 合同委員会において，本監視システムを平成元年末から東海再処理工場で査察用機器として使用することが合意された。

本報告書は，本監視システムの機能，I A E Aによるデモンストレーションとフィールドテストの結果等について述べる。

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## Surveillance System Using the CCTV at the Fuel Transfer Pond R0108

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### ABSTRACT

The spent fuels in the Fuel Transfer Pool (FTP) R0108 in the Tokai Reprocessing Plant are surveyed by the surveillance system with the CCTV. This surveillance system consists of cameras, lamps, VTRs, timers, TV monitor and anomaly detection device. They were improved for continuous, unattended surveillance. Demonstrations to IAEA and field test were successfully carried out. JD-8 task will complete with a final report. Japan and IAEA agreed at the 8th JASPAS joint committee meeting that the surveillance system with the CCTV will be routinely used as an inspection device in the Tokai Reprocessing Plant from the end of 1989.

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## 1. Introduction

JD-8 task has been performed as one of JASPAS in order to develop a surveillance system to survey continuously the spent fuels in the fuel receipt and storage area of the Tokai Reprocessing Plant. The objective of this task is to realize the continuous watch of the slanted tunnel through which the spent fuel carried by the conveyer are moved from the Fuel Transfer Pool (FTP) to the Mechanical Processing Cell (MPC).

The requirements established for the surveillance system used for an inspection device include the following:

- ① The system must have the ability of continuous, unattended surveillance of spent fuel on the conveyer path from the FTP to the MPC.
- ② The system must have tamper resistance functions for continuous, unattended surveillance of spent fuel.

JD-2 task started on August 1981 to develop a surveillance system in the fuel receipt and storage area prior to JD-8 task under JASPAS. The surveillance system developed in this task as follow:

- 1. a surveillance system of the cask for transporting spent fuels using the camera,
- 2. a surveillance system of spent fuel in the cask unloading pool (CUP) using the underwater CCTV (Closed Circuit Television),
- 3. a surveillance system of spent fuel in the FTP using the underwater CCTV.

The JD-2 task was completed on July 1982. The surveillance system of the cask for transporting spent fuels using the camera was not used as an inspection device. The surveillance system of spent fuel in the CUP using the underwater CCTV had been used but it was obsolescent as an inspection device on December 1988. The ICVD (Improved Cerenkov Viewing Device) has been used instead of it to verify the spent fuel since December 1988. But the operators still have

been using system to confirm the numbers of the spent fuels.

IAEA proposed that the surveillance system of spent fuel in the FTP with the underwater CCTV should be provided with tamper resistance function which was necessary for continuous surveillance of spent fuel in the FTP. Following the proposition, development of new surveillance system of spent fuel in fuel transfer pool had started as JD-8 task under JASPAS.

The new system was equipped with tamper resistance function. VTRs and cammeras provided to the system were improved. It was decided that development shall be finished at the 8th JASPAS joint committe meeting in 1989 between Japan and IAEA following the demonstrations to IAEA and the field test.

The details of the development of JD-8 task are shown in Table 1.

## 2. Configuration of the surveillance system

The system consists of the cameras, Lamps, VTRs, timers, TV monitor and anomaly detection device. Figure 1 shows the FTP and arrangement of the CCTV devices. Figure 2 shows the constitutional devices of the CCTV system.

These devices have been improved and developed since the beginning of the task on March 1983.

### 2.1 Cameras

Two cameras are located under the water of the FTP and watch down the entrance of the slanted tunnel. Both of monochrome video cameras with CCD (Charged Coupled Device) are highly sensitive and are installed in the cylindrical housing. The same two pictures are taken at the same time independently through the cameras.

The previous cameras which had been used since the beginning of the task on March 1983 were replaced for improvement by the CCD cameras which have long lifetime as much as the conventional semiconductor element has. The cameras are provided with exclusive lamps for lightening the pool all the time to survey the movements of spent fuels even if lamps for fuel handling are put out.

### 2.2 VTRs and timers

The surveillance system are provided with the time-lapse Video Tape Recorders (VTRs). They can record one frame at 60 seconds intervals at maximum. If a 120-minute tape is used and one frame is recorded at about 10 seconds intervals, they can record for about 47 days. It takes the conveyer with spent fuel about 90 seconds to disappear into the slanted tunnel. So they can record about 9 frames of the conveyer movement.



Each of two VTRs is connected with each camera. They have function of frame reviewing such as slow motion with changeable speed and temporary stop.

The previous VTRs which had been used since the beginning of the task on March 1983 were replaced by the present VTRs for improvement.

The both of VTRs are working on in parallel for continuous surveillance all the time.

The timers shown in the TV monitor read time in the form of "month-day-year hour:minute:second". Each character is displayed in double figures on the TV monitor. They have a back-up battery so that they may work for 10 days even if a power failure happens.

### 2.3 Anomaly detection device

This surveillance system was provided with three tamper resistance functions on March 1984. The functions are as follows:

① Detection of opening and shutting of the console box

If the console box door is opened, the limit switch in the box detects the opening. If the box door is shut, the limit switch in the box also detects the shutting.

② Detection of cable anomaly

There is the coaxial cable between the cameras and the console box. The anomaly detection device detects an electric current in the cable. If an anomaly occurs, the electric current will not flow within it. In this case, the anomaly is detected by the device. If it recovers to normal condition, the recovery is also detected by the device.

③ Detection of absence of synchronizing signal from cameras

The transmissinon signal from cameras consists of picture signal and synchronizing signal. The picture signal changes correspond to light and

shade of the picture but the synchronizing signal is transmitted with constant value and at regular intervals. If an anomaly occurs in them, the synchronizing signal will not be transmitted from them and the anomaly is detected by the device. If it recovers to normal condition, the recovery is also detected by it.

#### 2.4 Surveillance event recorder

The occurring times and signs of the above anomalies are printed out by the surveillance event recorder.

### 3. Demonstrations

Demonstrations to IAEA were organized three times on March 1985, September 1986 and February 1988 to confirm that applicability of the system with CCTV as a safeguards measure. The summary of the test activities during the demonstrations is shown in Table 2 and the details of the activities are described in Appendices 1,2 and 3.

#### 3.1 1st demonstration (March 1985) (See Appendix 1)

The 1st demonstration had been carried out with Mr. Vodrazka of IAEA. The objective of the 1st demonstration was that IAEA confirmed applicability of the system with CCTV as a safeguards measure.

The recorded tapes were reviewed and the operating procedure for inspectors was written with satisfactory. But the live video signal from the camera had not been examined due to the camera failure during the 1st demonstration. So this camera was replaced by a CCD camera after the 1st demonstration on October 1985.

#### 3.2 2nd demonstration (Sep. 1986) (See Appendix 2)

The 2nd demonstration had been carried out with Mr. Vodrazaka and other inspectors of IAEA because the camera had not been examined due to the camera failure during the 1st demonstration.

IAEA confirmed working of the devices, reviewed the recorded tapes and edited the operation check list.

#### 3.3 3rd demonstration (Feb. 1988) (See Appendices 3 and 4)

The 3rd demonstration had been carried out with Messrs Gaertner, Saukkonen and Whichello of IAEA to check whether the field test could be

performed or not. IAEA confirmed working of the devices and reviewed recorded tapes. As a result of the demonstration, IAEA evaluated that this sysyem can be used as an inspection device because the pictures of this system and continuous surveillance were good for inspection use so IAEA determined that the field test should be carried out after the 3rd demonstration. And IAEA requested that the TV-link should be installed which was developed in the Federal Republic of Germany in order to raise the tamper resistance function of the system.

#### 4. Field tests

The field tests had been carried out after the 3rd demonstration. The objective of the field tests was that IAEA inspectors got to be able to operate the system devices and confirmed that continuous surveillance worked well. The field tests were carried out six times from March to May 1988. PNC taught IAEA how to operate the system during the field tests using an operation manual (See Appendix 5). And IAEA confirmed that there had been no failure in continuous surveillance during the field tests by reviewing recorded tapes.

IAEA evaluated that this system could be used as an inspection device because the fields test had finished with satisfactory.

The summary of the activities during the field tests is shown in Table 3 and the details of the field tests are described in "Acceptance test report (by IAEA)". (See Appendix 6)

## 5. 8th JASPAS joint committee meeting

Japan and IAEA agreed that the development of this task will complete with a final report made by Japan and IAEA and the CCTV system will be used as an inspection device after the completion of the development at the 8th JASPAS joint committee meeting held on June 1989.

## 6. Preparation for using this system as an inspection device

The followings are carried out to prepare for using this system as an inspection device.

1. Meeting of preparation for inspection use was held between Japan and IAEA.
2. IAEA reviewed the recorded tapes.
3. IAEA sealed the camera housing and the console box.

### 6.1 Meeting of preparation for inspection use

The meeting was held on May 1989 with Ms. Johnson, Messers Whichello, Hope and Islam of IAEA. requested that IAEA will use this system as an inspection device without the TV-link because installation of TV-link would be delayed. Japan accepted this request. So it was agreed that sealing of the camera housing and the console box would be made. an inspection manual would be written by IAEA and the TV-link would be installed to raise the tamper resistance function of the system by IAEA.

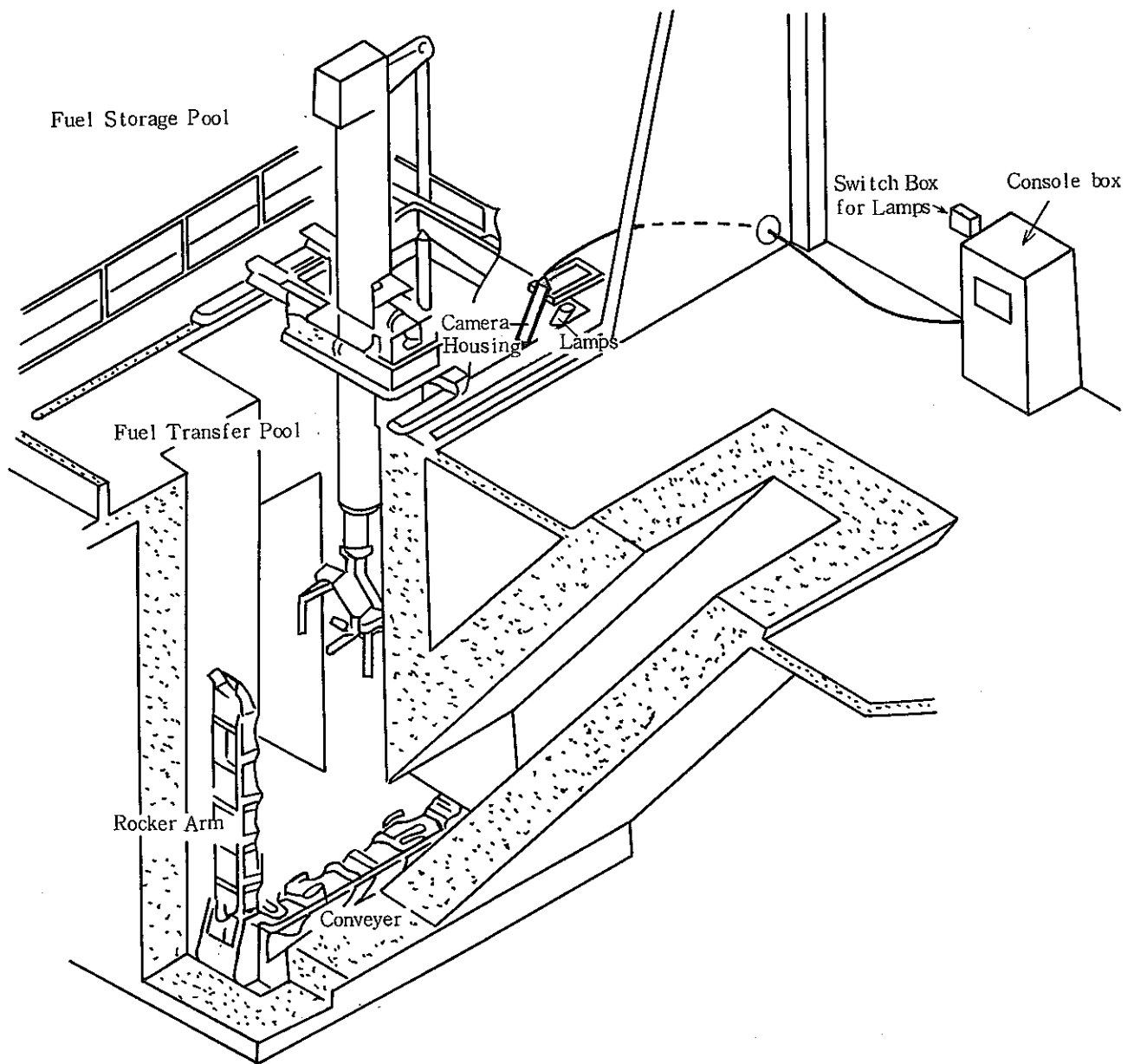


Figure 1 Fuel transfer pool and arrangement of the CCTV devices



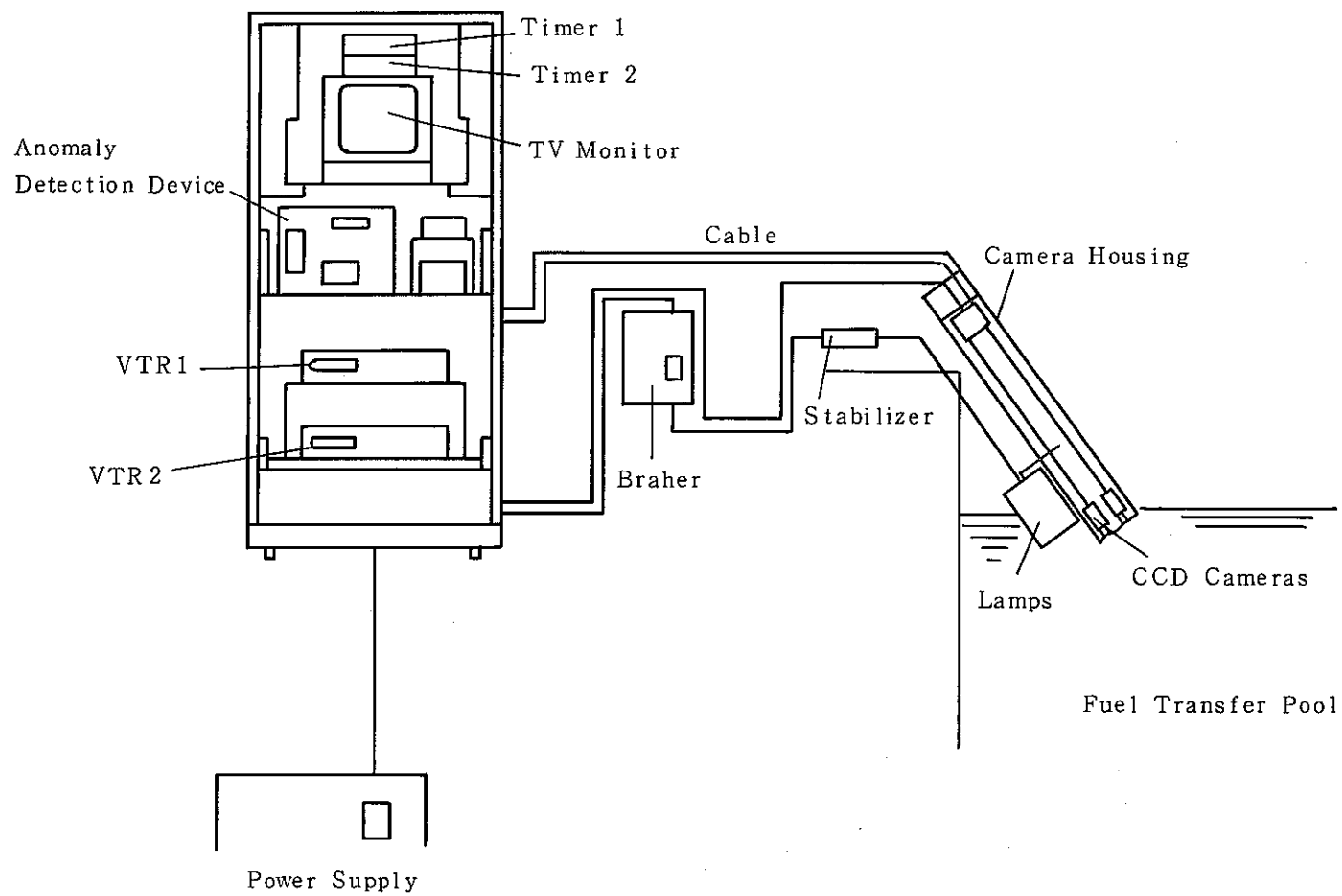


Figure 2 Constitutional devices of the CCTV system

Table 1 Details of development of JD-8 task

May 1981	End of TASTEX TASTEX task A which is "Evaluation of performance and application of surveillance devices in the spent fuel receiving areas" was evaluated to be used as a inspection device by IAEA.
Ang. 1981	Start of JASPAS Task A was succeeded as JASPAS task JD-2
Jul. 1982	<p>End of task JD-2</p> <p>JD-2 → Surveillance system of cask for transporting spent fuels ..... End of development (Not be used)</p> <p>JD-2 → CCTV in Cask Unloading Pool ..... Used (By Dec. 1988 ICVD (Improved Cerenkov Viewing Device) is used instead of the CCTV)</p> <p>JD-2 → <span style="border: 1px solid black; padding: 2px;">CCTV in Fuel Transfer Pool ..... Succeed as JD-8</span></p> <p>JD-2 → Others ..... Succeed as JB-3</p>
Mar. 1983	Registration as the new FASPAS task JD-8
Mar. 1984	Installation of tamper resistance function in the system
Mar. 1985	1st demonstration IAEA confirmed continuous surveillance by reviewing recorded tapes.
Oct. 1985	Exchange of cameras (Replacement by CCD)
Mar. 1986	Exchange of VTRs (Replacement by new ones)
Sep. 1986	2nd demonstration IAEA confirmed the working of the devices of the system and continuous surveillance by reviewing recorded tapes.
Feb. 1988	3rd demonstration IAEA confirmed the working of the devices of the system continuous surveillance by reviewing tapes. As a result of the demonstration, IAEA requested field test should be carried out and TV-link should be installed as higher tamper resistance.
Mar.~May 1988	Field test IAEA operated the system and confirmed continuous surveillance by recorded reviewing tapes. As a result of the field test, IAEA evaluated the system can be used as an inspection device.
Jun. 1988	8th JASPAS joint committee meeting Japan and IAEA agreed that the development will complete with a final report and system will be used as an inspection device.

Table 2 Summary of test activities during the demonstrations

No.	Date	IAEA inspectors	Activities	Results	Notes
1	Mar. 1985	Mr.Vodrazka	1. Confirmation of working of the devices	Not good	The camera failed so it was replaced
			2. Review of recorded tapes	Good	
			3. Writing of operating procedures for inspectors	Good	
2	Sep. 1986	Mr.Vodrazka Other inspectors	1. Confirmation of working of the devices	Good	The replaced camera was included
			2. Review of recorded tapes	Good	
			3. Editing of operation check list	Good	
3	Feb. 1988	Mr.Gaertner Mr.Saukkonen Mr.Whichello	1. Confirmation of working of the devices	Good	IAEA requested the installation of the TV-link in the system to raise the tamper resistance function of the system.
			2. Review of recorded tapes	Good	IAEA requested field test should be carried out after the 3rd demonstration.

Table 3 Summary of activities during the field test (1989)

No.	Date	IAEA inspectors	Activities	Results
1	15 Mar.	Mr. Saukkonen Mr. Joly	1. Confirmation of working of the devices	Good
			2. Operation of the devices	
			(1) Exchange of printer ribbon of surveillance event recorder	Good
			(2) Exchange of tapes	Good
			3. Review of recorded tapes (9 Feb. ~ 15 Mar.)	Good
2	23 Mar.	Mr. Saukkonen Mr. Whichello Mr. Slowiak	1. Confirmation of working of the devices	Good
			2. Operation the devices	
			(1) Exchange of tapes	Good
			(2) Exchange of VTRs	Good
			3. Review of recorded tapes (15 ~ 23 Mar.)	Good
3	7 Apr.	Mr. Saukkonen Mr. Schaerf	1. Confirmation of working of the devices	Good
			2. Operation of the devices	
			(1) Exchange of tapes	Good
			(2) Check of output of tamper signs	Good
			3. Reviw of tapes (23 Mar. ~ 7 Apr.)	Good
4	21 Apr.	Mr. Saukkonen Mr. Omar	1. Confirmation of working of the devices	Good
			2. Operation of the devices	
			(1) Exchange of tapes	Good
			3. Reviw of recorded tapes (7 Mar. ~ 21 Apr.)	Good
5	28 Apr.	Mr. Saukkonen Mr. Ertek	1. Confirmation of working of the devices	Good
			2. Operation of the devices	
			(1) Exchange of tapes	Good
			3. Reviw of recorded tapes (21 Apr. ~ 28 Apr.)	Good
6	9 May	Mr. Saukkonen Mr. Khaniki	1. Confirmation of working of the devices	Good
			2. Operation of the devices	
			(1) Exchange of tapes	Good
			3. Reviw of recorded tapes (28 Apr. ~ 9 May.)	Good

Table 4 Summary of reviewing the recorded tapes after the field test (1989)

No.	Date	IAEA inspectors	Results
1	17 May.	Mr.Hope	Good
2	15 Jun.	Mr.Khaniki	Good
3	16 Jun.	Mr.Khaniki	Good
4	13 Jul.	Mr.Lewis	Good
5	21 Aug.	Mr.Schaerf	Good
6	20 Oct.	Mr.Sanidad	Good
7	7 Nov.	Ms.Johnson	Good
8	21 Nov.	Mr.Lewis	Good
9	14 Dec.	Mr.Aquan	Good

## Reference

IAEA technical reports series No.213 TASTEX Tokai Advanced Safeguards  
Technology Exercise

## Appendix 1 Report of 1 st demonstration

## Appendix 1 Report of 1st demonstration

7 MARCH 1985

### Report

on demonstration and tests of the CCTV surveillance system at the fuel transfer pool at PNC Tokai (P.Vodrazka and inspectors)

#### 1. Introduction

In March (4-8) , 1985, P.Vodrazka (SGDE-IAEA) and a group of IAEA inspectors (Messrs Heinonen, Beguier and Alston) took part in demonstration and tests of the CCTV at the fuel transfer pool at PNC Tokai (JASPAS JD-8) . The system has been modified since 1982 when the last IAEA evaluation and comments were made. Video recorders and their controller were changed for a new type of equipment and most of the IAEA suggestion regarding tamper proofing of the system were implemented. The tamper monitor now records all tamper events inside the console and the log is available to the inspectors during their visit. The system can record pictures of the transfer pool continuously for up to 50 days with an interval 10 seconds between frames. There is a battery back up to support the time and date generator, however there is no battery support for the rest of the equipment.

#### 2. Test activities

During the visit, the system was inspected and the tamper indicating features demonstrated and tested. The camera video signal could not be observed as the vidicon tube failed at the beginings of the visit and its replacement was not available. However, a previously recorded tape was played back and its quality observed.



As one of the most important activity during the tests, inspector operating procedures were written and tested in practice by the inspectors. The procedures were made in a form of check lists leading inspectors through the operation of the system step by step. These procedures will be used by inspectors during the next 6 months of field tests and modified if necessary. Available instruction manuals for the Surveillance system, Cable and synchronizing signal detector and Surveillance event recorder were examined and their details explained by PNC staff. There were no detail manuals available for the rest of the equipment (i. e. NAC video recorders, time/date generators, VTR controller, power unit and the camera).

As the video recorders manufacturer strongly recommends to overhaul VTRs every 50 days, two operating schedules for the IAEA inspectors were worked out. The first comprises of 3 fourteen days intervals. Every third visit one of the VTRs will have to be sent to the factory for an overhaul. The second schedule is based on 56 days period of four two-weeks intervals where the VTR is exchanged every fourth visit and overhauled.

Both schedules will require at least 3 VTRs for the system: one operating, one stand-by and one spare. This operating and maintenance system will have to be further examined in practice during the field trials. Each machine overhaul costs about 1000\$ US. Payments and a system of maintenance during and after the 6 month field trials will have to be discussed further between the IAEA and PNC management.

Due to the TV camera failure the date of start of 6 month field trials might have to be changed (originally scheduled to begin in April 1985). A camera replacement is now being actively investigated by PNC (a Japanese manufacturer would be preferable from the practical and economical point of view)

The system experienced only one failure (VTR belts) during its 2 years of

operation with the exception of the recent camera failure. No further reliability data was available at the time of the visit.

### 3. Conclusions

- a) The system tamper indicating features were examined and tested and found to be working satisfactorily.
- b) A recorded tape was played back and observed. The inspectors found the picture quality high enough and the camera field of view correct in order to enable them to recognize every transfer of fuel elements.
- c) The IAEA will require a complete set of English technical manuals before the equipment is turned over to IAEA.
- d) Operating procedures for the inspectors were written and tested.
- e) The live video signal from the TV camera was not examined due to the camera failure. Camera replacement and its test is a necessary condition for start of the 6 month field trial.
- f) Two operating schedules having the 50 days overhaul period in mind, were worked out. The 56 day period is recommended to be tested during the field trials.
- g) It is recommended that safety of operating of the main power system breaker is examined by PNC. Also attachment for the IAEA wire seal is necessary for the camera enclosure.
- h) Practical questions of system maintenance, machine overhaul, payments for overhauls and availability of spares should be further discussed between IAEA and PNC during the next field trial period.

P.Vodrazka SGDE-IAEA

JR-1A

## OPERATION CHECK LIST FOR THE CCTV SURVEILLANCE SYSTEM AT FUEL TRANSFER POOL

(changing T A P E only)

DATE . . . / Report No. \_\_\_\_\_

INSPECTOR \_\_\_\_\_

	OPERATION	CERTIFICATION	FIG.No.
		SEAL-No. <input type="text"/>	
1.	Inspection of the console box		
	1) Open the box door after the seal is detached	<input type="text"/>	1
	2) Check which light above VTR push button is on at VTR control unit	VTR-No. <input type="text"/>	2
	3) Check that both VTR power lights are on		3
	4) Check that the interval switch is set to 10 sec.		18
2.	Check the system is alive		
	1) Connect monitor cable to the connector at the front panel		4
	2) Switch the monitor on		
	3) Check the image on the monitor		
3.	Inspection of the tamper recorder		
	1) Open the latch, pull out the table and pull out the tamper recorder as far as the cable allows.		5
	2) Push the paper advance button and check the log paper. Note the events in the cert. column or remove and keep the log paper.		6
	3) Remove the cover of the printer and check if enough paper available in the tamper recorder and put back the cover.(to remove the cover the white button and move the cover upward.)		
	4) Push the tamper recorder back		
4.	Stop the VTR that was checked at 1. 2)		
	1) Push the "S T O P" switch		7
5.	Stand-by VTR automatically starts and the "T I M E L A P S E" light goes on.		
	1) Check the "T I M E L A P S E" light and VTR controller panel.		8
6.	Changing the video cassette		
	1) Push the "E J E C T" switch.		9
	2) Take out a video cassette and write the date on the cassette label.		10
	3) Insert a new video cassette.		16

	OPERATION	CERTIFICATION	FIG.No.
	(write date and VTR No. on the cassette label) 4) Close the cassette cover to lock 5) Push the "R E C" and "P L A Y" switch at the same time. 6) Push the table back.		19
7.	Stop the other VTR 1) Push the "S T O P" switch.		7
8.	VTR which was checked at 1. 2) automatically starts and "T I M E L A P S E" light goes on. 1) Check the "T I M E L A P S E" light		8
9.	Push the "R E C" and "P L A Y" switch at the same time of the VTR which was stopped at 7		19
10.	Reset the alarm light by pushing the reset switch down and up.		20
11.	Check that the "A U T O" light is on.		21
12.	Switch the monitor off and disconnect the monitor cable off.		22
13.	Close the console box door and attach the new seal.	SEAL.No. <input type="text"/>	

## CODE of the tamper recorder

- 01 Synchronizing signal absence
- 02 Cable short or open-circuiting
- 03 Door open

The letters printed out when tamper alarms occur are red and those when reset are black. A power failure is indicated by 01 code (in black only) at the time when the power is restored.

NOTES ;

JR-1A

## OPERATION CHECK LIST FOR THE CCTV SURVEILLANCE SYSTEM AT FUEL TRANSFER POOL

(changing T A P E and R E C O R D E R)

DATE . . . / Report No. \_\_\_\_\_

INSPECTOR \_\_\_\_\_

	OPERATION	CERTIFICATION	FIG.No.
		SEAL-No.	
1.	Inspection of the console box		
	1) Open the box door after the seal is detached	<input type="text"/>	1
	2) Check which light above VTR push button is on at VTR control unit.	VTR-No. <input type="text"/>	2
	3) Check that both VTR power lights are on		3
2.	Check the system is alive		
	1) Connect monitor cable to the connector at the front panel		4
	2) Switch the monitor on		
	3) Check the image on the monitor.		
3.	Inspection of the tamper recorder		
	1) Open the latch, pull out the table and pull out the tamper recorder as far as the cable allows.		5
	2) Push the paper advance button and check the log paper. Note the events in the cert. column or remove and keep the log paper.		6
	3) Remove the cover of the printer and check if enough paper is available in the tamper recorder and put back the cover. (to remove the cover pull the white button and move the cover upward.)		
	4) Push the tamper recorder back.		
3.	Stop the VTR that was checked at 1. 2)		
	1) Push the "S T O P" switch.		7
4.	Stand-by VTR automatically starts and the "T I M E L A P S E" light goes on.		
	1) Check the "T I M E L A P S E" light and VTR controller panel.		8
5.	Take out the video cassette from the VTR checked at 1. 2)		
	1) Push the "E J E C T" switch.		9
	2) Take out a video cassette and write the data on the cassette label.		10
	3) Depress the cassette cover to lock.		11

	OPERATION	CERTIFICATION	FIG.No.
6.	Change the VTR to overhauled VTR. 1) turn off the "P O W E R" switch of the VTR which was checked at 1. 2). (takes a few seconds for the light to go off) 2) Pull out the table, and disconnect 4 cables at the rear end of the VTR. "VTR in" "VTR out".....BNC connectors "power" .....screw type connector "control" .....keyed screw type connector 3) Take out the VTR (send it for overhaul) 4) Install the overhauled VTR (spare set) 5) Connect 4 cables at the correct position, according to the tag and the colour code. "VTR in" "VTR out" "power" "control" 6) turn on the "P O W E R" switch. 7) Push the VTR back		12   13      14
7.	Insert a new video cassette. 1) Push the "E J E C T" switch. 2) Insert a new video cassette. (Write the date and VTR No.on the cassette label) 3) Close the cassette cover to lock. 4) Push the "T I M E L A P S E" switch. 5) Interval to be set on 10 sec by turning the interval switch. 6) Push the "R E C" and "P L A Y" switch at the same time. 7) Pushn the table back.		15 16   17 18 19
8.	Reset the alarm light by pushing the reset switch down and up.		20
9.	Check that the "A U T O" light is on.		21
10.	Switch the monitor off and disconnect the monitor cable off.		22
11.	Close the console box door and attach the new seal.	SEAL.No. <div style="border: 1px solid black; width: 100px; height: 15px; margin-top: 5px;"></div>	

CODE of the tamper recorder

- 01 Synchronizing signal absence
- 02 Cable short or open-circuiting
- 03 Door open

The letters printed out when tamper alarms occur are red and those when reset are black. A power failure is indicated by 01 code (in black only) at the time when the power is restored.

NOTES ;

Appendix 2 JD-8 DEMONSTRATION OF  
CCTV SURVEILLANCE SYSTEM AT  
FUEL TRANSFER POOL  
(2nd demonstration)



Appendix 2 JD-8 DEMONSTRATION OF CCTV SURVEILLANCE SYSTEM AT  
FUEL TRANSFER POOL (2nd demonstration)

sept 18. 1986

1. Introduction

On Sept 16-18, 1986 the CCTV Surveillance System at the fuel transfer pool at PNC TRP was demonstrated to a group of IAEA inspectors [Messrs. Vodrazka (full time), Joly, Frenzen, Ms. Perreira] . A new version of the operating manual was prepared in order to reflect changes and modifications done to the system since March 1985. Discussions were held on the system operation and comments made by the Agency staff.

2. Task activities

The CCTV system at the transfer pool was substantially modified since March 1985 when the last evaluation by the IAEA was made. Video recorders (originally NAC) were changed for SONY TSL-30 Time Lapse Recorders and the single Thompson TV camera was replaced by Two SONY CCD AVC-D1 cameras. The system operation was changed in such a way as to incorporate two redundant video channels operating in parallel 100% of the time.

A few changes were done also to the so called surveillance recorder in order to simplify its operation. Short or open-cable detector was disconnected at the camera and leaving only the power-off and synchronizing signal detection intact.

A special light was added at the camera location with the aim to maintain a sufficient scene illumination in the pool at all times. The system works now with a 10 sec surveillance period assuring about 47 days of continuous unattended operation.

On Sept 16 after Mr.Vodrazka's arrival to TRP the activity schedule for 3 days was prepared and discussed. Mr.FUKUHARA explained all changes to the system and handed over a description of the system and a new version of technical manual for the Surveillance Event Recorder and Synchronizing Signal Absence Detector.

In the afternoon on the first day a demonstration of the surveillance system took place in the plant. Both camera and console locations were examined and system parameters checked.

September 17 was dedicated to preparation of a new version of the Operating manual. The new version reflects all modifications and operation changes and should be easy for inspectors to use. For this reason it was prepared in form of operation check list where the inspector is led through the activities step by step. The manual incorporates also references to the system pictures where all buttons and indicators are identified in a cross reference with the text.

During this day further demonstration of the system operation was made for other Agency inspectors in the fuel bay. Recorded tapes were later examined on the playback system located in the office. Several tapes were reviewed with satisfactory results.

On September 18 the final typed version of the operation check list was edited and this task activity report was written and discussed. The Agency included also some comments regarding some system features requiring further attention.

### 3. Conclusions and results

A list of the comments is attached to this report.

It was decided that the IAEA, NSB and PNC participants will report the results of this visit to their respective superiors and further negotiations

then will have to take place between the Agency and NSB regarding the system ownership, joint operation, responsibility for maintenance and time scale in which the surveillance equipment will be in routine safeguards use. The type and length of a field trial by the IAEA will start whenever all necessary preparations for the field test are finished and the exact date is agreed upon by NSB and the Agency.

At the end of the visit Mr.Vodrazka thanked to the PNC-TRP staff their excellent cooperation and hospitality.

Attachment : List of comments

Participants: IAEA: Messrs. Vodrazka

Joly

Frenzen part time

Ms. Perreira

NSB: Mr. Toshiaki TANAKA

PNC-TRP: Messrs. Fusao OHYAMA

Hironobu OKAMOTO

Junichi FUKUHARA

PNC-SGO: Miss. Setsuko SAITO

Mr. Koichi ISHIKAWA

ANNEX 1 CCTV SURVEILLANCE SYSTEM  
FUEL TRANSFER POOL OPERATION CHECK LIST

made in the 2nd demonstration

## CCTV SURVEILLANCE SYSTEM - FUEL TRANSFER POOL

## Operation Check List (changing tape)

Date . . . Report No. \_\_\_\_\_

Inspector \_\_\_\_\_

	OPERATION PROCEDURE	OBSERVATION	FIG1	FIG2
1	<u>INSPECTION OF THE CONSOLE</u> 1) Check for signs of tamper on the enclosure. 2) Detach the seal and open the console door. 3) Check that on both VTRs "POWER" "REC" "INT.ON" and "1/567" lights are on. 4) Check the elapsed tape time on the VTRs readouts.	Seal No: _____  elapsed time: VTR 1 _____ VTR 2 _____	① ② ③ ④ ⑤	
2	<u>VIDEO SIGNAL CHECK</u> 1) Turn the TV monitor ON 2) Check the quality of the picture on the monitor for camera 1 and 2 using the camera selector switch. Check the time and date on both channels. Lights on the video timers are ON.	time/date: CAM 1 _____ CAM 2 _____		①     ② ⑧
3	<u>SURVEILLANCE RECORDER CHECK</u> 1) Push the paper feed button and check the log paper recording. Retrieve the recording. 2) Remove the printer cover and check if there is enough paper. Put the cover back. 3) Check the setting of the thumb-wheel switch (current year) and correct time and date on the readout. 4) Reset the alarm lights (OFF) on the surveillance recorder (pushing the button under the light). 5) Check that the TAMPER sensor switch is ON (light ON)	time/date on the surveillance recorder : _____		③ ④ ⑤   ⑥   ⑦
4	<u>CASSETTE TAPE CHANGE</u> 1) Push the STOP switch. 2) Push the EJECT switch. 3) Take out video cassettes and write the VTR identification and date on the cassette labels.		⑥ ⑦	

	<p>4) The tapes will be normally reviewed on the play back machine in the office.</p> <p>5) Insert new video cassettes (write the VTR ID's and date on the labels). Push the REW buttons.</p> <p>6) Push the "PLAY" button.</p> <p>7) Push the "REC" button immediately following. (if "PAUSE" light is lit push PAUSE)</p> <p>8) Check that only the following lights are ON: POWER, REC, INT. ON, 1/567, <math>\beta</math> II, STEP</p> <p>9) Push back the VTR support tray and secure with the latch.</p> <p>10) Check again the signal from both cameras on the monitor including the time and date information.</p> <p>11) Switch the monitor OFF.</p> <p>12) Close the console door and attach new seal.</p>	<p>Seal No. _____</p>	<p>⑩</p> <p>①②</p> <p>③④</p> <p>③④</p> <p>⑧⑨</p>	
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Code of the surveillance recorder

01 Synchronizing signal absence

03 Door open

The letters printed out when tamper alarms occur are red and black for the alarm reset. A power failure is indicated by 01 code at the time when the power is restored.

Notes;

## CCTV SURVEILLANCE SYSTEM - FUEL TRANSFER POOL

## Operation Check List (changing tape and recorder)

Date . . . Report No. \_\_\_\_\_

Inspector \_\_\_\_\_

	OPERATION PROCEDURE	OBSERVATION	FIG1	FIG2
1	<u>INSPECTION OF THE CONSOLE</u> 1) Check for signs of tamper on the enclosure. 2) Detach the seal and open the console door. 3) Check that on both VTRs "POWER" "REC" "INT.ON" and "1/567" lights are on. 4) Check the elapsed tape time on the VTRs readouts.	Seal No: _____  elapsed time: VTR 1 _____ VTR 2 _____	① ② ③ ④ ⑤	
2	<u>VIDEO SIGNAL CHECK</u> 1) Turn the TV monitor ON 2) Check the quality of the picture on the monitor for camera 1 and 2 using the camera selector switch. Check the time and date on both channels. Lights on the video timers are ON.	time/date: CAM 1 _____ CAM 2 _____		①     ② ⑧
3	<u>SURVEILLANCE RECORDER CHECK</u> 1) Push the paper feed button and check the log paper recording. Retrieve the recording. 2) Remove the printer cover and check if there is enough paper. Put the cover back. 3) Check the setting of the thumb-wheel switch (current year) and correct time and date on the readout.  4) Reset the alarm lights (OFF) on the surveillance recorder (pushing the button under the light). 5) Check that the TAMPER sensor switch is ON (light ON)	time/date on the surveillance recorder : _____		③ ④ ⑤   ⑥   ⑦
4	<u>CASSETTE TAPE CHANGE</u> 1) Push the STOP switch. 2) Push the EJECT switch. 3) Take out video cassettes and write the VTR identification and date on the cassette labels.		⑥ ⑦	



	<p>4) The tapes will be normally reviewed on the play back machine in the office.</p> <p>5 <u>VTR CHANGE (for maintenance only)</u></p> <p>1) Pull out the VTR support tray and disconnect 3 cables at the rear panel of the VTR:  "VIDEO IN", "VIDEO OUT" ..... BNC connectors  "POWER" ..... AC plug</p> <p>2) Take out the VTR (send it for maintenance).</p> <p>3) Install the spare VTR.</p> <p>4) Re-connect 3 cables at correct positions according to the tag No's:  "VIDEO IN", "VIDEO OUT", "POWER"</p> <p>5) Switch "AUTO REC" ON at the rear pannel of the VTR. <b>【IMPORTANT!】</b></p> <p>6) Turn ON the "POWER" switch.</p> <p>7) Push the VTR back to a proper position on the support tray.</p> <p>6 <u>CASSETTE TAPE CHANGE</u></p> <p>1) Insert new video cassettes (write the VTR ID's and date on the labels). Push the REW buttons.</p> <p>2) Push the "REC" and "PLAY" buttons at the same time</p> <p>3) Push the "REC" button immediately following. (if "PAUSE" light is lit push PAUSE)</p> <p>4) Check that only the following lights are ON: POWER, REC, INT. ON, 1/567, <math>\beta</math> II, STEP</p> <p>5) Push back the VTR support tray and secure with the latch.</p> <p>6) Check again the signal from both cameras on the monitor including the time and date information.</p> <p>7) Switch the monitor OFF.</p> <p>8) Close the console door and attach new seal.</p>	<p>Seal No. _____</p>	<p>⑩</p> <p>①②</p> <p>③④</p> <p>①②</p> <p>③④</p> <p>⑧⑨</p>	
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Code of the surveillance recorder

01 Synchronizing signal absence

03 Door open

The letters printed out when tamper alarms occur are red and black for the alarm reset. A power failure is indicated by 01 code at the time when the power is restored.

Notes;

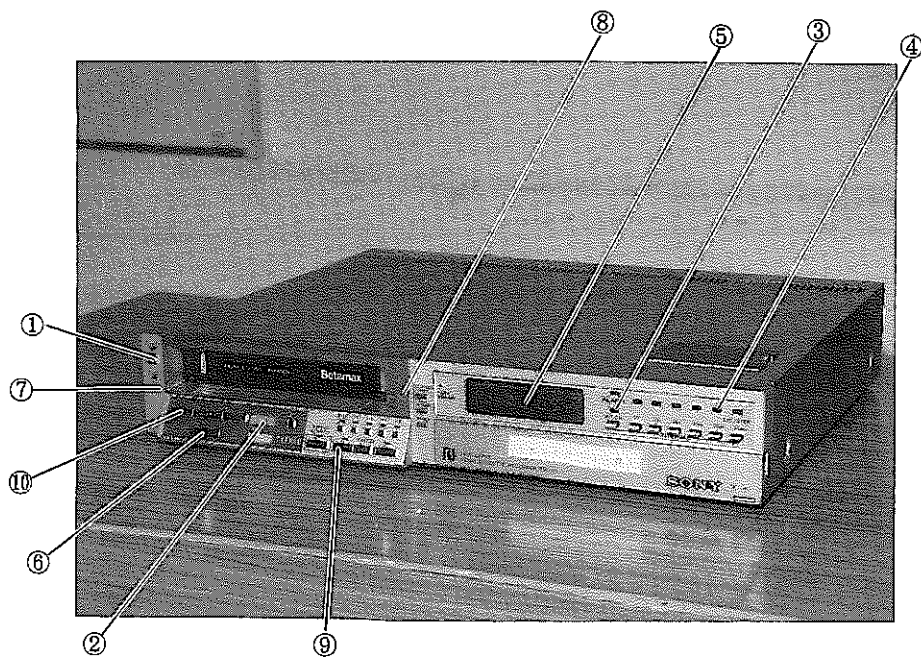


FIG.1

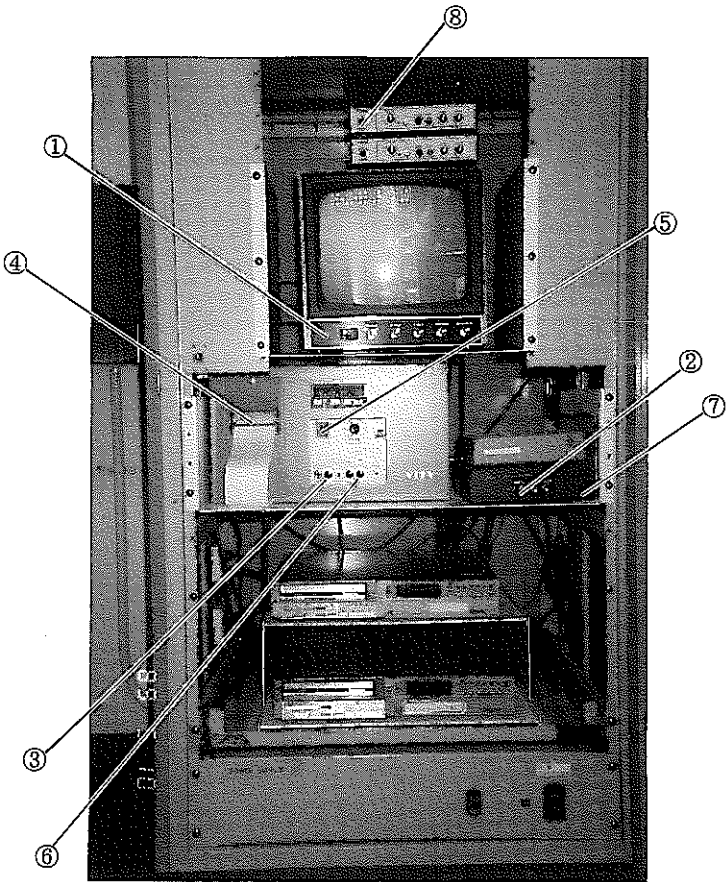


FIG.2

## ANNEX 2 INSTRUCTION MANUAL

### SURVEILLANCE EVENT RECORDER

(anomaly detection device)

## 1. Panel Description

### Front Panel

#### ① Power Switch

The main power switch of the system. When this switch is set to OFF (pulled to the bottom), the power of the entire system is turned off.

#### ② Paper Feed Button

This button is used to feed the printing paper.

#### ③ Status Check Selector Switch

This switch selects whether the contents of the inputs are to be printed out or not when 4 Status Check Button is pressed.

- ALL POINT position

To check all input points.

- NORMAL position

Normally, the switch should be set in this position. Nothing occurs even when 4 Status Check Button is pressed.

#### ④ Status Check Button

To print out the status of all input points.

#### ⑤ Alarm Reset Button

To reset the alarm lamp.

#### ⑥ Alarm Lamp

Turn on to indicate the alarm status.

#### ⑦ Test Switch

To test the program and printer.

Keeping this switch depressed, turn on the power Switch and then release this switch. The printer will type out test data in red and in black.

At the end of the data, the message "OK" will be typed out. This means that the program test result is OK. If the program test result is unsatisfactory other messages will be typed out.

When the test is over, control returns to the main program.

⑧ Time Synchronization Selector Switch

When this switch is set to the MONTH, DAY, O'CLOCK, or MINUTE position, the corresponding time display advances rapidly. As you turn the switch to the STOP position, the time display stops at the existing value.

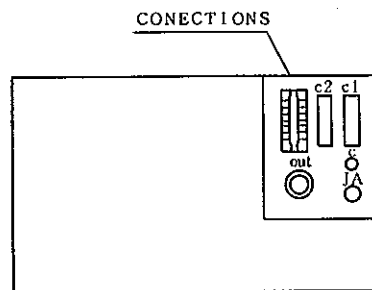
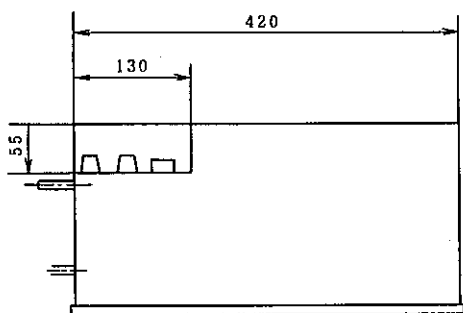
As you turn this switch to the START position, the clock operation starts.

⑨ Year-setting Digital Switches

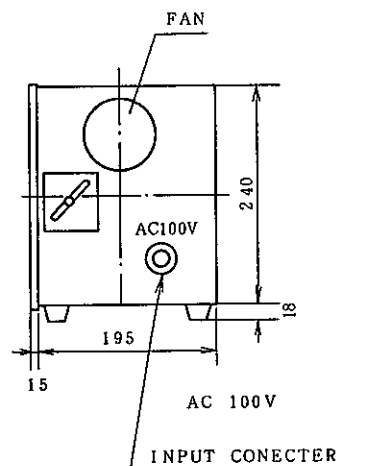
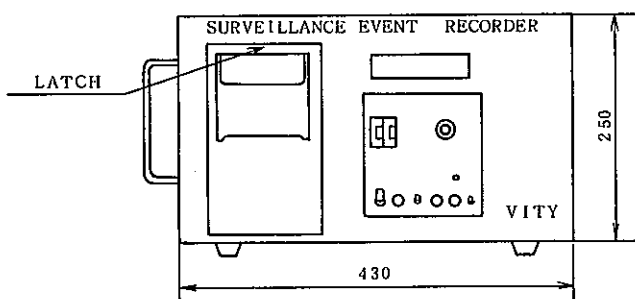
These 2-column digital switches are used to set a calendar year.

⑩ Time Display

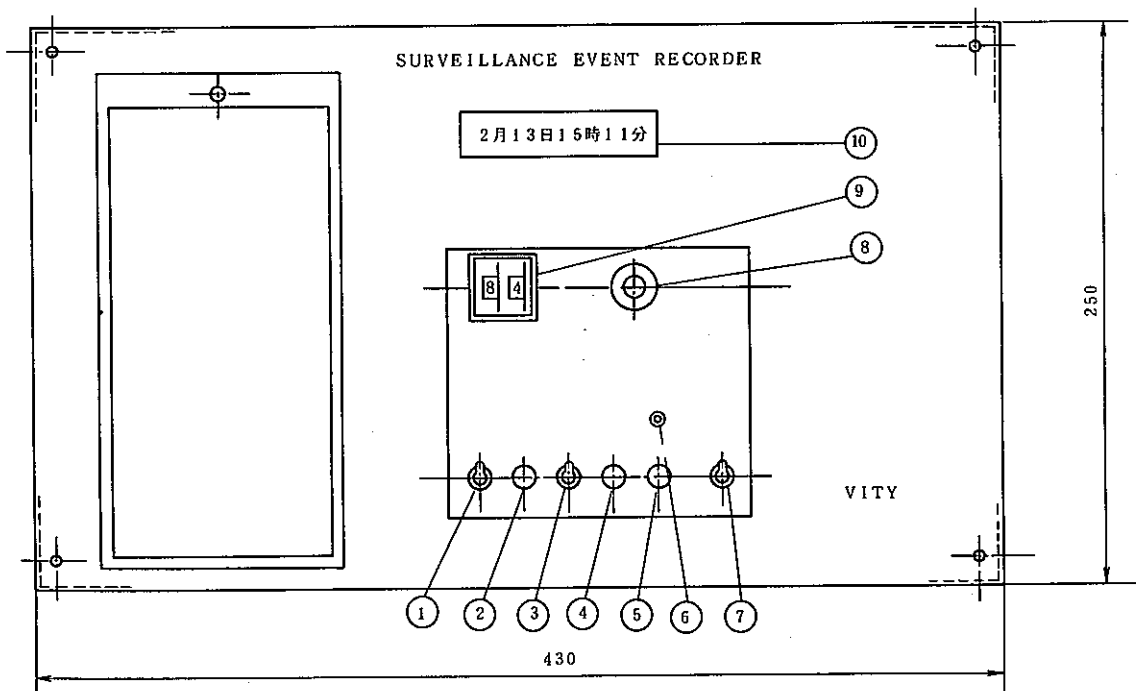
This 7-segment LED display indicates the time.



Rear View



Outward Form

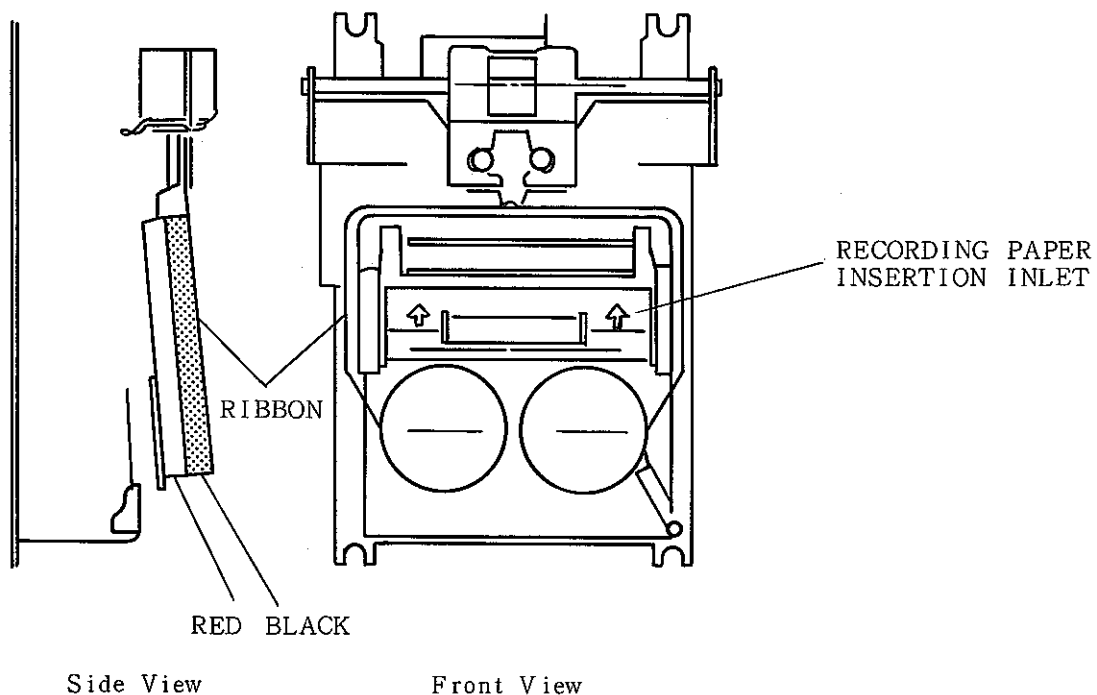


Front Panel



### Ribbon Change

- 1) Turn off the power.
- 2) If the ribbon is covered by the recording paper, remove the recording paper.
- 3) To install the ribbon, place its black side to yourself and thread it as shown by the bold line in the front view in the illustration below.
- 4) Take up the slack of the tape so that it runs taut. Insert the recording paper end into the insertion inlet indicated by the arrowheads in the front view illustration and keeping the Paper Feed button depressed, feed the paper until its end comes out of the head section.
- 5) With the above procedure, the ribbon change is complete and the instrument is ready to be used.



ANNEX 3 INSTRUCTION MANUAL  
SYNCHRONIZING SIGNAL ABSENCE DETECTOR

(anomaly detection device)

## 1. Functions

### (1) Video Signal Absence Detection

Absence of the video signal is detected by monitoring its synchronizing signal. When no synchronizing signal is received for a certain period (adjustable within a range of 5 to 500 ms), a video signal absence alarm signal is generated.

### (2) Power Off

When the power is off, an alarm signal, as in the case of (1), is generated.

## 2. Specifications

- (1) Video Input: VS 1.0 Vp-p, high impedance (approx. 10k ohms)
- (2) Video Absence Output: No-voltage contacts, 2 circuits
- (3) Alarm Output: No-voltage contacts, 2 circuits
- (4) Power Requirements: 100V  $\pm$  10 . 50/60 Hz AC
- (5) External Dimensions: 200 (W)  $\times$  150 (D)  $\times$  50 (H) mm

## 3. Circuit Description

### (1) Video Signal Absence Detector

The video input signal is fed via the emitter follower ( $\theta$  1) to diode D1 which clamps the negative peaks of the video signal at approximately 6 Vdc and then the signal is fed to comparator IC1. IC1 picks off the synchronizing signal with its pin 3 set at a level higher than the clamp level by 0.15 V with potentiometer VR1.

The synchronizing signal picked off as above triggers IC2 which operates as a monostable multivibrator and generates a pulse signal of a repetition period of 5 ms to 500 ms.

If no subsequent synchronizing signal is applied after IC2 is triggered

within the preset period, pin 3 of IC2 returns to the low level. If a subsequent synchronizing signal is applied, capacitor CII change is discharged through  $\theta 2$  and the pulse signal is converted into a continuous high level signal.

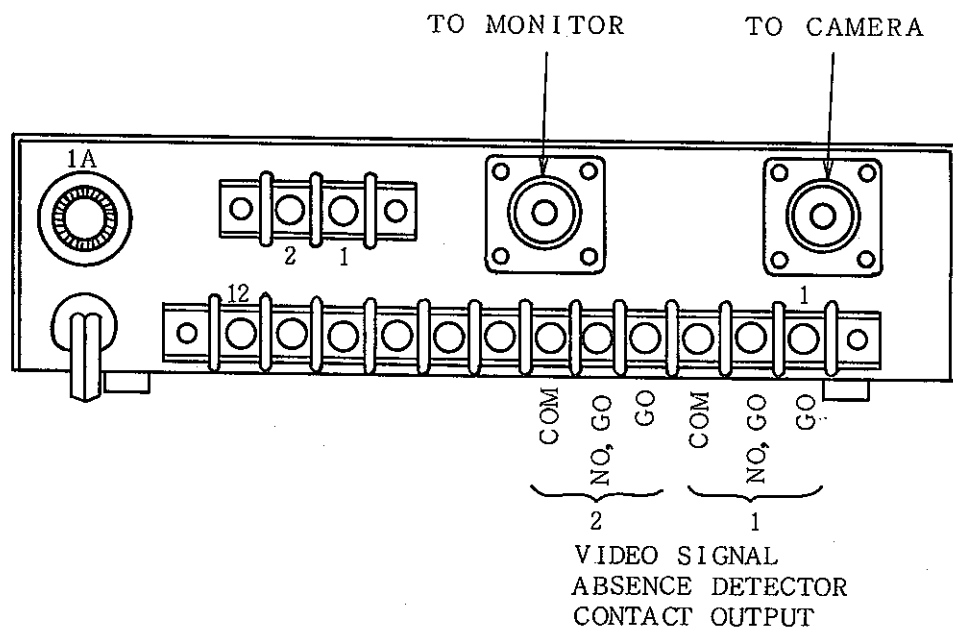
When the synchronizing signal is normal, relay K1 is energized and LED1 lamp illuminates. When the synchronizing signal is abnormal, the break contact of K1 is brought into effect.

#### 4. Adjustment and Maintenance

##### (1) Adjustment

For adjustment, refer to the Cable Alarm Function Description Sheet (Drawing).

##### (2) Connections



##### (3) Inspection and Maintenance

##### Video Signal Absence Detector

Apply a required signal to the video input terminal and check that LED1 illuminates.

Appendix 3 NOTE

REVIEW OF JASPAS TASK JD-8

(3rd demonstration)

Appendix 3 NOTE  
REVIEW OF JASPAS TASK JD-8  
(3rd demonstration)

09-02-88

Surveillance System Using the CCTV at the Transfer Pond R0108

1. Introduction

The CCTV system at the transfer pond R0108 was reviewed by IAEA staff in cooperation with staff from PNC and JNSB. Meetings and demonstrations were organised from 8 February to 10 February, 1988.

Participants:

PNC	SGO	S. Saito
		H. Tomikawa
	TRO	H. Okamoto
		K. Terunuma
		T. Hayakawa
JNSB		H. Sato
		M. Miyamoto
		T. Inoue
IAEA		K. Gartner
		H. Saukkonen
		J. Whichello

2. Safeguards Requirements for Fuel Transfer Pool (FTP) to Mechanical Processing Cell (MPC)

Safeguards for the slanted tunnel between FTP and MPC should provide IAEA with assurance that all the transfers are as declared by the operator.

### 3. Present Safeguards Scheme

There are no safeguards measures for the slanted tunnel or the conveyer. However, after receiving the fuel assembly in MPC, the radiation level is measured and the fuel identified by a serial number.

### 4. CCTV Objective

To realise the continuous watch of the slanted tunnel through which the spent fuel assemblies are moved from the FTP to MPC.

### 5. Applicability of the CCTV as a Safeguards Measure

The system was observed to survey the movement of conveyer cart from FTP to entrance of the tunnel (approximately 3 metres of the total length of 20 metres) leading to MPC. The basket in FTP and the movement of the rocker arm can be detected.

For the purposes of the field test, a recording interval of 9.5 seconds was chosen. The time interval between the start of the conveyer and the point at which the carrier enters the tunnel is approximately 1.5 minutes. This gives about 10 recorded scenes.

Operator controlled lamps provide normal lighting of the FTP. Additional lighting is provided by two mercury lamps which are focussed on the area of interest. Power to the lamps comes from the recording console.

### 6. Tamper Resistance and Authentication

#### 6.1 Equipment Enclosures

The equipment enclosure (recording console and camera housing) will require additional features to enhance their tamper resistance and to allow adequate sealing. Modifications of this nature must be performed before the equipment can be accepted for routine use.

## 6.2 Camera Authentication

At present the system only detects the loss of synchronising pulses from camera 2. The representatives from the Agency proposed that the recently developed tamper resistant T.V. link should be incorporated within the first year of operation. Installation will require the assistance of PNC.

## 7. Field Test Plan

### 7.1 Criteria for Acceptance

Reference is made to the letter from Mr. D.E. Rundquist to Mr. N. Suyama dated 24 July, 1987. The attachment to this letter defines the criteria for acceptance.

- i ) No more than 1 total loss of surveillance period during test for all causes.
- ii ) Adequate tamper features.
- iii ) Clear identification of fuel transfer to MPC.
- iv ) Adequate arrangements for maintenance.
- v ) Acceptable provisions for use including provisions for recovering from inconclusive results (to be agreed between SGOA, JNSB and PNC).

To support the evaluation fo the system set out in item (iii) above, the IAEA representatives request that the data output of the Real Time Accountancy System (RIAS) be made available for the period covering the field test. \*

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\* With respect to the note on the review of JASPAS task JB-3, dated 05-02-88, paragraph 5.1.8, PNC stated that the fuel data are not deleted from the computer data base following the completion of the shearing process. The data remains stored for an indefinite period.



It is requested that the system is made available for training to IAEA inspectors scheduled for TRP. It is also requested that a SONY video cassette recorder, type TSL-30, and a T.V. monitor be made available to Mr. Saukkonen at the TRP IAEA office for review of the tapes.

It is requested that the tapes from the field test are made available for review at the IAEA office in Vienna.

In reference to (iv), a request for additional documentation covering the system is attached (see Attachment 1).

The Agency requires a statement covering the emergency power supply arrangements to the CCTV and the lighting equipment.

The Agency urgently requires clarification concerning ownership of the system so that it may arrange maintenance and repair procedures. Such arrangements must be in place prior to up-grading of the equipment to routine use.

#### 8. Proposed Schedule

The field test was started by the IAEA representatives 9 February, 1988 for a duration of 3 months. For the IAEA side, Mr. J. Whichello is the responsible project officer and Mr. H. Saukkonen, from the Tokyo Office, will direct IAEA contact with the facility. The project officer at the facility is Mr. H. Okamoto. PNC and IAEA will keep JNSB informed about the progress of the field test.

It is intended to have a final report of the field test by September 1988.

Assuming a positive outcome of the test, the system could then be classified as category B (limited use equipment for inspections) .

Additional tamper resistant and authentication features (Section 6.) should be scheduled for March-April, 1989. Consideration should then be given to classification of the system as category A (routine use for inspections).

ATTACHMENT 1

To assist in the field test of the JD-8 surveillance system, the following documentation (in English language) would be appreciated:

1. Manufacturer's service manual and operation manual for the SONY CCD camera type AVC-D1
2. Drawing for the camera and spot light housings.
3. Circuits and details of the "camera adaptor".
4. A clear copy of the video tamper detector circuit diagram.
5. Manufacturer's service manual and operation manual for the FOR.A video timer (time/date generator) .
6. Manufacturer's service manual and operation manual for the SONY TSL-30 video tape recorder.
7. Manufacturer's service manual and operation manual for the VITY Surveillance Event Recorder.
8. Manufacturer's service manual for the T.V. monitor.
9. Details of the cabling and wiring between the surveillance cabinet power supply and the cameras and spot lights.
10. Manufacturer's data for the spot lights.
11. Report of the operator's maintenance experience with the CCTV system prior to the field test.

Communication of the above to Vienna can be made through Mr. H.Saukkonen at the IAEA Tokyo Office.

Appendix 4 SURVEILLANCE SYSTEM USING  
THE CCTV AT FUEL TRANSFER POND R0108  
(Document for 3rd demonstration)

FEBRUARY 1988

POWER REACTOR AND NUCLEAR FUEL DEVELOPMENT CORPORATION

# Appendix 4 SURVEILLANCE SYSTEM USING THE CCTV AT FUEL TRANSFER POND R0108

(Document for 3rd demonstration)

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## 1. Introduction

CCTV Surveillance System at fuel transfer pool have been begun in 1983 as a JASPAS programme task (JD-8) at the Tokai Reprocessing Plant. This system provides a continuous search of a tunnel entrance, through which the spent fuel assemblies are transferred from the Fuel Transfer Pool (FTP) to the Mechanical Processing Cell (MPC) for chopping. This tunnel is the only way to transfer the fuel assemblies to the MPC, so it can be verified that there was no undeclared transfer of the spent fuel assemblies to the MPC.

Bird's eye view of the fuel transfer pool is given in FIG.1.

In March 1985, the system was demonstrated to the IAEA. An exchange of the main system components (camera and VTR) were subsequently changed with the fuel system completed in March 1986.

## 2. Description of the system

### 2.1 Overview

Block Diagram of the main features of the system is given in FIG.2.

This system consists of two CCD camera and recording units. To make maintenance of the camera easier, it is enclosed in a drip-proof housing which is located on the bank of the pool. The housing has a tube with one end dipping below the pool water surface to provide viewing window for the camera. The recording unit consists of the video timer, two sets of a special type VTR and the equipment for tamperproof. These equipment are all mounted in the console box which can be sealed.

## 2.2 Camera

TV camera is the monochrome CCD (SONY AVC-D1) camera with light.

Two cameras run continuously, one camera is connected to one VTR, another camera to another VTR. Each camera views the scene through a glass window at the end of the camera housing.

- Pick-up tube ..... interline-transfer CCD
- Synchronizing system ..... internal
- Scanning system ..... 2 : 1 interlaced, 525 lines,  
60 fields
- Horizontal resolution ..... 280 lines at center
- Minimum illumination ..... 3 lux
- Weight ..... 270 g with lens

## 2.3 VTR

The special long recording type VTR (SONY TSL-30) is time-lapse. It can choose the interval from 1 to 60 seconds. When 9.5 seconds is chosen as the interval, it can record continuously for 1,134 hours (47 days) using 2 hours Betamax tape.

Recording time	Recording mode
2 hr	normal ( 0.016 sec )
14 hr	1 / 7 ( 0.11 sec )
42 hr	1 / 21 ( 0.33 sec )
126 hr	1 / 63 ( 1 sec )
378 hr	1 / 189 ( 3 sec )
1,134 hr	1 / 567 ( 9.5 sec )
7,202 hr	1 / 3601 ( 60 sec )

### 3. Tamper Detection

#### 3.1 Camera synchronizing signal

The camera transmits a video signal consisting of a picture signal and a synchronizing signal. While levels of the picture signal are changed in accordance with the object for surveillance, the synchronizing signal is constantly transmitted at a specified interval. If the horizontal synchronizing signal is absent, the camera synchronizing signal absence detector detects this fact and the surveillance event recorder type out the time of occurrence of this event. The signal detector trips when the cable connector is disconnected, the power of the camera is turned off, or the camera fails. For further details of the cable signal detector, refer to its instruction manual.

#### 3.2 Recorder

The surveillance recorder prints out the time of the occurrence and contents (code number) of each of the tamper alarms and other events mentioned in paragraphs 01 or 03 in red. When the alarm status is reset, the recorder prints out the events in black. For the time synchronization method and other operation methods of the surveillance recorder, refer to its instruction manual.

#### 3.3 Tamper alarm lamp

The red lamp goes on when the synchronizing signal absence event is detected. The red lamp does not go off until the push button (reset button) is pressed. If the event is still present, the red lamp does not go off even when the reset button is pressed. The alarm signal hold circuit and lamp power supply circuit are built in the alarm indicator circuit of the console box.

#### 4. System Security

##### 4.1 Doors

The console from the front with the door open is given FIG.3. If the door is opened, it is detected by a microswitch and the time of occurrence of the event is printed out on the surveillance recorder.

##### 4.2 Cable protection

The coaxial cable between the camera and console box, and the power cable between the power board and console box are protected in steel conduits or flexible metallic conduits. The power board is provided with a lock, preventing unauthorized access to the power switches.



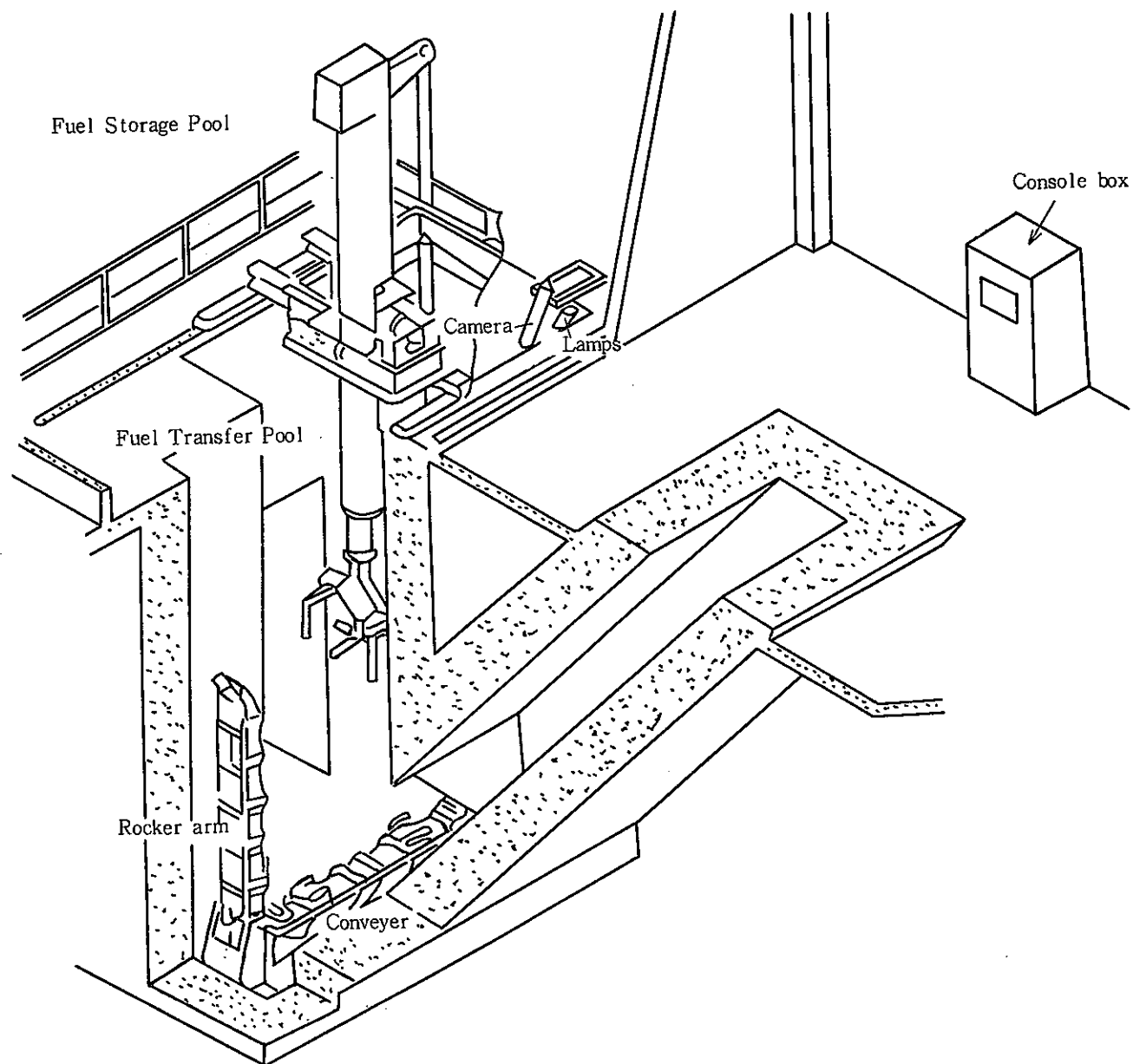


FIG.1 Bird's eye view of the FTP

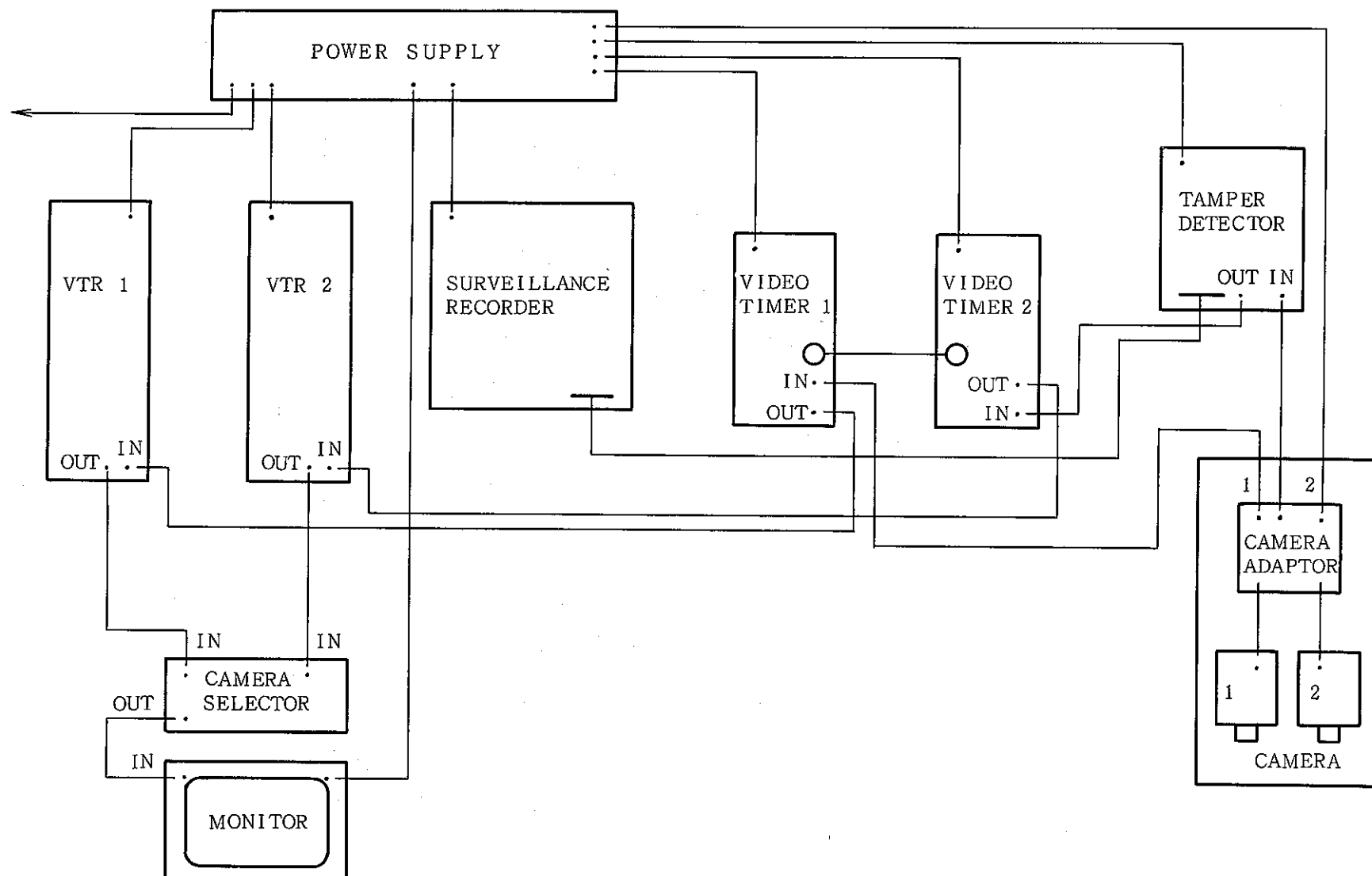


FIG.2 Block Diagram

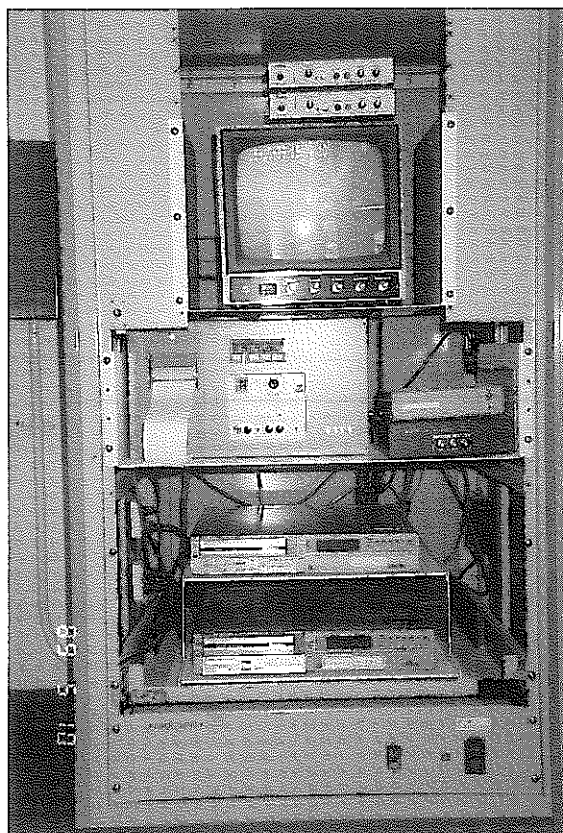


FIG.3 Console Box



FIG.4 Monitor TV

ANNEX 1 CCTV SURVEILLANCE SYSTEM

FUEL TRANSFER POOL OPERATION CHECK LIST

## CCTV SURVEILLANCE SYSTEM - FUEL TRANSFER POOL

## Operation Check List (changing tape)

Date . . . Report No. \_\_\_\_\_

Inspector \_\_\_\_\_

	OPERATION PROCEDURE	OBSERVATION	FIG1	FIG2
1	<u>INSPECTION OF THE CONSOLE</u> 1) Check for signs of tamper on the enclosure. 2) Detach the seal and open the console door. 3) Check that on both VTRs "POWER" "REC" "INT.ON" and "1/567" lights are on. 4) Check the elapsed tape time on the VTRs readouts.	Seal No: _____  elapsed time: VTR 1 _____ VTR 2 _____	① ② ③ ④ ⑤	
2	<u>VIDEO SIGNAL CHECK</u> 1) Turn the TV monitor ON 2) Check the quality of the picture on the monitor for camera 1 and 2 using the camera selector switch. Check the time and date on both channels. Lights on the video timers are ON.	time/date: CAM 1 _____ CAM 2 _____		①    ② ⑧
3	<u>SURVEILLANCE RECORDER CHECK</u> 1) Push the paper feed button and check the log paper recording. Retrieve the recording. 2) Remove the printer cover and check if there is enough paper. Put the cover back. 3) Check the setting of the thumb-wheel switch (current year) and correct time and date on the readout.  4) Reset the alarm lights (OFF) on the surveillance recorder (pushing the button under the light). 5) Check that the TAMPER sensor switch is ON (light ON)	time/date on the surveillance recorder : _____		③ ④ ⑤  ⑥  ⑦
4	<u>CASSETTE TAPE CHANGE</u> 1) Push the STOP switch. 2) Push the EJECT switch. 3) Take out video cassettes and write the VTR identification and date on the cassette labels.		⑥ ⑦	

4) The tapes will be normally reviewed on the play back machine in the office.			
5) Insert new video cassettes (write the VTR ID's and date on the labels). Push the REW buttons.		⑩	
6) Push the "PLAY" button.			
7) Push the "REC" button immediately following. (if "PAUSE" light is lit push PAUSE)		① ②	
8) Check that only the following lights are ON: POWER, REC, INT. ON, 1/567, $\beta$ II, STEP		③ ④	
9) Push back the VTR support tray and secure with the latch.		③ ④	
10) Check again the signal from both cameras on the monitor including the time and date information.		⑧ ⑨	
11) Switch the monitor OFF.			
12) Close the console door and attach new seal.	Seal No. _____		

Code of the surveillance recorder

01 Synchronizing signal absence

03 Door open

The letters printed out when tamper alarms occur are red and black for the alarm reset. A power failure is indicated by 01 code at the time when the power is restored.

Notes;

## CCTV SURVEILLANCE SYSTEM - FUEL TRANSFER POOL

## Operation Check List (changing tape and recorder)

Date . . . Report No. \_\_\_\_\_

Inspector \_\_\_\_\_

	OPERATION PROCEDURE	OBSERVATION	FIG1	FIG2
1	<u>INSPECTION OF THE CONSOLE</u> 1) Check for signs of tamper on the enclosure. 2) Detach the seal and open the console door. 3) Check that on both VTRs "POWER" "REC" "INT.ON" and "1/567" lights are on. 4) Check the elapsed tape time on the VTRs readouts.	Seal No: _____  elapsed time: VTR 1 _____ VTR 2 _____	① ② ③ ④ ⑤	
2	<u>VIDEO SIGNAL CHECK</u> 1) Turn the TV monitor ON 2) Check the quality of the picture on the monitor for camera 1 and 2 using the camera selector switch. Check the time and date on both channels. Lights on the video timers are ON.	time/date: CAM 1 _____ CAM 2 _____		①   ② ⑧
3	<u>SURVEILLANCE RECORDER CHECK</u> 1) Push the paper feed button and check the log paper recording. Retrieve the recording. 2) Remove the printer cover and check if there is enough paper. Put the cover back. 3) Check the setting of the thumb-wheel switch (current year) and correct time and date on the readout. 4) Reset the alarm lights (OFF) on the surveillance recorder (pushing the button under the light). 5) Check that the TAMPER sensor switch is ON (light ON)	time/date on the surveillance recorder : _____		③ ④ ⑤  ⑥  ⑦
4	<u>CASSETTE TAPE CHANGE</u> 1) Push the STOP switch. 2) Push the EJECT switch. 3) Take out video cassettes and write the VTR identification and date on the cassette labels.		⑥ ⑦	



	<p>4) The tapes will be normally reviewed on the play back machine in the office.</p> <p>5 <u>VTR CHANGE (for maintenance only)</u></p> <p>1) Pull out the VTR support tray and disconnect 3 cables at the rear panel of the VTR:  "VIDEO IN", "VIDEO OUT" . . . BNC connectors  "POWER" . . . AC plug</p> <p>2) Take out the VTR (send it for maintenance).</p> <p>3) Install the spare VTR.</p> <p>4) Re-connect 3 cables at correct positions according to the tag No's:  "VIDEO IN", "VIDEO OUT", "POWER"</p> <p>5) Switch "AUTO REC" ON at the rear panel of the VTR. <b>【 I M P O R T A N T ! 】</b></p> <p>6) Turn ON the "POWER" switch.</p> <p>7) Push the VTR back to a proper position on the support tray.</p> <p>6 <u>CASSETTE TAPE CHANGE</u></p> <p>1) Insert new video cassettes (write the VTR ID's and date on the labels). Push the REW buttons.</p> <p>2) Push the "REC" and "PLAY" buttons at the same time</p> <p>3) Push the "REC" button immediately following.  (if "PAUSE" light is lit push PAUSE)</p> <p>4) Check that only the following lights are ON:  POWER, REC, INT.ON, 1/567, <math>\beta</math> II, STEP</p> <p>5) Push back the VTR support tray and secure with the latch.</p> <p>6) Check again the signal from both cameras on the monitor including the time and date information.</p> <p>7) Switch the monitor OFF.</p> <p>8) Close the console door and attach new seal.</p>	<p>Seal No. _____</p>	<p>⑩</p> <p>①②</p> <p>③④</p> <p>①②</p> <p>③④</p> <p>⑧⑨</p>	
--	--	-----------------------	--	--

Code of the surveillance recorder

01 Synchronizing signal absence

03 Door open

The letters printed out when tamper alarms occur are red and black for the alarm reset. A power failure is indicated by 01 code at the time when the power is restored.

Notes;

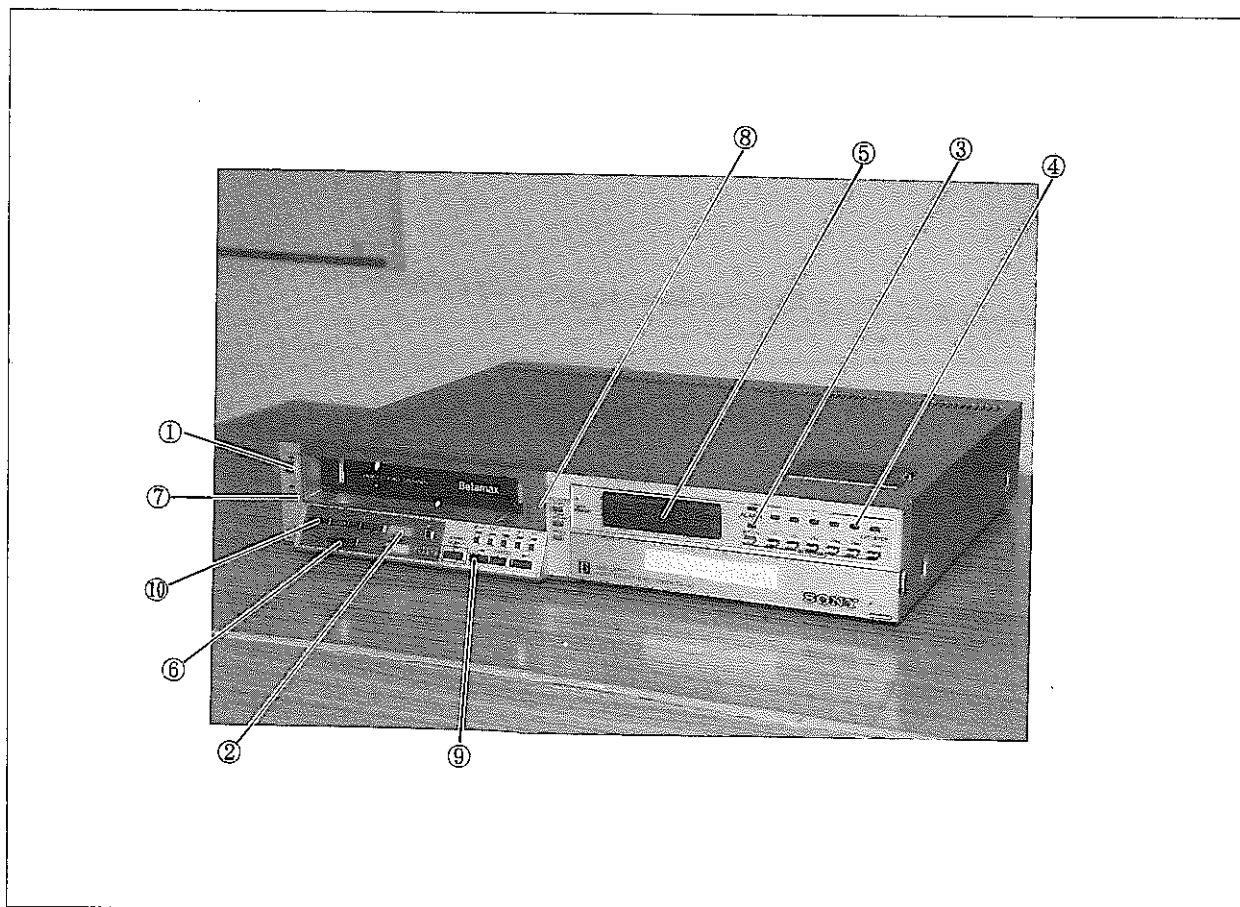


FIG. 1

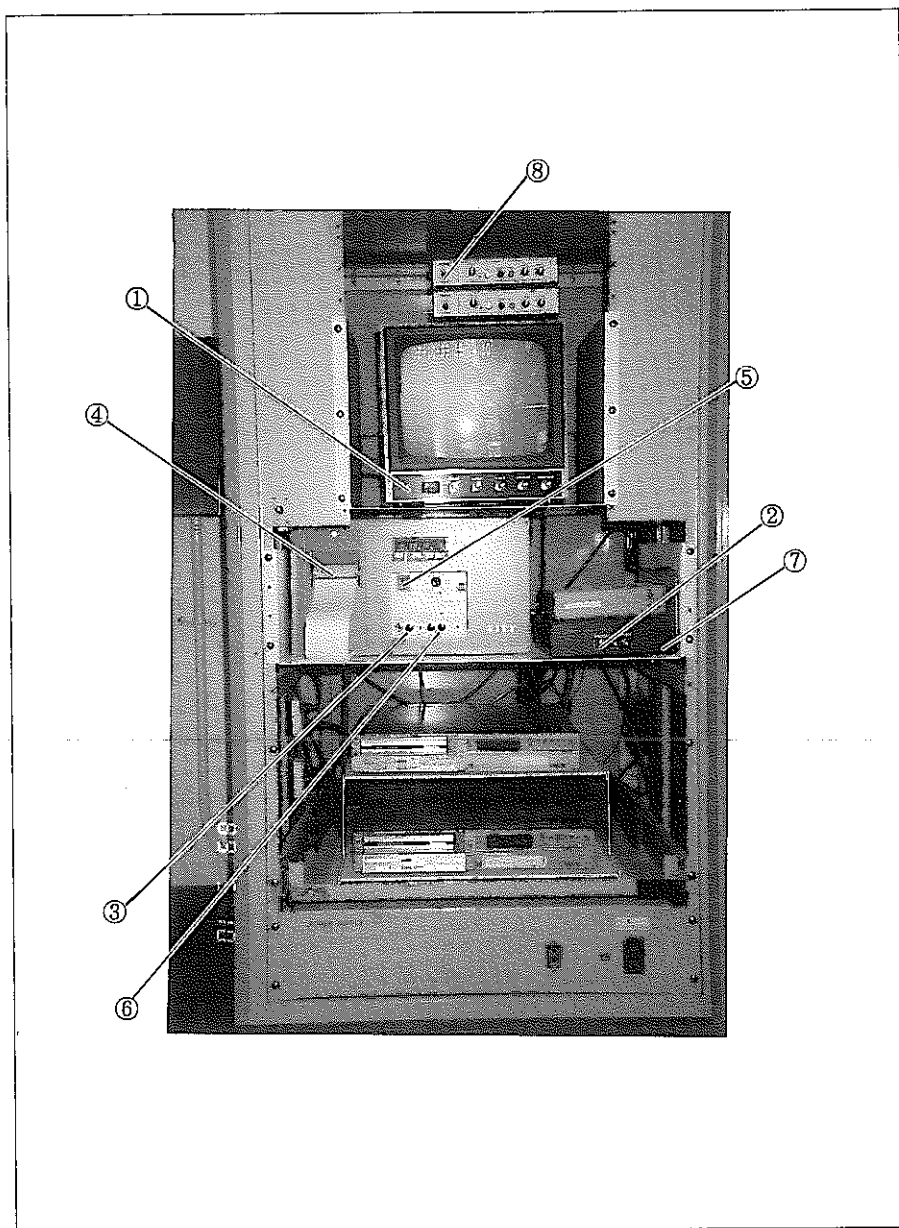


FIG.2

ANNEX 2 INSTRUCTION MANUAL

SURVEILLANCE EVENT RECORDER

---

## 1. Panel Description

### Front Panel

#### ① Power Switch

The main power switch of the system. When this switch is set to OFF (pulled to the bottom), the power of the entire system is turned off.

#### ② Paper Feed Button

This button is used to feed the printing paper.

#### ③ Status Check Selector Switch

This switch selects whether the contents of the inputs are to be printed out or when 4 Status Check Button is pressed.

- ALL POINT position

To check all input points.

- NORMAL position

Normally, the switch should be set in this position. Nothing occurs even when 4 Status Check Button is pressed.

#### ④ Status Check Button

To print out the status of all input points.

#### ⑤ Alarm Reset Button

To reset the alarm lamp.

#### ⑥ Alarm Lamp

Turn on to indicate the alarm status.

#### ⑦ Test Switch

To test the program and printer.

Keeping this switch depressed, turn on the Power Switch and then release this switch. The printer will type out test data in red and in black.

At the end of the data, the message "OK" will be typed out. This means that the program test result is OK. If the program test result is unsatisfactory, other messages will be type out.

When the test is over, control returns to the main program.

⑧ Time Synchronization Selector Switch

When this switch is set to the MONTH, DAY, O'CLOCK, or MINUTE position, the corresponding time display advances rapidly. As you turn the switch to the STOP position, the time display stops at the existing value.

As you turn this switch to the START position, the clock operation starts.

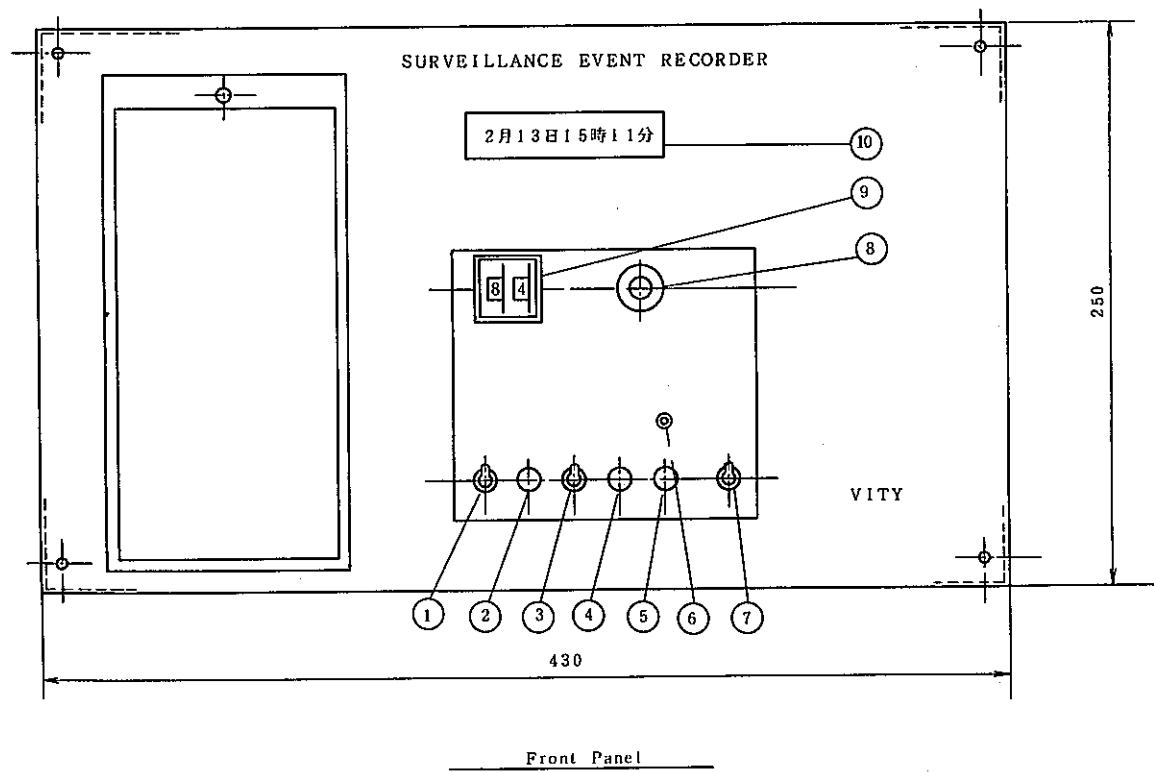
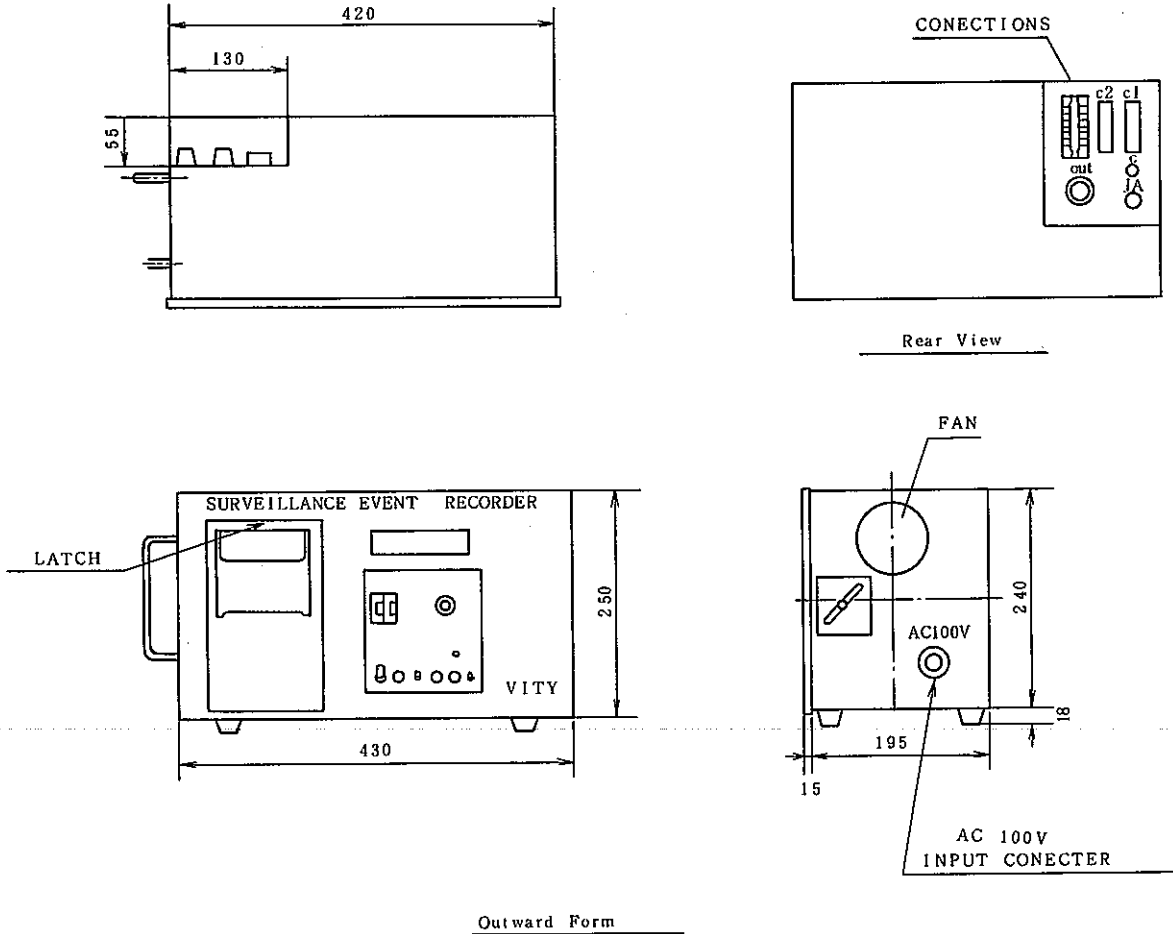
⑨ Year-setting Digital Switches

These 2-column digital switches are used to set a calendar year.

⑩ Time Display

This 7-segment LED display indicates the time.

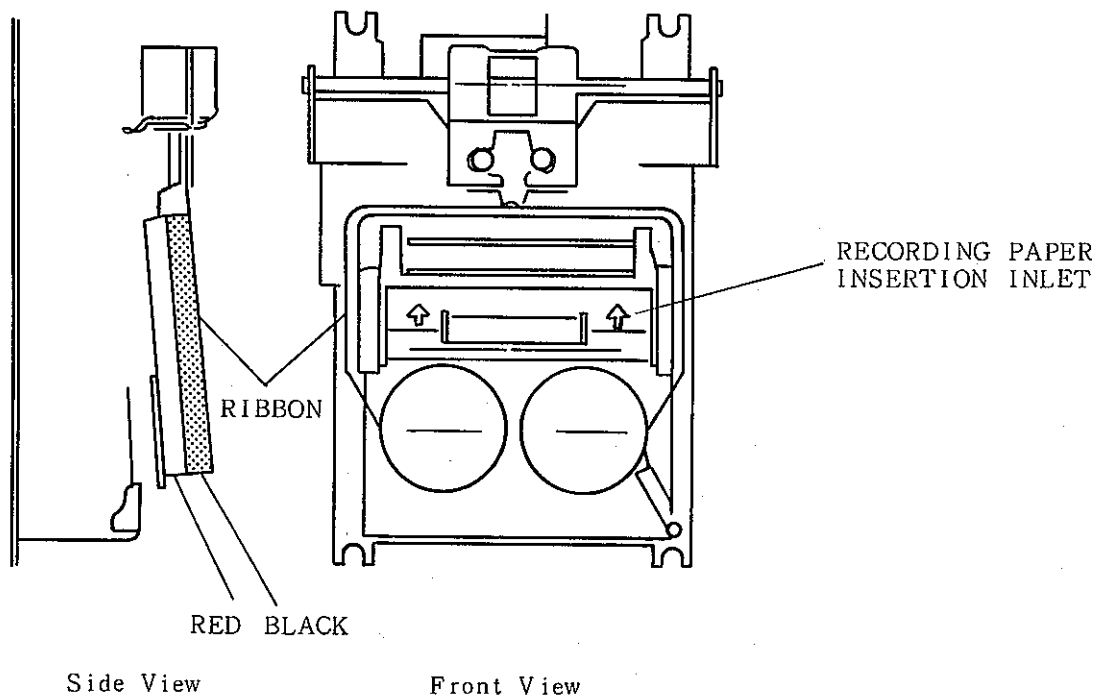
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### Ribbon Change

- 1) Turn off the power.
- 2) If the ribbon is covered by the recording paper, remove the recording paper.
- 3) To install the ribbon, place its black side to yourself and thread it as shown by the bold line in the front view in the illustration below.
- 4) Take up the slack of the tape so that it runs taut. Insert the recording paper end into the insertion inlet indicated by the arrowheads in the front view illustration and keeping the Paper Feed button depressed, feed the paper until its end comes out of the head section.
- 5) With the above procedure, the ribbon change is complete and the instrument is ready to be used.



ANNEX 3 INSTRUCTION MANUAL

SYNCHRONIZING SIGNAL ABSENCE DETECTOR

---

## 1. Functions

### (1) Video Signal Absence Detection

Absence of the video signal is detected by monitoring its synchronizing signal. When no synchronizing signal is received for a certain period (adjustable within a range of 5 to 500 ms), a video signal absence alarm signal is generated.

### (2) Power off

When the power is off, an alarm signal, as in the case of (1), is generated.

## 2. Specifications

- (1) Video Input: VS 1.0 Vp-p, high impedance  
(approx. 10K ohms)
- (2) Video Absence Output: No-voltage contacts, 2 circuits
- (3) Alarm Output: No-voltage contacts, 2 circuits
- (4) Power Requirements: 100V $\pm$  10%, 50/60 Hz AC
- (5) External Dimensions: 200(W) $\times$  150(D) $\times$  50(H)mm

## 3. Circuit Description

### (1) Video Signal Absence Detector

The video input signal is fed via the emitter follower ( $\theta$  1) to diode D1 which clamps the negative peaks of the video signal at approximately 6 Vdc and then the signal is fed to comparator IC1. IC1 picks off the synchronizing signal with its pin 3 set at a level higher than the clamp level by 0.15 V with potentiometer VR1.

The synchronizing signal picked off as above triggers IC2 which operates as a monostable multivibrator and generates a pulse signal of a repetition period of 5 ms to 500 ms.

If no subsequent synchronizing signal is applied after IC2 is triggered within the preset period, pin 3 of IC2 returns to the low level. If a subsequent synchronizing signal is applied, capacitor CII change is discharged through  $\theta 2$  and the pulse signal is converted into a continuous high level signal.

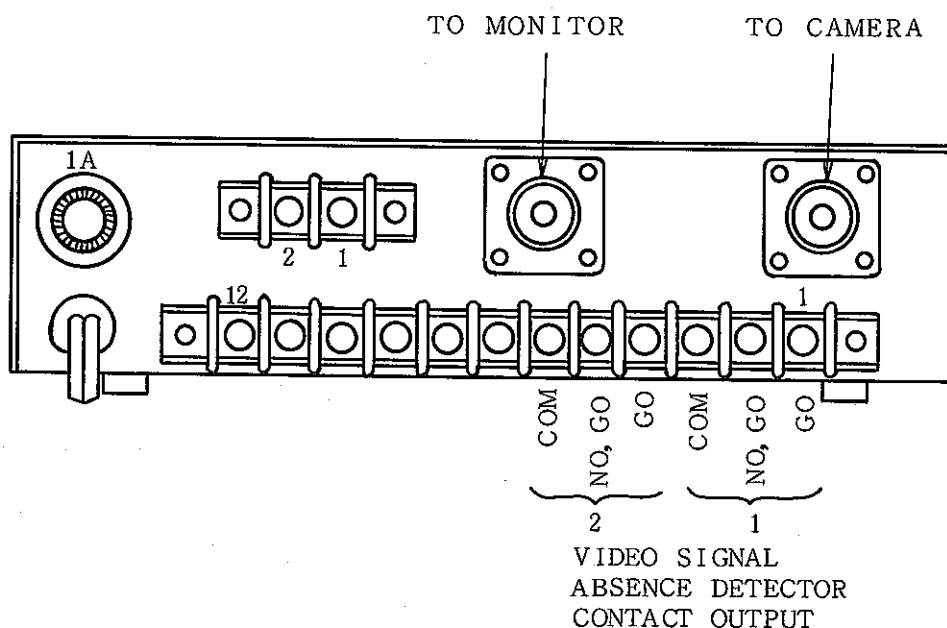
When the synchronizing signal is normal, relay K1 is energized and LED1 lamp illuminates. When the synchronizing signal is abnormal, the break contact of K1 is brought into effect.

#### 4. Adjustment and Maintenance

##### (1) Adjustment

For adjustment, refer to the Cable Alarm Function Description Sheet (Drawing).

##### (2) Connections



##### (3) Inspection and Maintenance

##### Video Signal Absence Detector

Apply a required signal to the video input terminal and check that LED1 illuminates.

Appendix 5 OPERATION OF THE CCTV SYSTEM  
AT THE SPENT FUEL POND R0108 FOR FIELD TEST  
D R A F T

---

Revision 1 88-02-25

Appendix 5 OPERATION OF THE CCTV SYSTEM AT THE SPENT FUEL POND  
R0108 FOR FIELD TEST

- D R A F T -

Revision 1 88-02-25

INTRODUCTION

The CCTV surveillance system for the spent fuel pond R0108 is presently undergoing field test. The test began 09-02-88 and will end 09-05-88. Project Officer is Mr. J. Whichello from SGDE in Vienna. Mr. H. Saukkonen of the IAEA Tokyo office is responsible for inspector training during the field test. All failures, problems and anomalies (see item 7.) should be reported to Mr. Saukkonen.

While reviewing the tapes, it is essential to detect any loss of scenes and to pay attention to clear identification of fuel transfers to the mechanical processing cell (MPC). The recording interval is presently set to one scene every 9.5 seconds on each video tape recorder (VTR). When the fuel cart starts to move from the fuel transfer pond (FTP), it can be seen by the cameras for approximately 1.5 minutes.

You will find a log book in the left hand side, lowest drawer of the desk at IAEA TRP office. Your name, surveillance period, all anomalies, system failures, problems (e.g. incorrect time / date) and any other comments considered relevant to the CCTV system will be of considerable assistance to the field test.

SYSTEM DESCRIPTION

The CCTV system consists of the following major components:

- i ) Two cameras installed in a housing which is located on the south bank of the FTP. The housing is fixed to the bank of the pool with the viewing end

submerged beneath the water surface. See FIG.1.

ii ) Two lamps installed in a housing located next to the cameras. See FIG.1.

iii ) Console box containing the recording and surveillance equipment located in the south end of disolver loading cell (DLC) operating areas (the next room west of the FTP - see FIG.2). The following items are contained within the console:

- 2 Video timers (FOR.A VTG-12 time/date generator)
- T.V. monitor
- Surveillance event recorder
- Video Switch
- Anomaly detection box
- 2 Video tape recorders (SONY TSL-30)
- Power supply rack

See FIG.3.

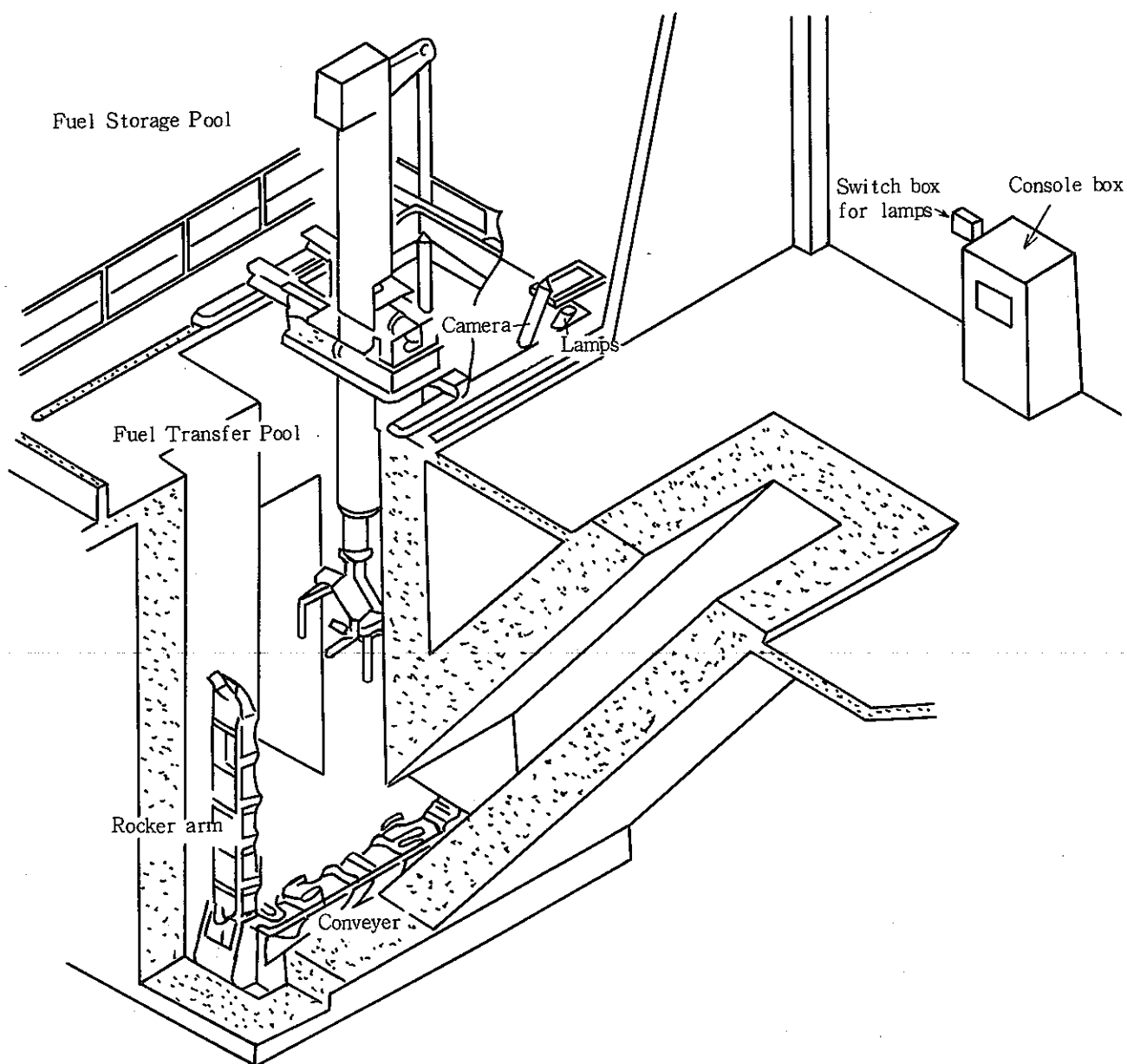


FIG.1 View of the FTP



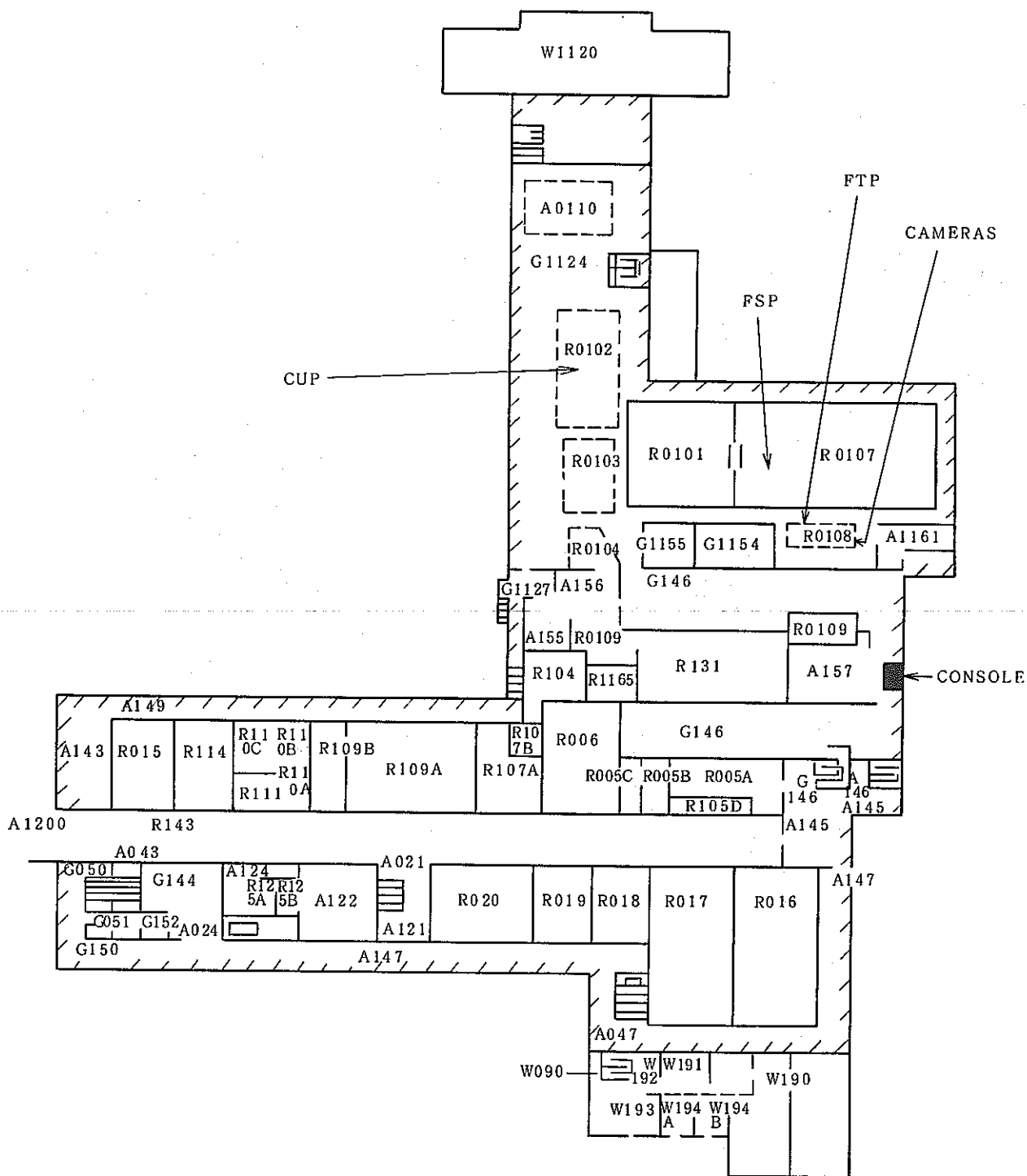


FIG.2 Plan of the Main Plant - 1st Floor

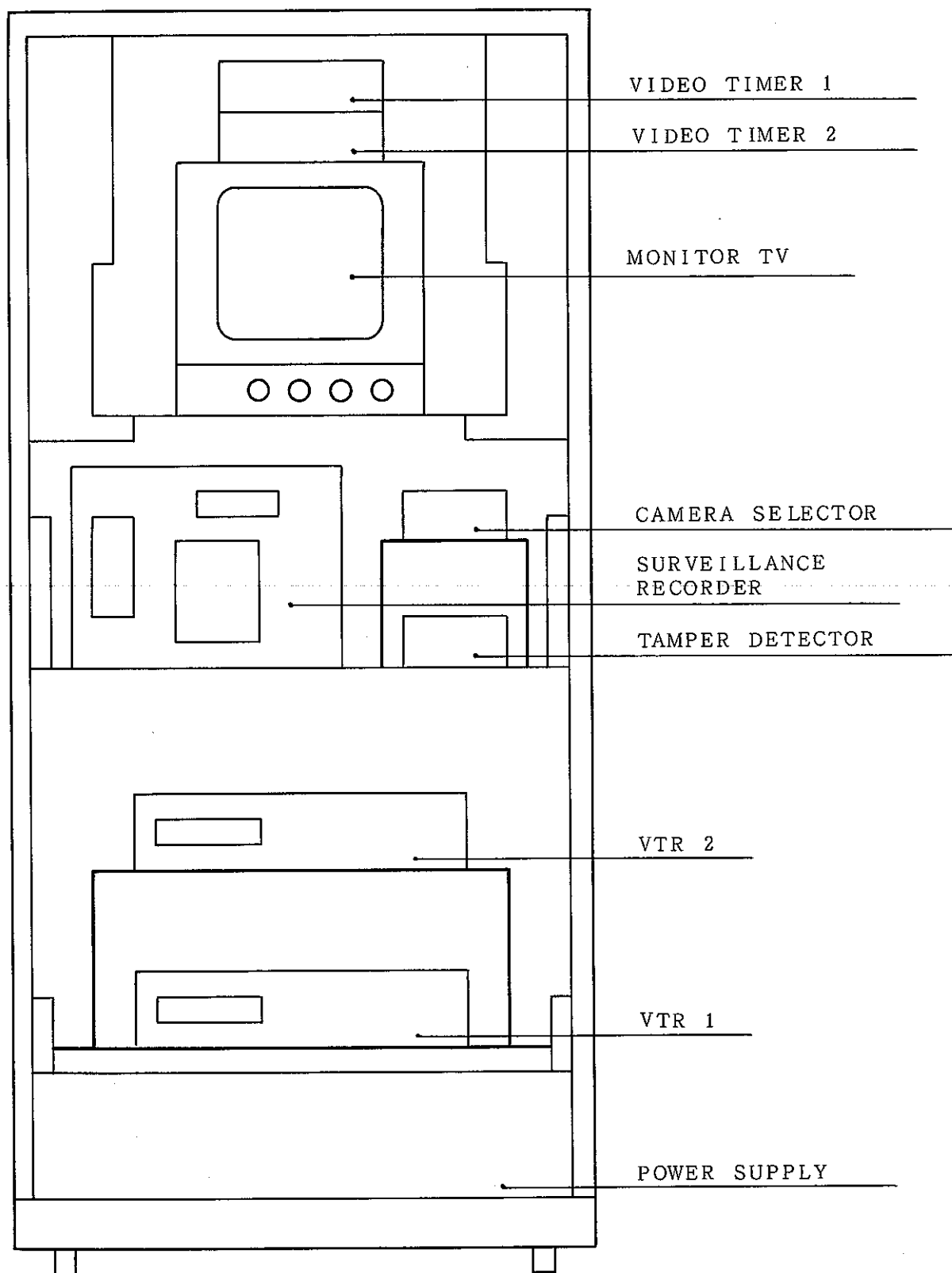


FIG.3 Main Console

## PREPARATIONS

- i) Request from the operator the RIAS output for the FTP and MPC during the surveillance period.
- ii) Collect two, 2 hour BETA cassettes from the left hand side, lowest drawer in the IAEA TRP office. Take them with you to the plant.
- iii) Check that the lights adjacent to the cameras at FTP are ON. In the event of a failure, inform the operator.
- iv) Check if there is a fuel assembly on the conveyer cart in the FTP. Check if there is a basket in the FTP. Record your findings.
- v) Confirm that there is no fuel transfer scheduled during the CCTV console service. Do not perform the service if fuel is due to be transferred from FTP.

## OPERATION PROCEDURE

## OBSERVATION

### 1. CONSOLE CHECK

NOTE: The console door will remain unsealed for the duration of the field test.

- 1) Open the console door.
- 2) Check on both VTRs that "POWER" "REC" "INT.ON" "BII" "1/567" and "STEP" lights are ON.
- 3) Check the elapsed tape time on the VTR read-outs.  
Maximum = 2 hours.

Fig.4

① ② ③ ④ ⑤ ⑥

⑤

Elapsed time:

VTR1.....

VTR2.....

### 2. VIDEO SIGNAL CHECK

- 1) Turn the T.V. monitor ON.  
If the monitor has failed, see 6. T.V. Monitor Change.

Fig.5

①

- 2) Check the quality of the picture on the monitor  
for cameras 1 and 2 using the camera selector  
switch
- 3) Check the time and date on both channels.
- 4) Check that pilot lights on the video timers are ON.

②

⑧

Cam1.....

Cam2.....

If time or date are incorrect, report this to the  
operator.

### 3. SURVEILLANCE RECORDER CHECK

- 1) Push the paper feed button and check the log paper  
recording. Retrieve the recording.
- 2) Check anomaly codes (see 7. Anomaly Code Description).
- 3) Remove the printer cover and check if there  
is enough paper (see 8. Paper Loading Procedure).
- 4) Check the quality of the print. If the printing  
is poor, change the printer ribbon (see 9. Ribbon  
Loading Procedure).
- 5) Replace the cover.
- 6) Test program and printer. Turn power OFF.
- 7) Depress the TEST switch.
- 8) Turn ON the power switch.

Fig.6

②

⑪

①

⑦

The printer will type test data in red and black.  
At the end of the test, an "OK" message should be  
typed. In case any other message typed, report to  
the operator.

- 9) Check the setting of the thumb wheel switch

⑨

(current year). Check the correct time and date on the read-outs.

⑩

Note: first zero is blank for the date and month.

(See 10. Time / Date Setting Instructions)

Time / Date  
on the  
Surv. Rec.

Time:.....  
Date:.....

10) Reset the alarm light on the surveillance recorder.

⑤ ⑥

11) Check that the "TAMPER" sensor switch is ON (light ON).

Fig.5 ⑦

#### 4. CASSETTE TAPE CHANGE

1) Push the STOP switch on VTR1.

Fig.4 ⑥

2) Push the EJECT switch on VTR1.

⑦

3) Remove the cassette and write "VTR1", date and time of removal on the label.

4) Write "VTR1", date and time of insertion on the new cassette label.

5) Insert the new cassette into VTR1.

6) Press REW button to ensure that the tape is fully rewound.

⑩

7) To begin recording, first push the REC button. Keep it depressed and press PLAY button.

②

The red REC light should then come ON.

If the green PLAY light remains ON than press STOP and repeat this sequence.

If the orange PAUSE light comes ON, then push the PAUSE button again.

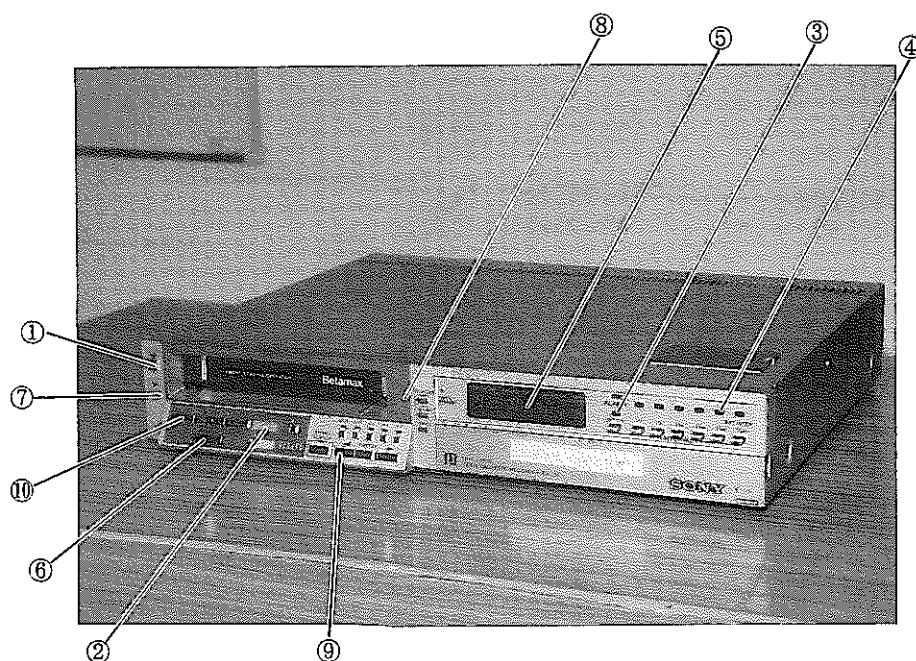


FIG.4 Video Tape Recorder

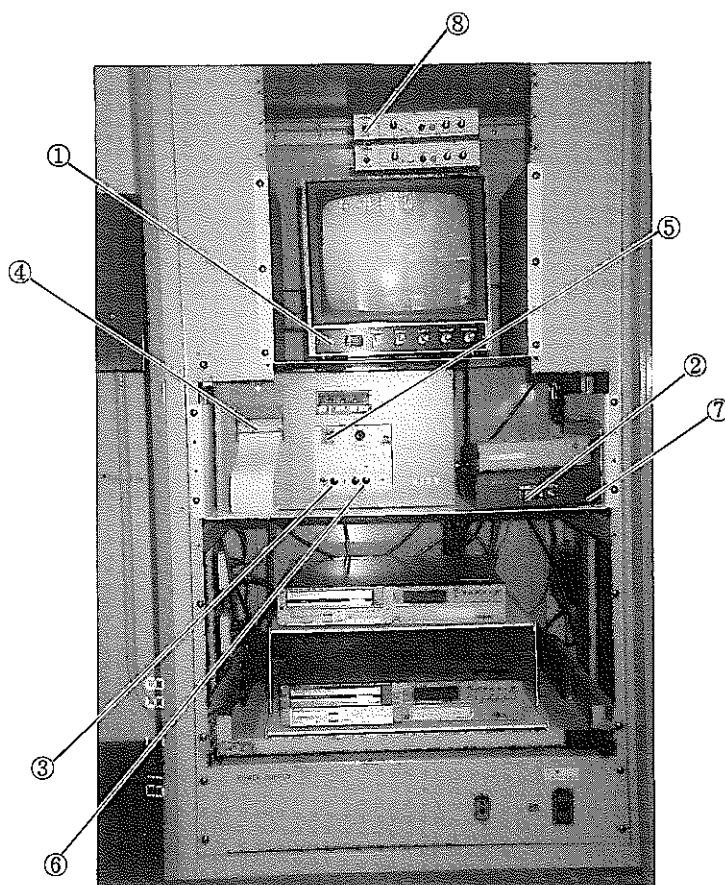


FIG.5 Photograph of the Main Console

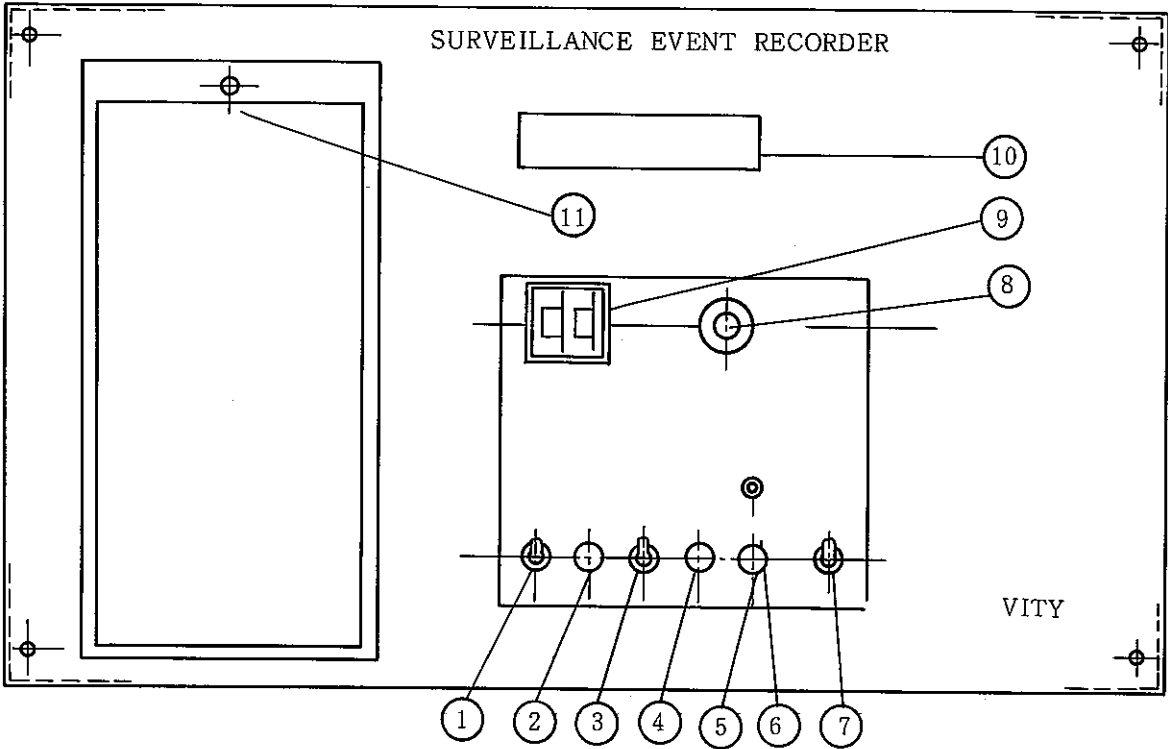


FIG.6 Surveillance Event Recorder

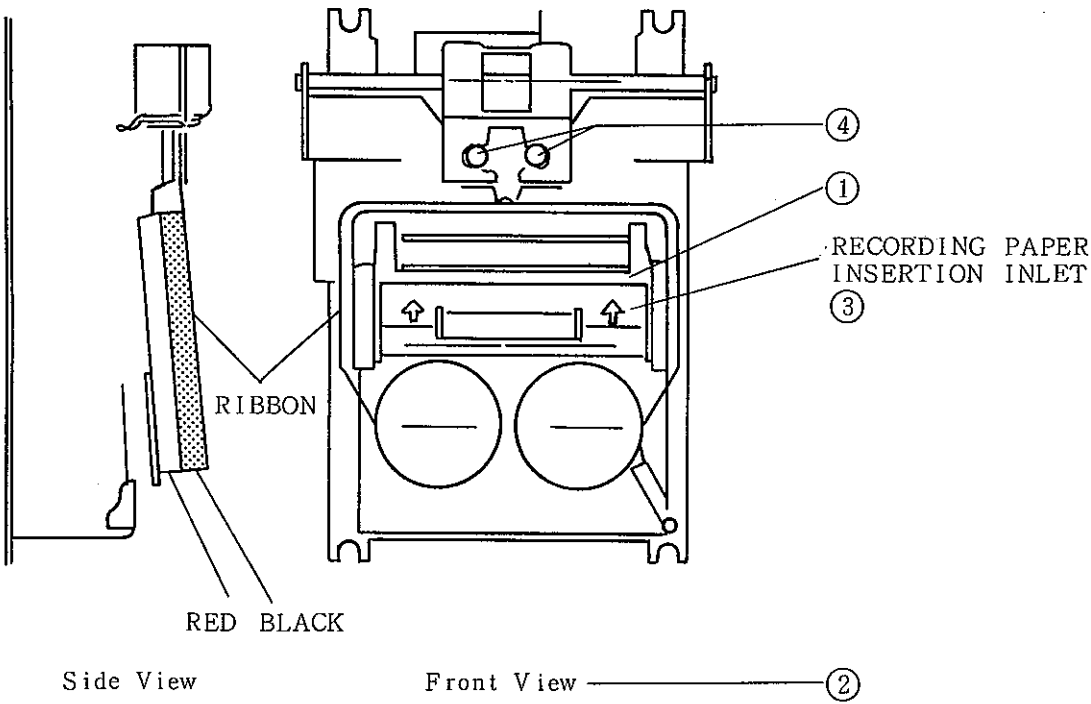


FIG.7 Printer

# Appendix 6 Acceptance test report

## (by IAEA)

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International Atomic Energy Agency

DEPARTMENT OF SAFEGUARDS

ACCEPTANCE TEST REPORT

---

CCTV SYSTEM AT THE TOKAI REPROCESSING PLANT (TRP)

FUEL TRANSFER POND (FTP)

(DEVELOPED UNDER JASPAS TASK JD-8)

Version 0: 1989-05-08

Revision 1: 1989-11-27

acc-test.jd8/891127/jw

This Acceptance Test Report was:

Prepared by: J. Whichello



Section for Instrument Development  
and Field Support

Assisted by: H. Saukkonen

Formerly, Section for Operations OAP

N. Islam

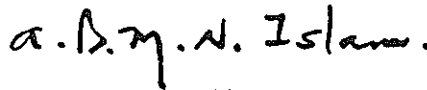
Section for Operations OA2

Reviewed by: H. Saukkonen



Section for Instrument Development  
and Field Support

N. Islam



Section for Operations OA2

Approved by: D.E. Rundquist

Head,



Section for Instrument Development  
and Field Support

K. Naito



Director,

Division of Development  
and Technical Support

File: ACC-TEST.JD8

## SUMMARY

The acceptance test covered by this report was devised for the closed circuit television (CCTV) system developed under the Japan Support Programme for Agency Safeguards (JASPAS) as task JD-8. The system was designed and installed to provide continuous, unattended surveillance of spent fuel assembly transfers on the conveyer path leading from the spent fuel transfer pond (FTP) to the mechanical processing cell (MPC).

Operation and service procedures were formulated and a programme of inspector training was undertaken and successfully completed. The system was assessed by inspection and field test. Particular items were identified which required further attention to enhance the system's tamper resistance and to replace obsolete equipment. Pending agreement to the refurbishment of the present arrangement, the CCTV system was recommended for Category A classification (Authorised for Inspection) based on the successful trial use of the present equipment.

Proposals have been forwarded to the Japanese side regarding the refurbishment programme. The Agency is presently awaiting a response.

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## 1.0 INTRODUCTION

The acceptance test covered by this report was devised for the closed circuit television (CCTV) system developed under the Japan Support Programme for Agency Safeguards (JASPAS) as task JD-8. The system was designed and installed to provide continuous, unattended surveillance of spent fuel assembly transfers on the conveyer path leading from the spent fuel transfer pond (FTP) to the mechanical processing cell (MPC).

The present cameras and video recorders equipment were installed in March, 1986. Some limited tests regarding the system's reliability were subsequently undertaken by Agency personnel [1].

## 2.0 SYSTEM DESCRIPTION

The CCTV system consists of the following major components:

- i ) Two cameras installed in a housing which is located on the south bank of the FTP. The housing is fixed to the bank of the pond with the viewing end submerged beneath the water surface. See Figure 1.
- ii ) Two lamps installed in a housing located next to the cameras. See Figure 1.
- iii ) Console box containing the recording and surveillance equipment located in the south end of dissolver loading cell (DLC) operating areas (thenext room west of the FTP) - see Figure 2. The following items are contained within the console:
  - 2 Video timers (FOR.A VTG-12 time/date generator)
  - T.V. monitor
  - Surveillance (event) recorder
  - Video switch
  - Video tamper detection device (for camera 2 only)
  - 2 time lapse video cassette recorders (SONY TSL-30)

— Power supply unit

See Figure 3.

### 3.0 THE ROLE OF THE SYSTEM AS A SAFEGUARDS DEVICE

#### 3.1 Description of the Processes in the Area of the Surveillance System

The basket containing the fuel scheduled for shearing is transferred by the fuel storage pond (FSP) crane from the storage position onto the shuttle cart between the FSP and the FTP.

The door between the FSP and the FTP is opened and the cart is driven into the FTP.

The basket is lifted by the FTP crane so that the shuttle cart can be driven back into the FSP. The door between the FSP and The FTP is closed.

The basket is lowered onto the unloading position.

The lid of the fuel container of the basket containing the fuel for shearing is removed using manual tools from the FTP crane bridge.

The fuel is transferred by the fuel handling tool of the FTP crane onto the rocker arm.

The rocker arm, controlled by the console located in the FTP crane, grab the fuel and tilts it 90 degrees allowing the fuel to lay horizontally on the fuel supports of the conveyer. The fuel is released and the rocker arm is turned back 90 degrees.

The fuel container of the basket is closed.

The fuel is transferred by the conveyer into the MPC for shearing.

If the basket contains the next assembly for shearing, it remains in the FTP. If not, then it is lifted by the FTP crane so that the shuttle cart can be driven below it.

The door between the FSP and the FTP is opened and the shuttle is driven into the FTP. The basket is loaded onto the cart and then the cart



is driven back into the FSP. The door is closed.

The basket is transferred by the FSP crane into a storage position.

### 3.2 Description of Surveillance Requirements

The CCTV system is designed to provide the IAEA and JNSB with continuous unattended surveillance of the entrance to the slanted spent fuel transfer tunnel leading from the FTP to the MPC.

The recording interval is presently set to one scene every 9.5 seconds on each video cassette recorder (VCR).

The movement of the conveyer from the FTP out of the camera field of view takes approximately 1.5 minutes.

Based on experience, the require recording time interval shall be 10 seconds, or less. For a 2 hour Beta cassette tape, the approximate maximum recording time (surveillance interval) shall be greater than 31 days. The Sony TSL-30 will record up to 1134 hours (47 days) when set to the "1/567" (9.5 sec) recording mode.

The consequences from a surveillance loss by the CCTV system shall be handled, for example, by gaining assurance of transfer activities through checking the operator's in-cell gamma detectors, krypton stack monitor and dissolver recordings.

The video signals from the cameras to the VCR and from the VCR to the review monitor should conform to the EIA RS 170 standard. Scenes displayed on both the console and review monitors shall cover the area of interest, be clear and in focus.

### 3.3 Interrelationship with other Safeguards Measures

There are no other safeguards measures to detect the operation of the conveyer. However, the cask receiving area (CRA), the cask unloading pond

(CUP) and the fuel storage pond (FSP) are under IAEA surveillance. The receipts to the area are verified by NDA (gross defects) and item counting. Receipts in the MPC are verified by item counting, identification and gross-gamma monitoring. Shearing is confirmed by observance of the tail dump.

### 3.4 Interrelationship with the Facility Process Equipment

Both the MPC radiation detector and the identification number telescope are part of the facility operator's process equipment.

The surveillance record is checked against the operator's accounting and operating record.

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## 4.0 RESPONSIBILITIES FOR THE ACCEPTANCE TEST

For the IAEA side, Mr. J. Whichello was the responsible project officer and Mr. H. Saukkonen, formerly from the IAEA Tokyo Office, directed IAEA contact with the facility.

The project officer at the PNC facility was Mr. H. Okamoto.

PNC and IAEA undertook to keep JNSB informed about the progress of the field test.

It was intended to have a final acceptance test report by September, 1988. Assuming a positive outcome of the test, the system was then to be classified as Category B (Limited Use Equipment for Inspections). However, the use of this particular category is the classification of all equipment intended for safeguards use was modified on the recommendation of the Safeguards Department [2]. Thus, the adoption of the CCTV system as a safeguards tool was only possible after a positive outcome of the acceptance test and the subsequent recommendation for its inspection use by the Deputy Director General of Safeguards (DDG-SG).

The inclusion of additional tamper resistance and authentication features were scheduled for March - April, 1989 [3]. Classification of the system as Category A (Authorised for Inspection) would follow the installation of these additional features and final system test.

In a telex from Ms. S. Saito dated 14 March, 1989 [4], the Agency was informed that the Sony TSL-30 VCRs, used in the present system, were an obsolete item. Enquiries were made with a number of VCR manufacturers to identify a suitable replacement.

Based on this new information, Mr. Naito wrote to Mr. Takagi [5] suggesting that the current acceptance test should be concluded on the existing CCTV system. This would allow inspector use of the present system after approval for inspection use by the DDG. It was further proposed that plans for the refurbishment of the present system (new VCRs, equipment enclosure) and the installation of the tamper resistant TV links (TRTLs) should immediately commence so that new equipment could be specified and installed.

The Agency is presently awaiting a reply from the Japanese side regarding the refurbishment proposal under which:

- ( i ) The Agency provides two TRTL systems, a bigger console box, technical assistance for system installation and two time lapse video cassette recorders (to replace the Sony TSL-30 VSRs now installed).
- ( ii ) PNC make modifications that may be required to the present camera housing for application of a seal [\* - see footnote].

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[\*] The Agency has decided to use the miniaturised TRTL transmitters.

Both the miniaturised TRTL and CCD camera are integrated in a single unit and accommodated with the second TRTL and CCD camera in the present camera housing. Therefore, a larger camera housing is no longer required.

- (iii) The Agency, JNSB and PNC complete the necessary documentation for the system.

The acceptance of the present system was recommended based on the successful trial use of the system [6]. Pending the addition of the TRTL and the installation of the new equipment enclosure, Agency responsibility for the system remains with SG-DID.

The acceptance test results given in the following sections relate only to the present system. In a number of areas, the present system failed to meet the Agency's criteria for acceptance. However, additional features have been included in the refurbishment plans.

## 5.0 ACCEPTANCE TEST PLAN

### 5.1 Acceptance Test Preconditions

The following preconditions for the commencement of the acceptance test were discussed with the Japanese side [3]:

1. An agreed schedule for all actions related to the acceptance test.
2. Agreement covering responsibilities of participants (JNSB, PNC and IAEA)
3. That all technical documentation required by the Agency shall be available.
4. Assurance that the equipment is fully operational and that routine maintenance shall be undertaken prior to the test.

All preconditions were met by the Acceptance Test scheduled 9 February, 1988, commencement date.

### 5.2 Criteria of Acceptance

The criteria for acceptance was stated to be the following [7]:

1. No more than ONE total loss of surveillance period during the test period for ALL cases.

2. Adequate tamper detection.
3. Clear identification of fuel transfer to MPC.
4. Acceptance provisions for use including provisions for recovering from inconclusive results. These must be agreed between SGOA, JNSB and PNC. (N.B. SGOA has the responsibility to negotiate this matter for the Agency.)

To adequately test the functions of the CCTV system under operational conditions, the system was examined by IAEA personnel [3] and a three month field test was undertaken. Inspector operation procedures were specifically devised for the field test [8].

## 6.0 ASSESSMENT OF THE SYSTEM

ITEM	CRITERIA	COMMENTS	COMPLIANCE
1. Documentation	All operation and service manuals related to each equipment item in the OCTV surveillance system must be available to the Agency	For details of requirements, see Appendix 1	Partial
2. Containment	All possible diversion paths and strategies associated with the area for which the system was designed must be identified and covered.	System detects movements of the conveyer and clearly shows if it is loaded or empty. It gives no information regarding nature of the load.	Partial
3. Surveillance	The recorded surveillance record must cover the correct viewing area.		Yes
4. Recording capacity	The data recording capacity of the system must be sufficient to cover a 1 month inspection interval with one shot per VCR every 9.5 seconds		Yes
5. "Anomaly" reports	The surveillance recorder must accurately detect and record all openings and closings of the console and camera housing	Problems were encountered with the printer ribbon. Some difficulties in reading printer output. Adequate spare parts must be made available. Seals required on the camera housing	Partial
6. Video cameras	The cameras must give a clear and focussed image of the area of interest	Camera 2 required refocusing Camera 1 satisfactory	Yes
7. Video timers	Video timers must give clear and accurate time and date		Yes
8. TV monitor (console)	Monitor must give a clear, focussed and geometrically undistorted image	Extended use has resulted in phosphor burn on the on the screen	No
9. Camera selector	Must provide easy, reliable operation		Yes
10. Tamper detector	All forms of video tampering must be detected and recorded	Tests indicate that the system is only sensitive to tampering where the video is disconnected for a time which is significantly longer than the time to electronically substitute a false image.	No

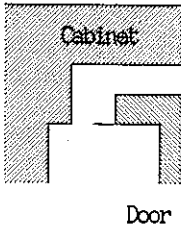
ITEM	REQUIREMENT	COMMENTS	COMPLIANCE
11. Video cassette recorders	Must provide reliable operation, clear and stable pictures for a picture taking frequency of 9.5 seconds.	There is noticeable deterioration in the picture quality due to machine wear.	Partial
12. Review station	A review station must be provided. The review station shall comprise a third Sony TSL-30 video cassette recorder connected to a video via a 75 $\Omega$ coaxial cable.	A review station is provided on Agency request to PNC facility operators.	Yes
	Pictures must be clear and stable	Some adjustments of the tape tracking were necessary. A faulty cable was replaced.	Partial
13. Power supply	The system must derive its electrical power from a guaranteed facility mains circuit	The CCTV system is connected to the facility's emergency mains circuit. In the event of power failure, the power is automatically restored from a second circuit. There will be a momentary loss of power. However, surveillance is automatically restarted when the power is restored.	Partial

## 7.0 ASSESSMENT OF SYSTEM VULNERABILITY

The system must be as difficult to defeat as possible. If the system can be defeated, then consideration must be given to the relative level of difficulty. An assessment of the system's acceptability must then ensue.

## 7.1 Equipment Enclosures

The main console was assessed against the following criteria:

ITEM	REQUIREMENT	COMMENTS	COMPLIANCE
1. Recessed hinges	Console must have recessed hinges		Yes
2. Lipping	Lipping must be included around the door seal to prevent the insertion of devices which effect the CCTV system		Yes
3. Finish	Anodised finish is preferred	Console is painted	No
4. Provision for Agency seal	Tabs welded from the inside frame to the outside of the door		Yes
5. Cabinet construction	Should be rigid with no exposed welds or screws		Yes
6. Cable entry	Cables should enter through a baffle to prevent the insertion of devices which may be used to effect the system	Cables enter via steel conduits	Yes
7. Air vents	Protection plates should be provided to prevent the insertion of devices which may be used to effect the system	No ventilation of the console provided	N/A
8. Floor sealing	Console should be fully sealed by a metal plate		No
9. Thermal indicators	The console should have some mechanism for the detection of abnormal heating	No thermal indicators provided	No
10. Vibration indicators	The console should have some mechanism for the detection of abnormal vibration	No vibration indicators provided	No
11. Door switches	The console should have door switches which are used to record opening closing of the door	One door switch provided and connected to the Surveillance Recorder	Yes

The equipment enclosures shall require additional features to enhance their tamper resistance and to allow adequate sealing arrangements.



## 7.2 Video Authentication

The present CCTV system only detects the loss of synchronising pulses from camera 2. Undetected substitution of video signals from the cameras to the recording console would be possible.

Sealing of the camera enclosure was also regarded as essential by the Agency side [3,6,9]. Proposals have been transmitted to the Japanese side for consideration [11]. The inclusion of the camera housing seals have been incorporated in the refurbishment plans (see Appendix 3).

## 8.0 PROVISION FOR THE REVIEW OF DATA

The system should have a dedicated video tape review station. Under the present arrangement, the inspector must request the loan of a third VCR and video monitor so that tape review can be undertaken.

This arrangement is not totally satisfactory. In the event of a failure of either surveillance VCR, the third recorder will be required as a replacement while the faulty VCR is being repaired.

## 9.0 ASSESSMENT OF EQUIPMENT SAFETY

Before equipment can be placed into inspection use by the Agency, it is necessary that the equipment be given an independent safety review using the appropriate standards for the country where the equipment is located. The Agency does not specify what criteria should be used for the safety review as this can vary between countries. The international standard IEC publication 348, "Safety Requirements for Electronic Measuring Apparatus", is suggested as an appropriate guide. However, it is important that the reviewing parties be independent from the developers and that an appropriate criteria be applied during the review.

## 10.0 SYSTEM RELIABILITY

The system must operate reliably and provide accurate data. The system must be designed so that the occurrence of an accidental conclusive negative or inconclusive is minimal. In the event of a total system failure, the system shall be designed so that there is no loss of recorded surveillance data.

The following are estimates provided by PNC concerning the recommended time between equipment item servicing or replacement:

Surveillance Event Recorder	7	years
Lamps	12000 hours	1.37 years
Video Cassette Recorders	-----	now obsolete -----
Video Cameras		?
Sync. Signal Absence Detector		?
Monitor		?
Camera Selector		?

## 11.0 OWNERSHIP AND COST SHARING

Requests for an agreement regarding the ownership of the CCTV system have been made to the Japanese side [3]. As yet, this point remains unresolved.

Cost sharing arrangements for the operation of the system have also been discussed [3,9]. The Japanese side has agreed to the following arrangements [12]:

Projected expenses per year	Assignment		
	JNSB	IAEA	PNC
1. Consumable Items			
(1) Ink ribbon (500 ¥/piece × 10 pieces) = 5000 ¥	*	*	
(2) Roll paper (600 ¥/roll × 5 rolls) = 3000 ¥	*	*	
(3) Video tape (1430 ¥/tape × 24 tapes) = 34320 ¥	*	*	
TOTAL = 42320 ¥			
2. Routine Maintenance			
(1) VCR routine maintenance (40000 ¥/VCR × 2 VCRs) = 80000 ¥			*

In response to a PNC inquiry regarding cost sharing for major repairs, the Agency proposed the following [11]:

"The expenses for major repair and upgrade (refurbishment) of instruments will be items to be consulted. The cost of such repairs and changes will be borne by the Agency for equipment supplied by the Agency, and by PNC for equipment supplied by PNC."

It should be noted that during the refurbishment process (see Appendix 3), most of the equipment would be supplied by the Agency.

## 12.0 MAINTENANCE

Maintenance of the system is presently the responsibility of the facility operator. In the event of an Inspector encountering an equipment fault, it must be immediately reported to the operator so that the appropriate corrective action can be arranged [10]. It is the responsibility of the OA2

Operations to decide the significance of the fault and its implications with respect to the safeguards approach.

### 13.0 INSPECTOR TRAINING

During the field test, the following IAEA personnel received training on the FTP CCTV surveillance system:

Mr. H. Saukkonen	1988-03-15
Mr. F. Joly	1988-03-15
Mr. J. Whichello	1988-03-23
Mr. P. Slowiak	1988-03-23
Mr. K. Schaerf	1988-04-07
Mr. J. Omar	1988-04-21
Mr. C. Ertek	1988-04-28
Mr. M. Khaniki	1988-05-09

Trainees performed the following activities:

- system check of the console (timers, monitor, surveillance event recorder, tamper sensor and VCRs)
- interpretation of anomaly codes as printed by the surveillance event recorder
- printer check (surveillance event recorder)
- tape change
- tape review of surveillance data since the previous inspection visit

Additionally, the location of the components of the CCTV surveillance system (console box, camera and lamp housing) were shown, the loading of paper into the printer and the change of printer ribbon were explained.

The Inspector's service procedures have since been revised and are included in Appendix 2.

#### 14.0 RECOMMENDATIONS

Whilst the review of the recorded surveillance data successfully detected the movements of the conveyer, the reviewed data did not provide conclusive information on what was conveyed. However, the CCTV system is a clear improvement compared with the earlier Minolta camera surveillance system, which was only able to detect the FTP crane movement.

The tamper resistance of the video signals was discussed during the February, 1988, joint JNSB, PNC and IAEA meeting held at TRP [3]. One of the recommendations for the completion of the acceptance test was the incorporation of a system of surveillance data authentication. To satisfy this requirement, it was decided to install a tamper resistant TV link (TRTL) between the cameras located at the FTP and the equipment console.

The tamper resistance of the console box was also discussed during the February, 1988, meeting. It was decided that additional features were required to enhance the equipment console tamper resistance and to allow for adequate sealing arrangements. Ms. Saito informed the IAEA [4] that it would be difficult to accommodate the TRTL and additional power units in the present equipment console. For these reasons, it was proposed that the existing equipment console should be replaced by a cabinet which completely meets the Agency's requirements for tamper resistance and which also allows sufficient space for the TRTL installation.

The new cabinet would be an approved type developed by the Agency for C/S applications. The Division for Development and Technical Support (SGDE) shall undertake the shipment of the cabinet to Tokai, Japan, and its installation in TRP.

The obsolescence of the Sony TSL-30 video cassette recorder, the depletion of available spare parts, the requirement to upgrade the present console, the inclusion of tamper resistant TV links and the requirement to provide a

sealing arrangement for the camera enclosure necessitate the refurbishment of the present system [9].

A proposed workplan for the refurbishment is included in Appendix 3.

For refurbishment to go ahead, an immediate response is necessary from the Japanese side stating that they accept the refurbishment scheme.

## 15.0 REFERENCES

- [1] IOM: P. Vodrazka to A. Ramalho dated 1986-02-26
- [2] IOM: J. Jennekens to DIRS-SG, COOS-SG & SHS-SG dated 1988-02-05
- [3] NTF: Review of Jaspas Task JD-8 dated 1988-02-09
- [4] TELEX: S. Saito to J. Whichello dated 1989-03-14
- [5] Letter: K. Naito to K. Takagi dated 1989-04-19
- [6] IOM: J. Jennekens to V. Schuricht dated 1989-06-13
- [7] Letter: D. Rundquist to Mr. Suyama dated 1987-07-24
- [8] Operation of the CCTV System  
at the Fuel Pond R0108 - Draft - Revision 1 dated 1988-02-25
- [9] NTF: CCTV System at the Tokai Reprocessing  
Plant (TRP) Fuel Transfer Pond (FTP)  
Version 1 dated 1989-07-19
- [10] Operation of the CCTV System at the Spent  
Fuel Pond R0108 - Draft dated 1989-01-11
- [11] Letter: T. Shea to T. Someya dated 1989-11-22
- [12] letter: K. Kaieda to T. Shea dated 1989-05-24

## Appendix 1 Documentation List

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The following is a list of FTP surveillance system technical documents now held by the Agency:

1. Sony AVC-D1 CCD Video Camera Operating Instructions
2. Sony AVC-D1 CCD Video Camera Service Manual
3. Sony CMA-D1/CMA-D1CE Camera Adaptor Operating Instructions
4. Instruction Manual: Surveillance Event Recorder
5. Instruction Manual: Synchronizing Signal Absence Detector
6. Sony TSL-30 Video Cassette Recorder Operating Instructions
7. Sony TSL-30 Video Cassette Recorder Service Manual
8. Model TMC-12M Monitor Service Manual
9. Surveillance System using the CCTV at the Pond R0108 - February 1988.

PNC Document

10. Drawing: Detail of Cable Path between the FTP and the CCTV Console
11. Drawing: Detail of the Spot Light
12. Drawing: Detail of the Camera and Spot Light Housing
13. Drawing: Detail of the Main Console Outer Dimensions
14. FOR.A VTG-12 Timer (Time/Date Generator) Operating Instructions

The following is a list of FTP surveillance system technical documents which have been requested by the Agency:

1. Circuits and details of the camera adapter
2. FOR.A VTG-12 Timer (Time/Date Generator) Service Manual
3. VITY Surveillance Event Recorder Service Manual



Appendix 2 CCTV Service Procedure

(Please see following pages)

---

Inspector Name      MBA      INSP. YEAR      REPORT NO.      DATE OF SERVICE

--	--	--	--	--

CCTV SERVICE PROCEDURE

AT THE POND

1. Two lamps adjacent to the cameras at FTP are ON.

YES	NO
-----	----

2. Camera enclosure and seal appear undamaged.

YES	NO
-----	----

AT THE CONSOLE

3. Console and its seal appear undamaged.

YES	NO
-----	----

4. Remove seal and note number.

--

5. Check the following:

Video Timer 1      green lamp ON

YES	NO
-----	----

Video Timer 2      green lamp ON

YES	NO
-----	----

Surveillance Recorder      red lamp ON

YES	NO
-----	----

display ON

YES	NO
-----	----

Tamper Detector      green lamp ON

YES	NO
-----	----

VTR 2      blue display ON

YES	NO
-----	----

VTR 1      blue display ON

YES	NO
-----	----

Power Supply      red lamp ON

YES	NO
-----	----

6. On both VTRs "POWER" "REC" "STEP" "INT.ON" "β II" and "1/567" lights are ON.

YES	NO
-----	----

SURVEILLANCE RECORDER

7. Push the paper feed button, remove printed record from printer and attach to this form.

--

8. Remove the printer cover and estimate if there is enough paper for at least 20 cms of printing.

YES	NO
-----	----

9. Is the quality of the print good?

YES	NO
-----	----

10. To test program and printer, turn power OFF. Keeping the TEST switch depressed, turn ON the POWER switch and then release the TEST switch. The printer will type test data in red and black. At the end of the test, an "OK" message should be typed. Remove the test data and attach it to this form.

--

YY MM DD HR MIN

11. Record the displayed time and date

--	--	--	--	--

12. Reset the alarm light on the surveillance recorder.

--

13. Check that the "TAMPER" sensor switch (Green light) is ON.

YES	NO
-----	----

VIDEO

14. Turn the T.V. monitor ON.

15. Using the camera selector, check if the quality of the picture on the monitor for cameras 1 and 2 acceptable?

YES	NO
-----	----

YYMMDDHRMIN

16. Using the monitor, check and record the Timer time and date of both cameras.

(1)  
(2)


HRMIN

17. Record the elapsed tape time on the VTR read-outs. Maximum = 2 hours

VTR1  
VTR2


CASSETTE CHANGE

18. Push the STOP switch on VTR1.

19. Push the EJECT switch on VTR1.

20. Remove the cassette and write "VTR1", date and time of removal on the label.

21. Write "VTR1", date and time of insertion on the new cassette label.

22. Insert the new cassette in VTR1. Press REW button to ensure that the tape is fully rewound. With the REC button depressed, press PLAY button. The red REC light should then come ON.  
(If the green PLAY light remains ON then press STOP and repeat this sequence. If the orange PAUSE light comes ON, then push the PAUSE button again).

YES	NO
-----	----

23. Check that only the following lights are ON:  
POWER, REC, STEP, INT.ON, 1/567,  $\beta$  II

YES	NO
-----	----

24. Repeat 18 to 23 for VTR2.

--

25. Using the monitor check that the signal from both cameras includes the correct time and date.

YES	NO
-----	----

CONSOLE CLOSURE
-----------------

26. Switch the T.V. monitor OFF, close the console door and lock it. Attach a seal. Seal number is:

--

REVIEW PROCEDURE
------------------

27. Connect the monitor to the review VTR. Turn on the monitor and VTR. Insert the cassette to be reviewed. Rewind the tape to the start. Press PLAY button. Review the tape. Confirm spent fuel transfers to MPC against operator's declaration and inspection data

--

COMMENTS

NOTES

1. Service and review are to be carried out at monthly intervals during shutdown and on biweekly basis during campaign.
2. For any requirements like the need to replace paper ribbon, VTR, etc. or correction needed to date and time, follow detailed instructions provided by SGDDI.

NIslam/JWhichello/11 (2168)

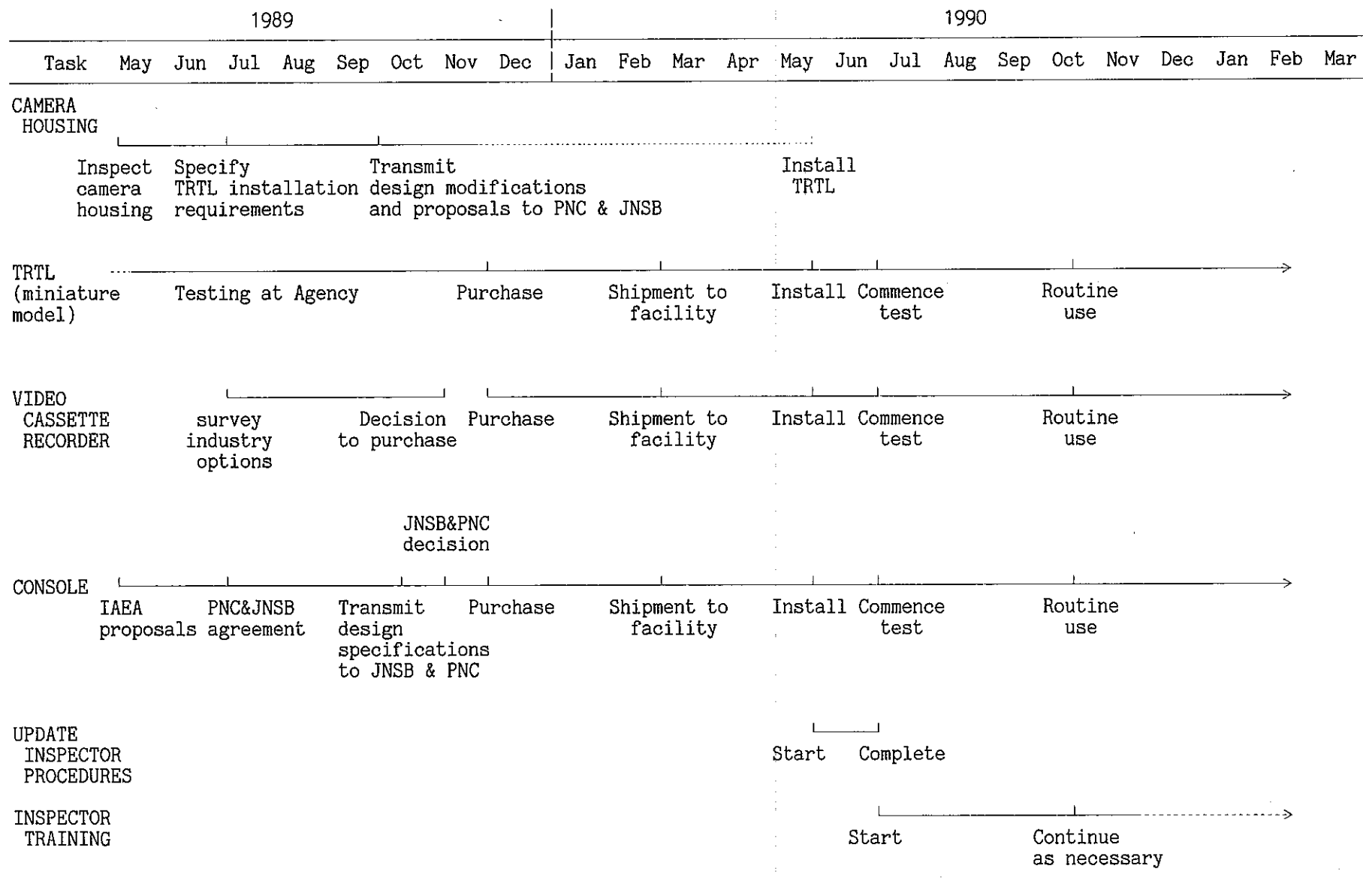
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Appendix 3 Proposed Refurbishment Workplan

(Original submitted to the JNSB and PNC on 89-05-22)

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## Proposed Refurbishment Workplan





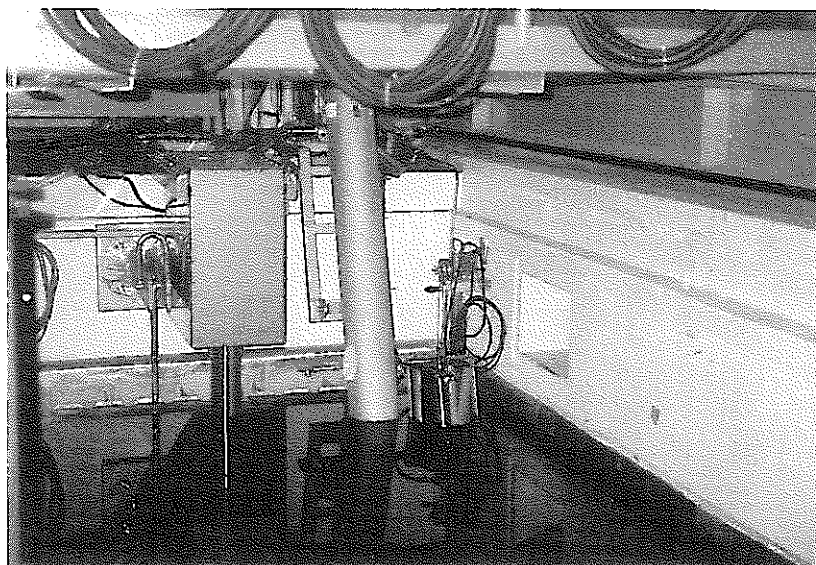
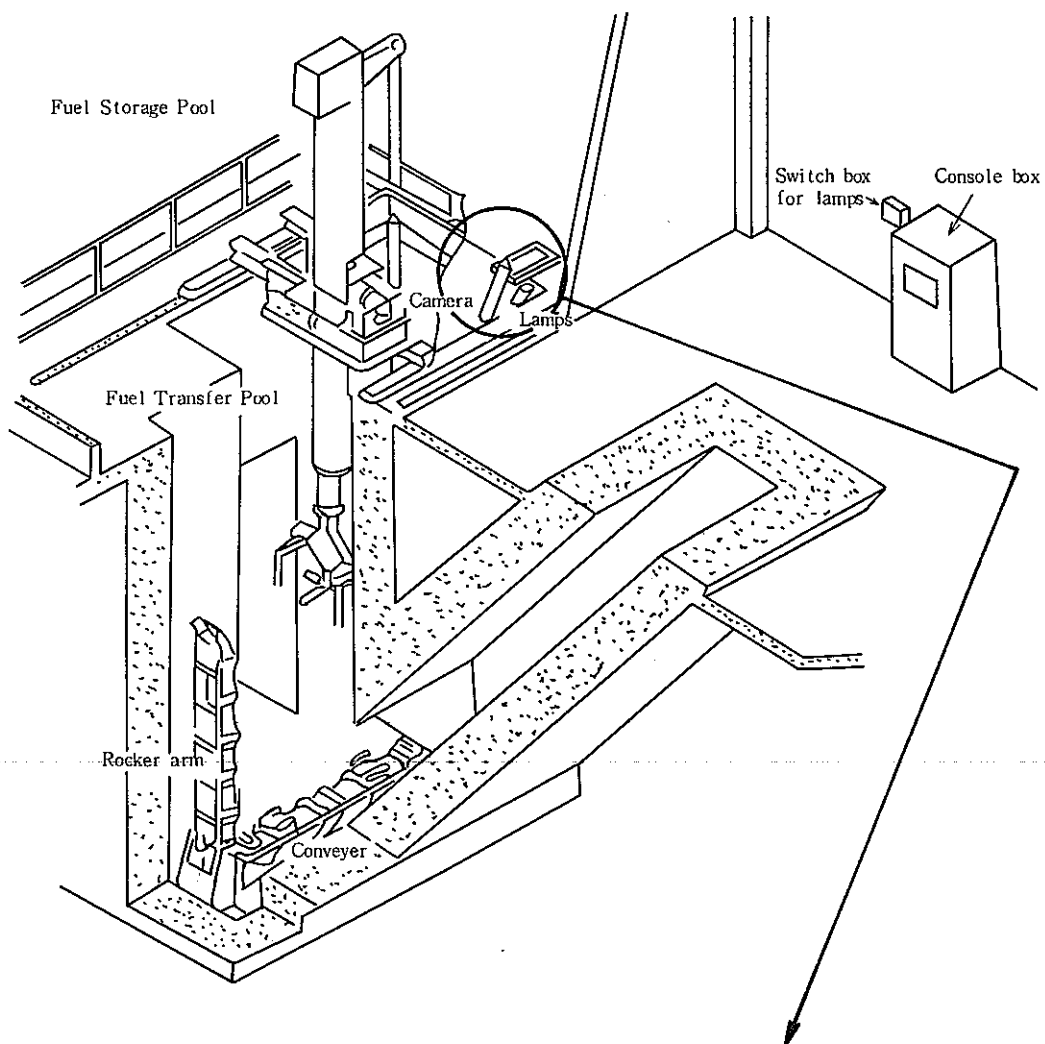


Figure 1 Schematic of the Fuel Transfer Pond



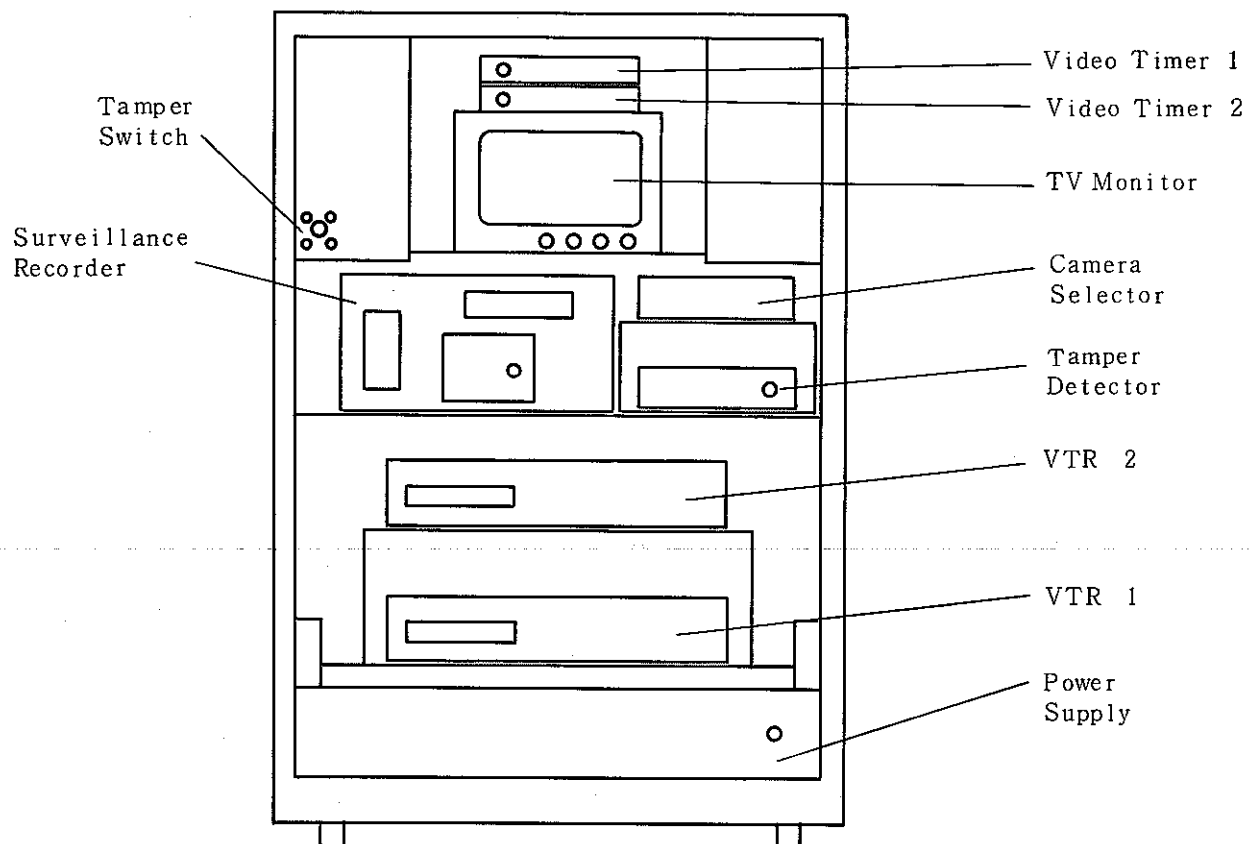


Figure 3 Schematic of the Main Console