

**MAKKONEN ASSOCIATES**

**TWO RAVINIA DRIVE, SUITE 1470  
ATLANTA, GEORGIA 30346  
PHONE (404) 396-0309  
FAX (404) 396-2449**

May 1, 1991

Georgia Department of Natural Resources  
Radioactive Materials Program  
205 Butler St., S.E.  
Atlanta, GA 30334

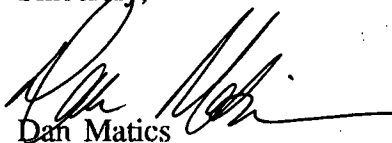
Gentlemen:

Our application for registration and for license to Rule 290-5-23-02 (11) (d) to persons generally licensed under Rule 290-5-23-.02 (6) (c) is enclosed.

We are requesting that the device be approved for testing at three year intervals for proper operation of the on-off mechanism and for leakage of radioactive material. The bases for extended intervals between testing of the on-off mechanism and the sealed source are included.

As instructed by Bill Slocumb, our check for \$5,700.00 (fee categories C.5.a and J.1) is attached. If you have any questions or require any additional information, please call Eli Port at 708-965-1999. *Chicago, IL.*

Sincerely,

  
Dan Matics

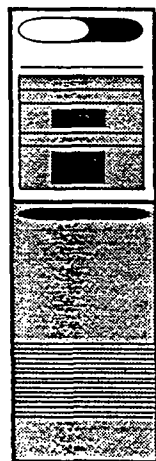
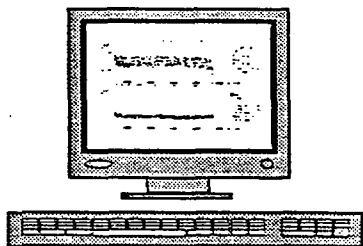
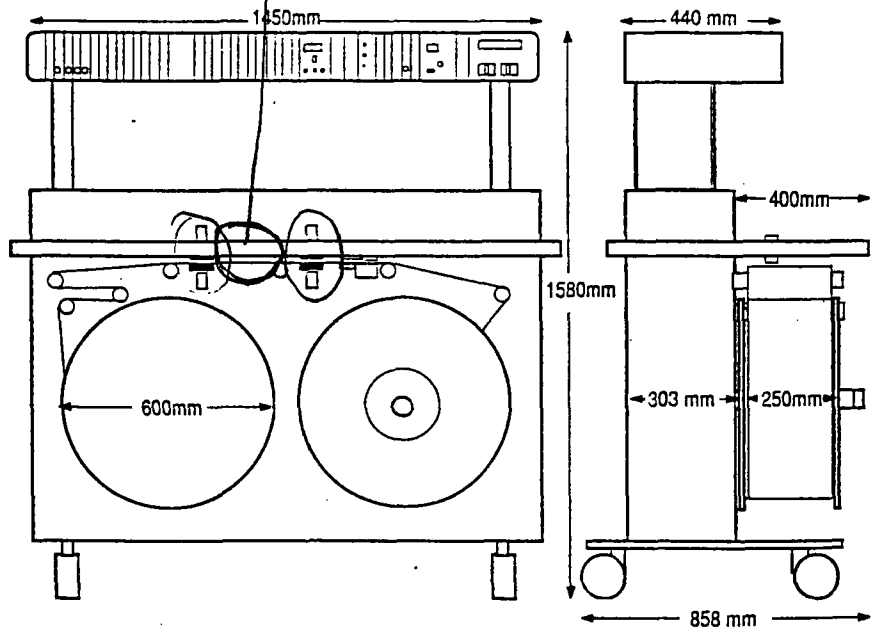
Attachment

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actuated when power is available. A series of illustrations showing details of construction and a typical installation follow.

DRAWINGS

*Device Installed HERE*



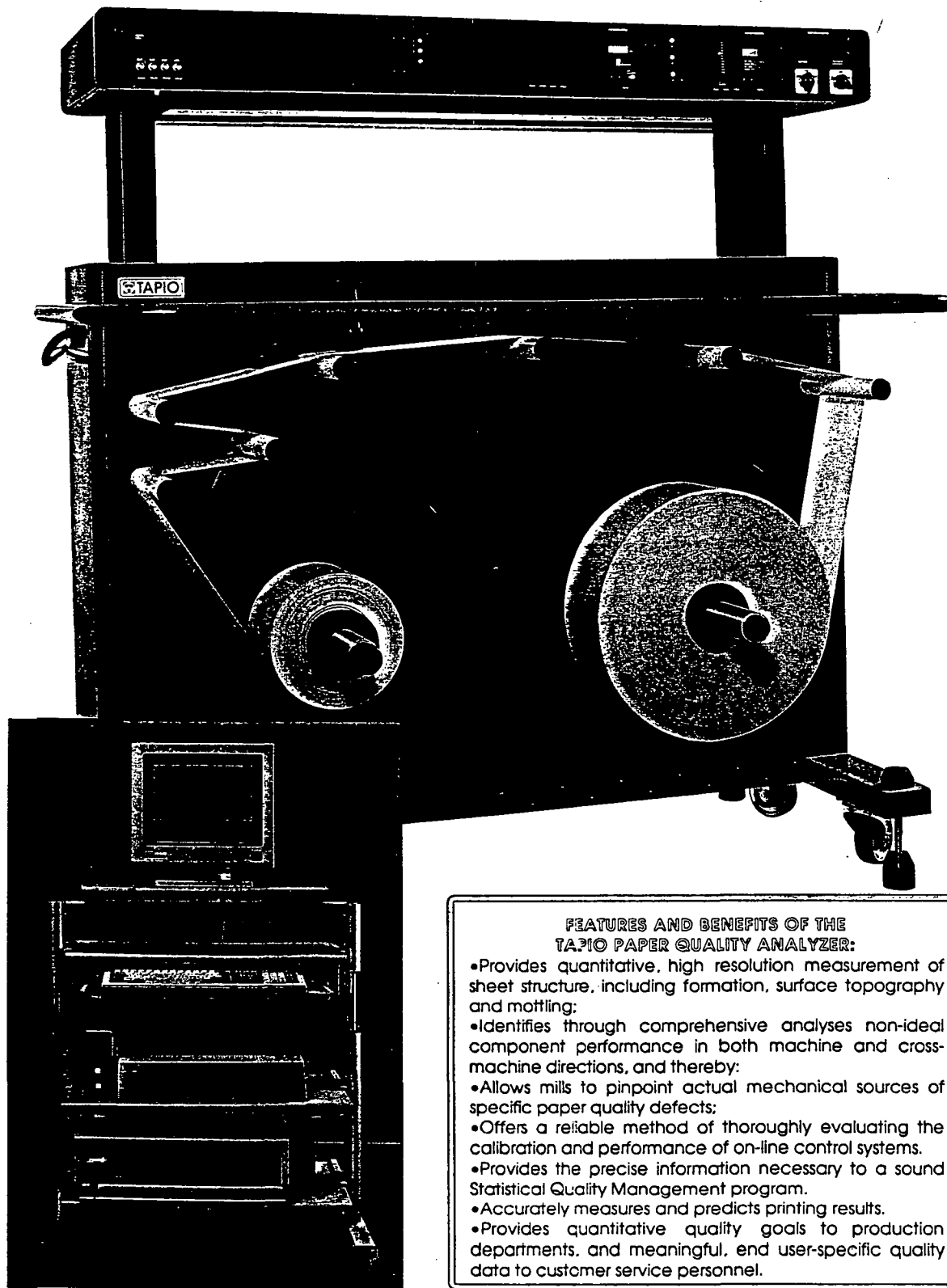
**Computer HW:**

- Compaq Systempro 386, 4 MB
- Hard disc: 120...600 MB
- Printer
- TAPIO SW**



# T A P I O

## PAPER VARIABILITY ANALYZER



### FEATURES AND BENEFITS OF THE TAPIO PAPER QUALITY ANALYZER:

- Provides quantitative, high resolution measurement of sheet structure, including formation, surface topography and mottling;
- Identifies through comprehensive analyses non-ideal component performance in both machine and cross-machine directions, and thereby:
- Allows mills to pinpoint actual mechanical sources of specific paper quality defects;
- Offers a reliable method of thoroughly evaluating the calibration and performance of on-line control systems.
- Provides the precise information necessary to a sound Statistical Quality Management program.
- Accurately measures and predicts printing results.
- Provides quantitative quality goals to production departments, and meaningful, end user-specific quality data to customer service personnel.

THE ULTIMATE QUALITY ANALYZER FOR PAPER, BOARD AND TISSUE

## C. HEALTH AND SAFETY DATA

### 1. Safety Analysis Summary

The BW-2h54 tapio basis weight sensors will typically operate in a normal indoor laboratory environment. Typical temperatures will be about 20 C. The sealed source has been tested for thermal shock between -40 C and 80 C and is constructed of corrosion resistant material. The source is housed in a rugged instrument enclosure intended to protect the source and the associated electronic components from damage under the most severe predicted operating conditions. The short path beam produces no significant radiation outside the instrument. The beam path is completely intercepted by the detector.

### 2. Manufacturing and Distribution Controls

a) The source quality control standards are described in the application for the registration of the source, Registration No. NR-136-S-219-S.

b) See the sections B.2., Labeling and C.2.c., Manufacturer's Instructions to users for the manufacturer's recommendations regarding maintenance, servicing and testing.

c) A copy of the instructions for the safe usage of the BW-2h54 is attached. Each device shall be accompanied by the leak test certificate and source strength information provided by the source manufacturer.

3. Manufacturer's safety analysis of device review.

a) The sealed source contained in the BW-2h54 is designed for applications far more severe than the conditions under which the tapio basis weight sensors will be used. In the intended use of basis weight sensors, they are subject to little vibration in a laboratory and the source is normally not contacted by the material being tested. The source-detector enclosure is rugged, primarily to protect the electronic components and is sufficiently strong to withstand any inadvertent or accidental contact with test material. The location of the basis weight analyzer in laboratories makes contact with other equipment unlikely.

The sources are designed to withstand conditions of fire and explosion, and loss of the source from the device is unlikely.

b) The sealed source, ANSI classification 77C33222, is designed and approved for operating conditions far more severe than the BW-2h54 applications. The BW-2h54 has been approved by the Finnish Center for Radiation and Nuclear Safety in applications identical with the proposed applications for one year without any evidence of failure. The source, its holder, the basis weight sensor and the complete paper variability analyzer are designed to withstand normal conditions of handling, use, and storage and the probable effects of accidents including breaking of test material, fire, and explosion without release of radioactive material.

The source housing at the basis weight sensor components effectively attenuate all significant radiation from the Promethium 147 beta and by bremsstrahlung. Exposure rates around the basis weight sensor are less than 0.1 mr/hour at 10 centimeters from the nearest accessible surface. In the inaccessible direct beam, the calculated exposure rate is approximately 25 R/hr near the source. 9

The BW-2h54 are designed to be safely operated by persons not having trained in radiological protection. Human access to the direct beam is not possible. Under these conditions of use and normal conditions of handling and storage, the radioactive material is contained in the device and cannot be removed without the use of tools by a knowledgeable individual.

Under normal conditions of use, it is unlikely that any person will receive in any period of one calendar year an external radiation dose to the whole body, head and trunk, active blood-forming organs, gonads, or lenses of eye in excess of 0.5 rem or to the hands and forearms, feet and ankles, localized areas of skin averaged over areas no larger than 1 square cm of 7.5 rems or to other organs in excess of 3 rems. These doses are, in fact, physically impossible.

In accident conditions, including direct handling of the source following complete destruction of the device, it is unlikely that any individual would receive an external radiation dose to the whole body, head and trunk, active blood-forming organs, gonads,

or lenses of eye in excess of 15 rems, to the hands and forearms, feet and ankles, localized areas of skin averaged over no larger than 1 square cm of 200 rems and to other organs in excess of 50 rems. With the exception of the dose to localized areas of skin, these doses are virtually impossible and a 200 rem dose to a localized area of skin can result only from prolonged direct handling of the source.

The source manufacturer reports that since the sources were introduced in about 1984, there has been no reported leakage or other failure. The Tapio basis weight sensor was approved by the Finnish government one year ago and has been in use since then without any radiation safety related failures.



The following information is supplied in support of a request that the Tapio BW-2h54 be required to be tested for proper operation of the on-off mechanism, and for leakage of radioactive material at 3 year intervals.

1. Radioactive material is contained in an Amersham X.8095 source capsule.
2. The source is protected by the brass and stainless steel source holder shown in the accompanying application for the registration of a device.
3. The primary containment is sealed by a titanium window.
4. The primary containment is a brass, steel, and titanium capsule.
5. The radioactive material is incorporated in a ceramic.
6. The maximum temperature during prototype tests is 80 C.
7. The maximum pressure withstood during prototype tests is 2 MPa.
8. The maximum quantity of contained radioactive material is 200 mCi.
9. Promethium 147 is moderately radiotoxic. However, when incorporated in a ceramic it is resistant to most chemical agents, resulting in much lower radiotoxicity for the

material incorporated in the ceramic.

10. The source manufacturer, Amersham, reports no failures of any type for these sources since the first was registered in 1984. Tapio basis weight sensors have never experienced failures related to shutters or other radiation safety features.

The Tapio basis weight sensor source is normally not accessible to users. These factors combine to make unlikely any significant exposure even should a shutter failure occur. The enclosure would minimize the spread of contamination even if the radioactive material in the source was not contained in a fused ceramic enamel.

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Ref# 6839

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RADIOACTIVE MATERIALS PROGRAM

APPLICATION FOR THE  
REGISTRATION OF A DEVICE

TAPIO BASIS WEIGHT SENSOR

MAKKONEN ASSOCIATES, INC.

A. SUMMARY DATA

1. Date: February 6, 1991
2. Device Type: Beta Gauge
3. Model: BW-2h54
4. Distributor: Makkonen Associates, Inc.  
Two Ravinia Drive, Suite 1470  
Atlanta, GA 30346  
(404) 396-0309
5. Manufacturer: Tapio Technologies, Inc.  
Teknikantie 17D  
SF-02150 Espoo  
Finland
6. Sealed Source Model Designation: PH C.C1 (Capsule X.8095)
  - a. Amersham Corp.  
2536 South Clearbrook Drive  
Arlington Heights, IL 60005
  - b. Amersham Buchler  
Gieselweg 1  
D-3300 Braunschweig  
Federal Republic of Germany, or
  - c. Amersham International PLC  
UK Sales Office  
Lincoln Place, Green End  
Aylesbury, Buckinghamshire  
England
7. Isotope and Maximum Activity: Pm-147, 200 mCi nominal
8. Leak Test Interval: 3 years
9. Principal Use: Generally licensed Beta Gauges
10. Custom Device: No

## B. DESCRIPTIVE DATA

### 1. Summary Description

The Tapio basis weight sensor is manufactured by Tapio Technologies, Inc., and distributed in the United States by Makkonen Associates, Inc., as part of a paper variability analyzer system to users who measure and analyze paper and film products.

The basic weight sensor uses a 200 mCi promethium 147 sealed source. Use of a scintillation detector enables rapid, efficient inspection of paper and film moving between the source and detector without contact. The ANSI classification for the sources is 77C33222.

### 2. Labeling

Each basis weight sensor will bear a label containing the symbol described in Rule 290-5-23-.03(3)(c) Illustration A, the words "Caution-Radioactive Materials," and the following information:

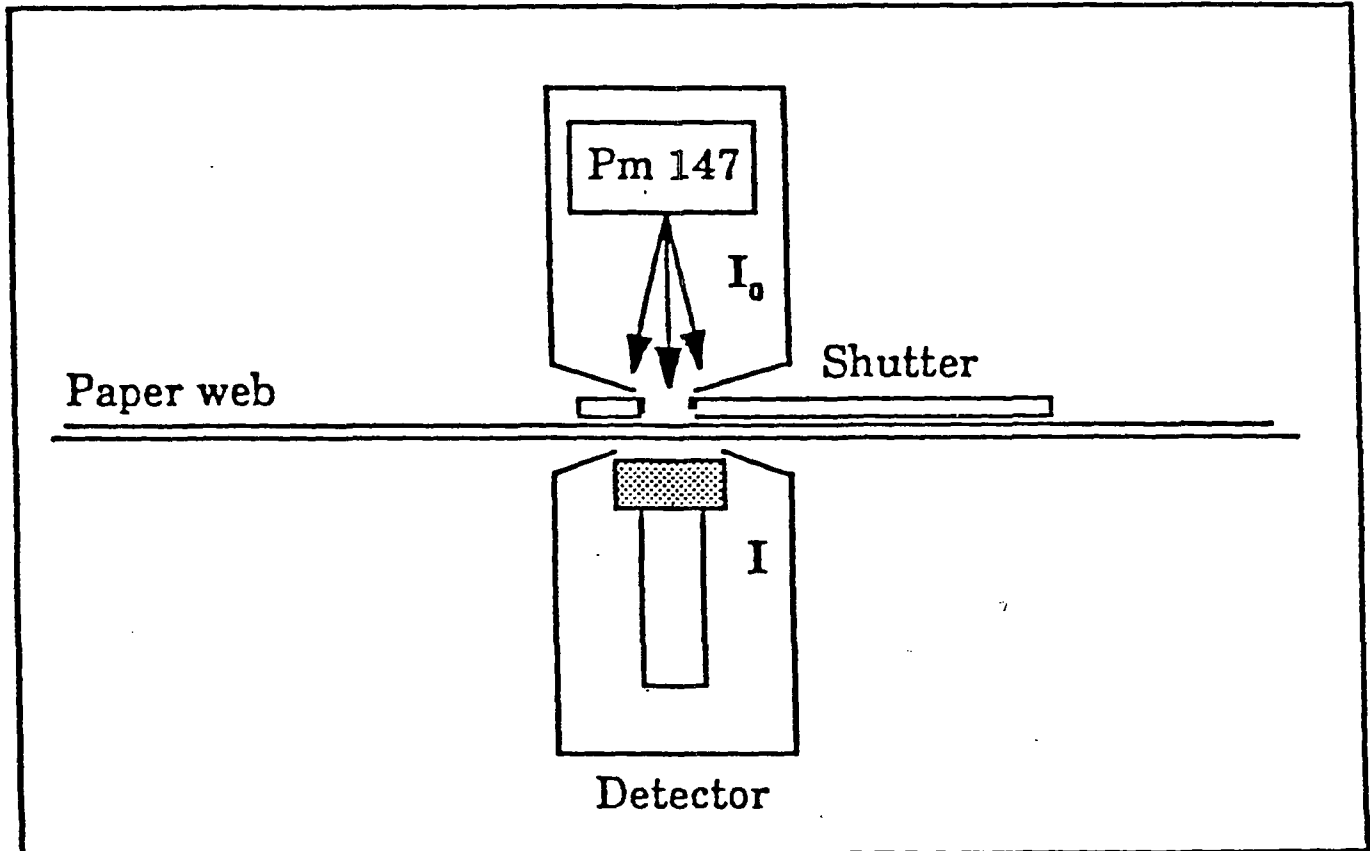
"The receipt, possession, use, and transfer of the Model BW-2h54 basis weight sensor, Serial No. XXXX, containing 200 mCi on MM/DD/YY, are subject to a general license or the equivalent and the regulations of the USNRC or a state with which the USNRC has entered into an agreement for the exercise of regulatory authority.

This label shall be maintained on the device in a legible condition. Removal of this label is prohibited.

Source changes and repair of this device shall be performed only by the manufacturer or another person specifically authorized by the USNRC or an agreement state.

The device shall be tested for proper operation of the on-off shutter mechanism and the integrity of the sealed source at intervals not to exceed three years."

3. Diagram



#### 4. Conditions of Normal Use

The anticipated uses of the Model BW-2h54 will be in controlled laboratory environments. The most likely condition of use is at room temperature, 20 C. The typical users will be laboratory technicians and quality control professionals. The basis weight sensor analyzes paper and film products and is not operated directly by production line workers. It is extremely unlikely that under circumstances of normal use, the source in the BW-2h54 will be incorporated as a component in other products.

The radiation source is enclosed in a rugged source housing. Although severe accidents, such as fire may damage the housing and source, it is very unlikely that the radioactive content, in the form of a fused ceramic covered with a titanium foil, could be dispersed even under severe accident conditions. The most likely failure under severe conditions would involve the shutter mechanism. Such a failure could leave the source in the "on" condition. Due to the inaccessible short beam path, it is unlikely that any significant inadvertent exposure to the direct beam will occur. The useful life of the source is in excess of three years.

#### 5. Supporting Detail

The source is housed in a rugged metal housing. The beam is intercepted when the lead shutter is in the "off" position. The normally closed shutter is opened by a solenoid that can only be