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September 27, 2004

United States Nuclear Regulatory Commission
Materials Safety Branch
Division of Industrial Safety and Material Nuclear Safety
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852
Attention: Mr. Xiasong Yin

Reference: Your letter and Fax of September 7, 2004

Dear Mr. Yin:

In reference to your letter:

1. Model Number

The Model XC-Series-50 Coal Analyzer is loaded with up to 50 micrograms (ugm) of Cf-252. The belt width can be from 48 inches to 72 inches and the distance from the top of the empty conveyor belt to the lower edge of the analyzer structure above the belt can be up to 36 inches. This opening allows coal with nominal top size of 12 to 24 inches to flow through the analyzer without damaging the structure. The side shields are 7 inches thick. The inside dimension between the side shields is typically 10 to 20 inches wider than the belt width.

The Model XC-Series-25 Coal Analyzer is loaded with up to 25 ugm of Cf-252. The belt width can be from 30 inches to 72 inches and the distance from the top of the empty conveyor belt to the lower edge of the analyzer structure above the belt can be up to 24 inches. This opening allows coal with nominal top size of up to 12 inches to flow through the analyzer without damaging the structure. The side shields are 5 inches thick. The inside dimension between the side shields is typically 10 to 20 inches wider than the belt width.

The distance from the top of the empty conveyor belt to the lower edge of the analyzer structure above the belt is made as small as is compatible with the material being transported on the conveyor belt because the analysis performance improves as that distance is made smaller. The analyzer is normally turned on and performing analyses 24 hours a day, and the conveyor belt may be running or stopped and may be fully loaded, partially loaded, or empty. Neutron sources can be moved to a store position to allow maintenance on the conveyor system in the vicinity of the analyzer. Conveyor idler rollers are typically spaced every 4 or 5 feet along the length of the belt Typical maintenance consists of greasing idler bearings, replacing idler rollers, or repairing the conveyor belt. The analyzer source and detector are always centered between idler rollers to maximize the distance of the nearest idler from the detector in order to minimize their effect on the analysis. This ensures that the idlers will be easily accessible for maintenance.

The potential accident conditions include earthquake, typhoon, fire that could spread along a conveyor belt, a large object on the belt causing a jam at the analyzer, or a piece of large equipment, such as a crane, or tractor, colliding with the conveyor belt, crushing the analyzer. These conditions are considered as unlikely, however, under these worst case conditions, the sources would retain their integrity, due to their ANSI classification.

Below is a simplified chart, which indicates the differences between the model numbers in the series of the SABIA, Inc. Materials Analyzers.

SABIA Inc. Coal Analyzers		
Model	XC-Series-25	XC-Series-50
Maximum Source Activity (ugm)	25	50
Thickness of Side Shielding (inches)	5	7
Clearance above Conveyor Belt (inches)	Up to 24	Up to 36
Conveyor Belt Width (inches)	30 to 72	48 to 72
Distance between Side Shielding (inches)	40 to 92	58 to 92

2. Construction

2.1 In reference to NUREG 1556, Vol. 3, Section 10.3, the SABIA drawing 600167 "Source Sled" is a detail drawing of the Source Holder as described in the NUREG. If the Frontier Model 100 series source is used, the part shown in drawing 600167-4 provides the support and mounting of the sources into the overall source holder. This provides for a maximum of 3 sources in each source holder. If the Frontier Model 100S series source is used, 600167-3 shows the support and mounting for the sources into the overall source holder. This provides for a maximum of 5 sources in each source holder.

In reference to Figure A, provided with the SABIA letter of July 20, 2004. The source holder (Source Sled) is shown inside of the path assembly.

Figure A also shows the location of the 1-inch diameter shaft and drive wheel and stainless steel cable which provides the manual drive mechanism.

The primary shield is associated with the Model S-3 source housing. Figures B and C show the auxiliary shielding located within the 2 inch steel frame surrounding the conveyor belt. These two figures also show the location of the source housing and shielding in relative position to the conveyor belts.

The neutron beam is best represented as a cloud of neutrons, exiting downward from the source housing in the direction of the conveyor belt and material, when the source handle is in the "ON" position, which places the source sled within the bottom shield block and 8 inch cube moderator block. The beam geometry in this instance is the useful cross section of these neutrons, which represent a solid angle of approximately 90 degrees, with the neutron flux at the location of the side shields sufficiently low to be properly attenuated by the shielding material contained within.

Figure B shows the detector location in relative position to the conveyor belt and return conveyor belt.

Attached are additional annotated photographs which indicate the location of the two hasps and locks on the source housing.

Figure B shows the location of the detector in relation to the conveyor belt. Figure C shows the side view, which indicated the detector access cover in the side shield. This access cover is attached with 4 screws, and is designed to allow access to the detector for initial installation, or for repair or replacement by authorized personnel.

Figure C and Figure D show the swing frame(s). There are four, located two on each side of the shielding. These are bolted in the closed position, and allow access to the conveyor components for maintenance, when the sources are stored in the OFF position.

Drawing 600308 is not applicable to this application and was submitted in error.

Proprietary drawings are attached separately providing additional design details.

2.2 The device shutter is associated with the Model S-3 Source Housing, as shown in Figure A attached to the SABIA letter of July 20. 2004.

The source holder (Source Sled) is shown in the "OFF" position. This positions the sources centered within a 4 inch block of lead (which surrounds the path assembly). The 1-inch diameter shaft is supported by brackets attached to the side of the source housing. An arm is attached to the end of the shaft, which acts as a manual actuator for the source movement, and also provides the visual indication of source position (ON, OFF). A wheel attached to the shaft holds a stainless steel cable attached to the source holder (source sled). This stainless steel cable provides the mechanical movement for the source holder from ON to OFF positions. This is shown in Figure A. Mechanical stops on the source position indicator provides the mechanical limit for the ON and OFF positions. A hole through the arm aligns with a hole in the source position indicator when the sources are in the OFF position, allowing a lock to be inserted to prevent movement of the sources.

2.3 When the source is in the "ON" position, the beam from the Model S-3 neutron source housing is from the bottom of the source housing, in the direction of the conveyor belt and material under analysis. The neutron beam is best represented as a cloud of neutrons, exiting downward from the bottom of the source housing in the direction of the conveyor belt and material, when the source handle is in the "ON" position, which places the source sled within the bottom shield block and 8 inch cube moderator block. The beam geometry in this instance is the useful cross section of these neutrons, which represent a solid angle of approximately 90 degrees, with the neutron flux at the location of the side shields sufficiently low to be properly attenuated by the shielding material contained within.

2.4 Drawing 600167 shows the source holder. The title of the drawing is "Source Sled". This is the source holder, as defined in NUREG-1556, Vol. 3. The Source Sled is attached to the two ends of the stainless steel cable and placed into the end of the path assembly. The stainless steel cable is attached to the wheel as shown in Figure A. Mechanical stops are inserted into the top and bottom of the path assembly, and the final position adjustments for the precise location of the "Source Sled" are made for the indicator handle. When sources are installed or wiped, that is done as outlined in the attached procedure which outlines the steps necessary to access the source holder assembly for periodic source wipe testing, for source replacement, and for adjustment of the source position within the source housing.

2.5 Identical source holder assemblies are used in all SABIA XC-Series materials analyzers. These source holders are identical for the XC-Series-25 and for the XC-Series-50 models.

2.6 The hydrogenous material is high density polyethylene (HDPE) or equivalent plastic. HDPE has 14.28% hydrogen by weight. The remaining percentage is 85.71% carbon by weight. A thickness of 7 inches provides a factor of 10 reduction in the intensity of fast neutron flux. Reference: Cf-252 Shielding Guide, Figure 8, page 36, D. H. Stoddard, March 1971.

The physical properties of this high density polyethylene (HDPE) are as follows:

Density 0.944 g/cc
Flexural Modulus 180,000 psi
Tensile Strength @ Yield 4,300 psi

Tensile Impact Strength 92 ft-lbs.in²
Elongation @ Break >700 %
Heat Deflection Temperature @ 66psi 76 °C
Softening Point 128 °C
Melting Point 137 to 143 °C
Low Temperature Brittleness <-80 °C

2.7 The undermount configuration which is used on materials analyzers for non-hydrogenous materials will be a separate device registration, due to the differences in the source housing. This device registration will be submitted separately at a later date. SABIA is not prepared to have these devices included as part of this device registration, due to the differences in design.

3. Sources

a. There are a maximum of three source holders used with the model S-3 source housing. This includes up to three path assemblies, up to three wheels on the 1 inch diameter shaft, and up to three Source Sleds and stainless steel cables. If at least one of the Frontier Technology Model 100 series sources is used in each source holder, then there can be up to 9 sources in the materials analyzer (Up to 3 sources in each source holder). If only the Frontier Technology Model 100S series sources are used, there can be up to five sources in each source holder, for a maximum number of 15 sources. SABIA had requested that the maximum of 12 sources to be installed into an individual materials analyzer. This should be changed to be a maximum of 15 individual sources.

b. If at least one of the Frontier Technology Model 100 series sources is used in each source holder, then there can be up to 9 sources in the materials analyzer (Up to 3 sources in each source holder). If only the Frontier Technology Model 100S series sources are used, there can be up to five sources in each source holder, for a maximum number of 15 sources. SABIA had requested a maximum of up to 12 sources be installed into an individual materials analyzer. This should be changed to a maximum of 15 individual sources.

c. The sources have an outside diameter of 0.375 inches. The holders (spacers), 600167-3 and 600167-4, have a hole diameter of 0.40 inches. The sources are slipped into these holes. This holder, which acts as a spacer within the source sled, is then inserted into the Source Sled, which is fastened closed, securing the sources. The Source Sled is then held in proper position by the stainless steel cable. The stainless steel cable is marine grade and is coated with nylon to minimize fraying and corrosion in salt spray. It attaches to both ends of the source holder (sled); therefore, if the wire were separated from the sled in one direction, it could be removed by pulling the cable in the other direction. If the cable were separated from the sled on both sides, the sled could be easily pushed out through its track with a flexible rod. Though the probability of the cable failing is small and of its failing two times simultaneously is extremely small, even that unlikely event would not be a problem.

4. Prototype Testing

Material data sheets are attached providing the physical properties for the high density polyethylene used as the shielding in the steel frames of the SABIA materials analyzer. These data sheets indicate the maximum and minimum operating temperature conditions, the softening point, and the coefficient of thermal expansion for the material. The engineering analysis for these materials has provided sufficient design detail to ensure that operation of this materials analyzer at or near the maximum specified temperatures will not cause any degradation in the properties of the shielding material, and will not cause any adverse mechanical problems with the steel frame. The only concern is the differential thermal expansion of the two different materials, HDPE versus the steel frame. A comparison of the coefficient of thermal expansion for the HDPE was compared to the thermal coefficient of expansion for the steel frame. The difference in this thermal expansion will not cause mechanical interference of the two different materials over the full range of operating conditions.

For the first three installations of prototype analyzers, the first was installed in Colorado in October 2002. The second prototype analyzer was installed in Colorado in March 2003. The third prototype analyzer was installed in Utah in November 2003. The first materials analyzer was originally installed with lower activity of Cf-252 sources, with a source housing which did not have an ON-OFF position, and without the additional side shielding provided by the swing frames. While the external radiation levels were sufficiently low, the performance provided by this prototype did not meet the analysis precision that was desired, mainly due to increased uncertainty at low statistical count-rates to the detector. That analyzer was modified to have additional side shielding, the swing frames, and a new source housing with ON-OFF positions for the sources for allowing maintenance on the conveyor without source removal. The second analyzer in Colorado was originally installed with additional side shielding and swing frames but without source retraction for maintenance. A new source housing with ON-OFF positions for the sources was also provided as an upgrade for the second analyzer in Colorado. These analyzers were then brought to the configuration as stated in the device registration. The installation of the third prototype analyzer in November, 2003, had the source housing which is described in this device registration with the ON-OFF positions, has the source activity as described in the radiation survey provided, and has the additional side shielding provided by the swing frames. An additional four inches of shielding was added to the top of each of the three source housings. With the installation of this additional shielding, this device is as proposed in the device registration. The above stated tasks were performed by SABIA, Inc. field service personnel along with source leak testing and periodic inspections of the shielding and source housings and are the only maintenance that has been required to be performed to date on these installations. There have been no reported failures of the source cable or other components related to the source housing.

The source positioning plate, shown in Figure C, is a powder-coated steel plate marked with the source ON-OFF information in permanent white paint. On the maintenance intervals corresponding to source leak testing, SABIA, Inc. field personnel inspect all markings, and ensure that all indications are clearly legible. Touch-up of this marking is performed, if necessary, as a part of these semi-annual maintenance inspections.

Presently there are three SABIA, Inc. employees who have primary responsibility for the installation of Cf-252 sources, source leak testing, and maintenance and servicing of these materials analyzers. There is also additional work performed by these individuals during the same time frame, relating to maintenance, installation, removal, relocation, and servicing of other fixed gauges. The average radiation dose to these individuals has been less than 100 mRem per quarter.

5. Radiation Profiles

5.1 The models in the field are the same as the models that will be manufactured in production. All models in the field and all models that will be manufactured in production will have this additional 4 inches of polyethylene shielding. A thickness of 4 inches provides greater than a factor of 3 reduction in the intensity of fast neutron flux. Reference: Cf-252 Shielding Guide, Fig. 8, page 36, D. H. Stoddard, March 1971.

5.2 The model XC-Series-50 analyzer was surveyed for external radiation on June 12, 2004, using the figure and radiation survey information provided with the SABIA letter of July 20, 2004. The external radiation levels were measured using an air ionization meter for gamma radiation and a neutron REM meter "Snoopy" for neutron radiation. The radiation fields were measured with the meters centered at both 30-cm distance and at 1-meter distance from the external surface of the locations provided. All radiation levels were measured with no material on the conveyor belt (maximum radiation level) and were measured with both the source in the "ON" and "OFF" positions. The meters used were: GAMMA-

Victoreen Model 450P, S/N 857, Calibrated January 30, 2004 Calibration Due July 30, 2004.
NEUTRON- Rem Rad Model NP-2 S/N-NP971304, Calibrated January 30, 2004 Calibration Due July 30, 2004.

The model XC-Series-25 analyzer was surveyed for external radiation on March 2, 2004, using the figure and radiation survey information provided with the SABIA letter of July 20, 2004. The external radiation levels were measured using an air ionization meter for gamma radiation and a neutron REM meter "Snoopy" for neutron radiation. The radiation fields were measured with the meters centered at both 30-cm distance and at 1-meter distance from the external surface of the locations provided. All radiation levels were measured with no material on the conveyor belt (maximum radiation level) and were measured with both the source in the "ON" and "OFF" positions. The meters used were: GAMMA-Victoreen Model 450P, S/N 857, Calibrated January 30, 2004 Calibration Due July 30, 2004.
NEUTRON- Rem Rad Model NP-2 S/N-NP971304, Calibrated January 30, 2004 Calibration Due July 30, 2004.

The calculations for the increase in source strength are based on a simple multiplication of the source activity used in the prototype to the maximum source activity for the materials analyzer. The calculations for the additional shielding are only pertinent to the measurement at the location on the top of the source housing. These calculations are based on a 10% reduction in the gamma radiation levels and a factor of 3 reduction in neutron radiation levels. These calculations are conservative, and are based on figure 8 on page 36 in the Cf-252 shielding guide, D. H. Stoddard, March 1971.

5.3 The radiation survey for the 35.27-ugm source (XC-series-50 materials analyzer) used 1 source which was located at a center position within the Model S-3 source housing. The radiation survey for the 19.34 ugm source (XC-series-25 materials analyzer) used a total of 4 individual sources which were located (2 each) at the left and right positions within the Model S-3 source housing. The different geometry within the source housing from the source to the exterior of the source housing provides the difference in external radiation levels.

The worst-case external radiation would be for an installation with a narrow belt installation, which requires the use of at least two source locations (48 inches for the XC-Series-50). The possibility of the XC-Series-25 with a narrow belt of 30 inches would require one source location centered on the source housing. The external radiation levels would be reduced because of the more compact geometry, which limits the effects of external radiation past the side shields due to the increased angle from the source to the edge of the side shielding.
The external radiation levels for the worst case installation has been analyzed, and these external radiation levels are not greater than the maximum levels indicated on the device registration, and meet the ANSI classification of ANSI-24-142-142-R1.

5.4 Calculated radiation levels were not provided for these locations, since these locations are not accessibly by the maintenance personnel when the sources are in the "ON" position. When the sources are moved to the "OFF" position, the doors on the side shielding (Swing Frame) can be placed in the open position for maintenance on the conveyor components.

5.5 At certain locations near the sides of the analyzer, there is an additional shielding effect from portions of the side shielding. At a distance of 1 meter, the effect of this shielding is eliminated, allowing radiation from other directions. All measurements indicated on the radiation survey form indicate actual radiation measurements at these locations.

7. Installation, Safety Instructions

Facilities with conveyor belts have safety provisions for protecting personnel from getting too close to moving belts and have trip wires that can stop the belt if a person, by whatever means, gets onto a moving belt. Safety considerations require conveyor belts to be stopped before performing any maintenance on the conveyor system. Hinged shield panels on the SABIA materials analyzer allows authorized personnel to do maintenance on a conveyor belt at the analyzer location. The SABIA operation and maintenance manual provides instructions for storing the neutron sources and opening those panels for maintenance.

A copy of the safety instructions and the appropriate sections from the users manual are attached to this document for your review.

Thank you for your prompt attention to this matter. If there are any further questions, please contact me.

Sincerely,

James F. Miller

James F. Miller, R.S.O.

High Density Polyethylene

TECHNICAL INFORMATION FORM • *Physical Properties*

Property	Method	SI Unit	SI Value	English Unit	English Value
Density	ASTM D-792	kg/m^3	944	lbs/ft^3	58.9
Yield Point	ASTM D-638	MPa	22.4	psi	3250
Elongation at Yield	ASTM D-638	%	12	%	12
Tensile Break	ASTM D-638	MPa	38.6	psi	5600
Elongated at Break	ASTM D-638	%	330	%	330
Tensile Modulus	ASTM D-638	MPa	1075	psi	155900
Flexural Modulus	ASTM D-790	MPa	744	psi	107900
Izod Impact	ASTM D-256A	J/m	No Break	ft-lbs/in	No Break
Sand Wheel Wear	ASTM G-65	T-1000=100	95	T-1000=100	95
Hardness	ASTM D-2240	Shore D	69	Shore D	69
Static Friction	ASTM D-1894	Unitless	0.17	Unitless	0.17
Dynamic Friction	ASTM D-1894	Unitless	0.14	Unitless	0.14
Coefficient of Thermal Exp.	ASTM D-696	$°C^{-1}$	0.00018	$°F^{-1}$	0.00011
Melt Point	ASTM D-3417	°C	137-143	°F	278-289
Compressive Modulus	ASTM D-695	MPa	480.2	psi	69650
Compression Deformation	ASTM D-621	% at 454.5 kg	6-8	% at 1000 psi	6-8
Volume Resistivity	ASTM D-257	Ohm-cm	$>10^{15}$	Ohm-cm	$>10^{15}$
Surface Resistivity	ASTM D-257	Ohm	$>10^{15}$	Ohm	$>10^{15}$
Water Absorption	ASTM D-570	%	nil	%	nil

2. Construction

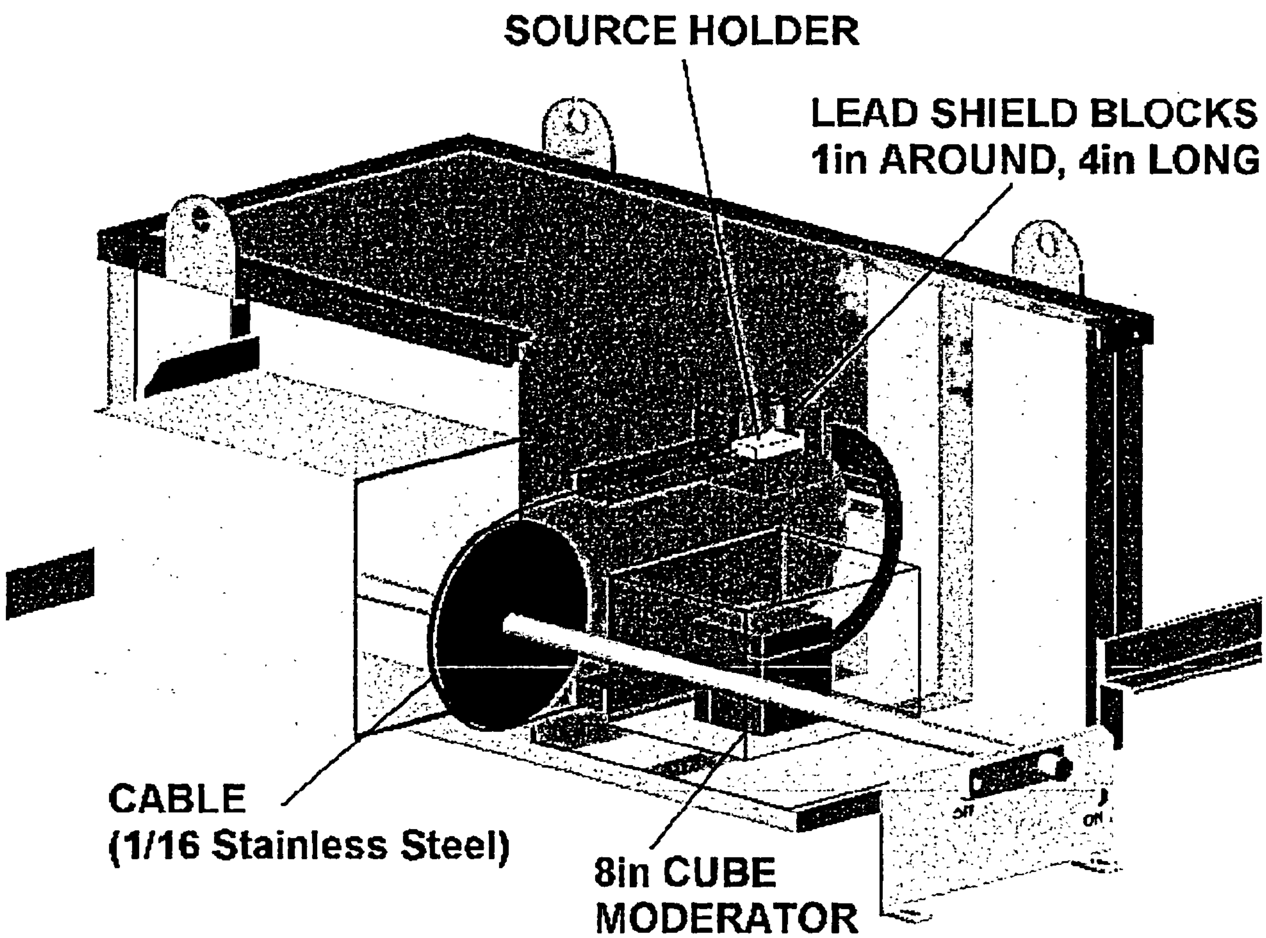

Figure A
Model S-3 Source Housing

Cutaway view showing internal details

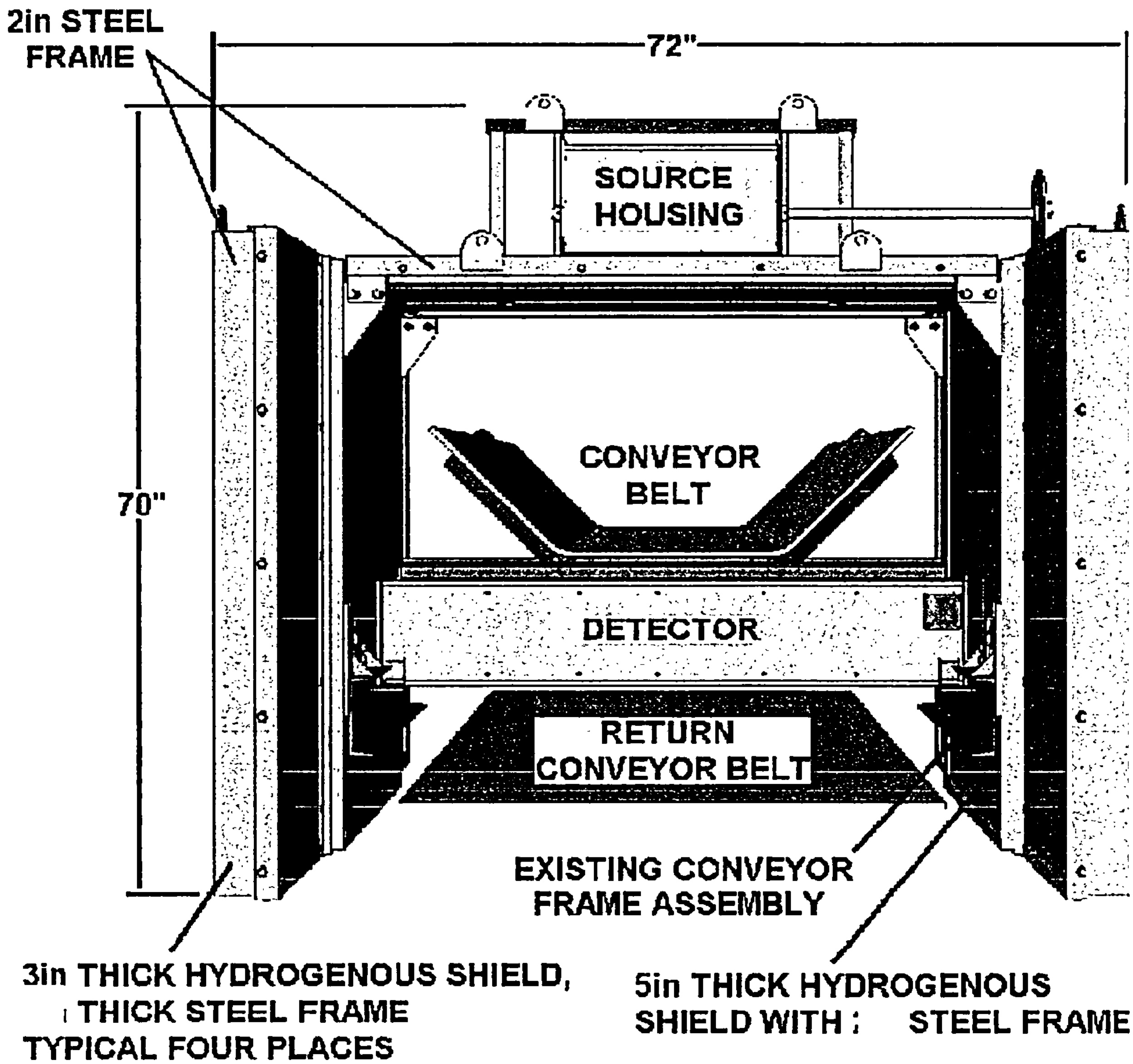

Figure B
Model XC– Series -25 Materials Analyzer

Typical Mounting details surrounding existing conveyor belt

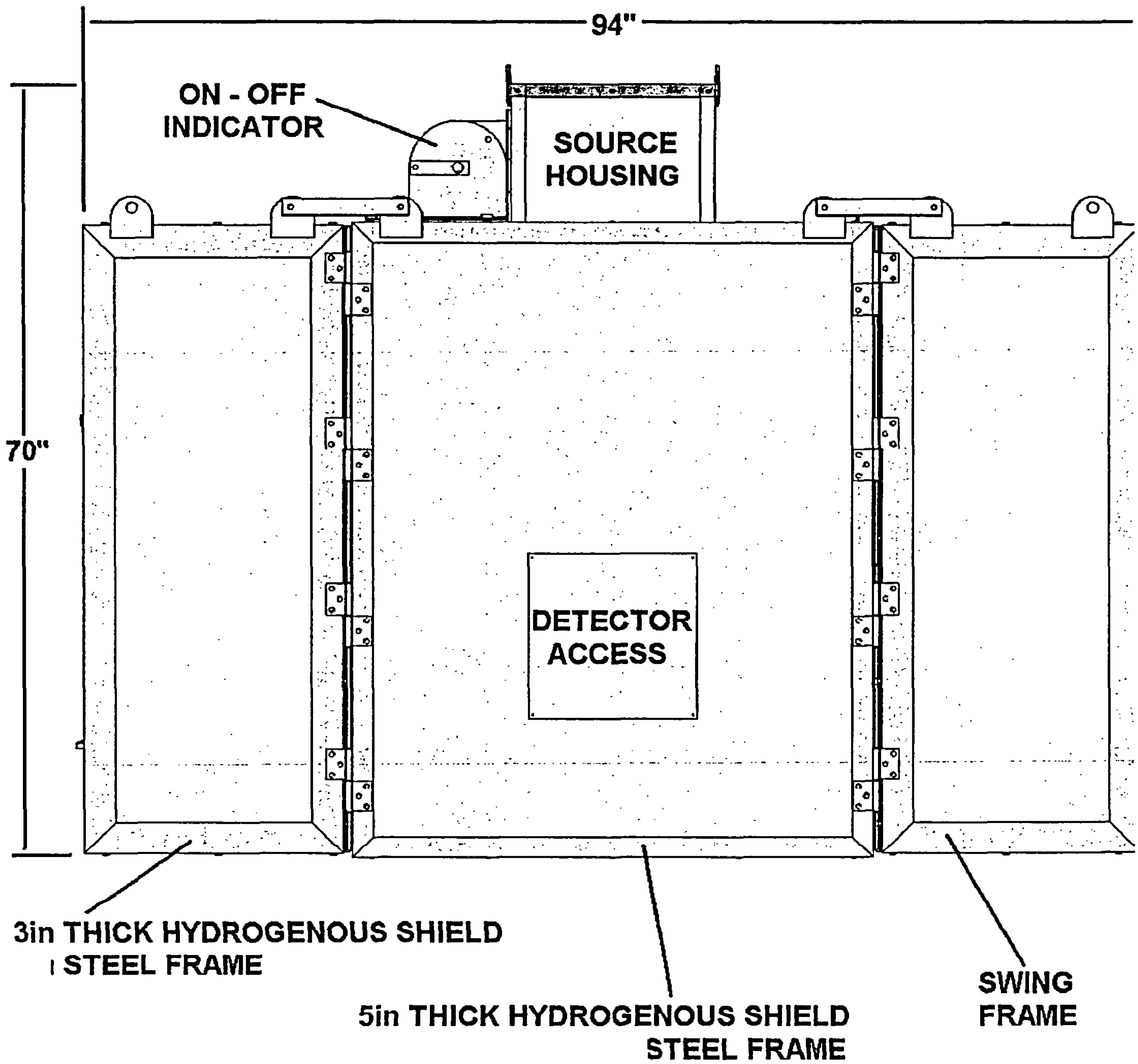

Figure C
Model XC – Series –25 Materials Analyzer

Typical side view showing shielding, detector access cover and swing frame

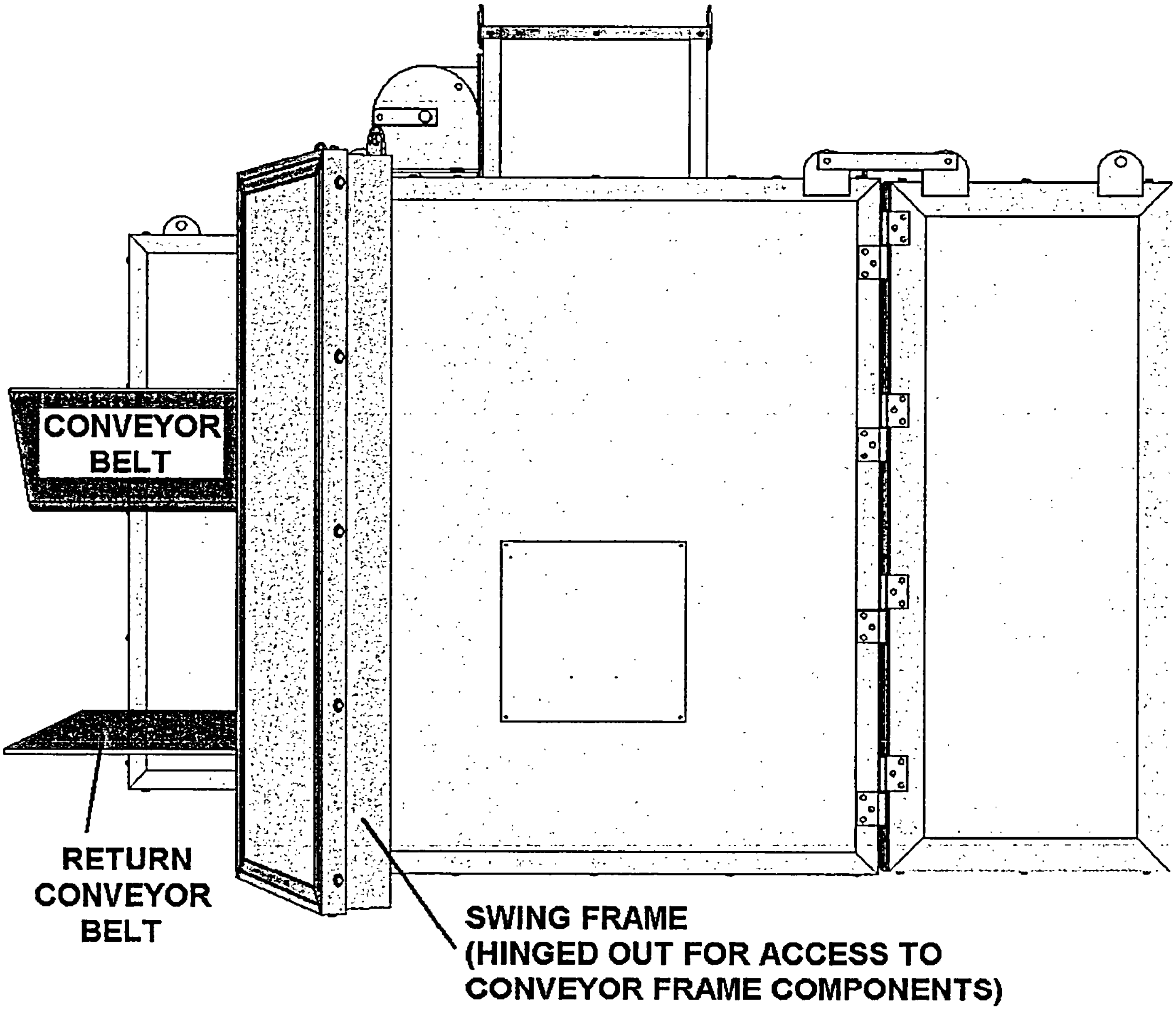

Figure D
Model XC – Series Materials Analyzer

Maintenance conditions showing
Swing Frame moved out for access
to conveyor belt components
(To be done only when source is in OFF position)

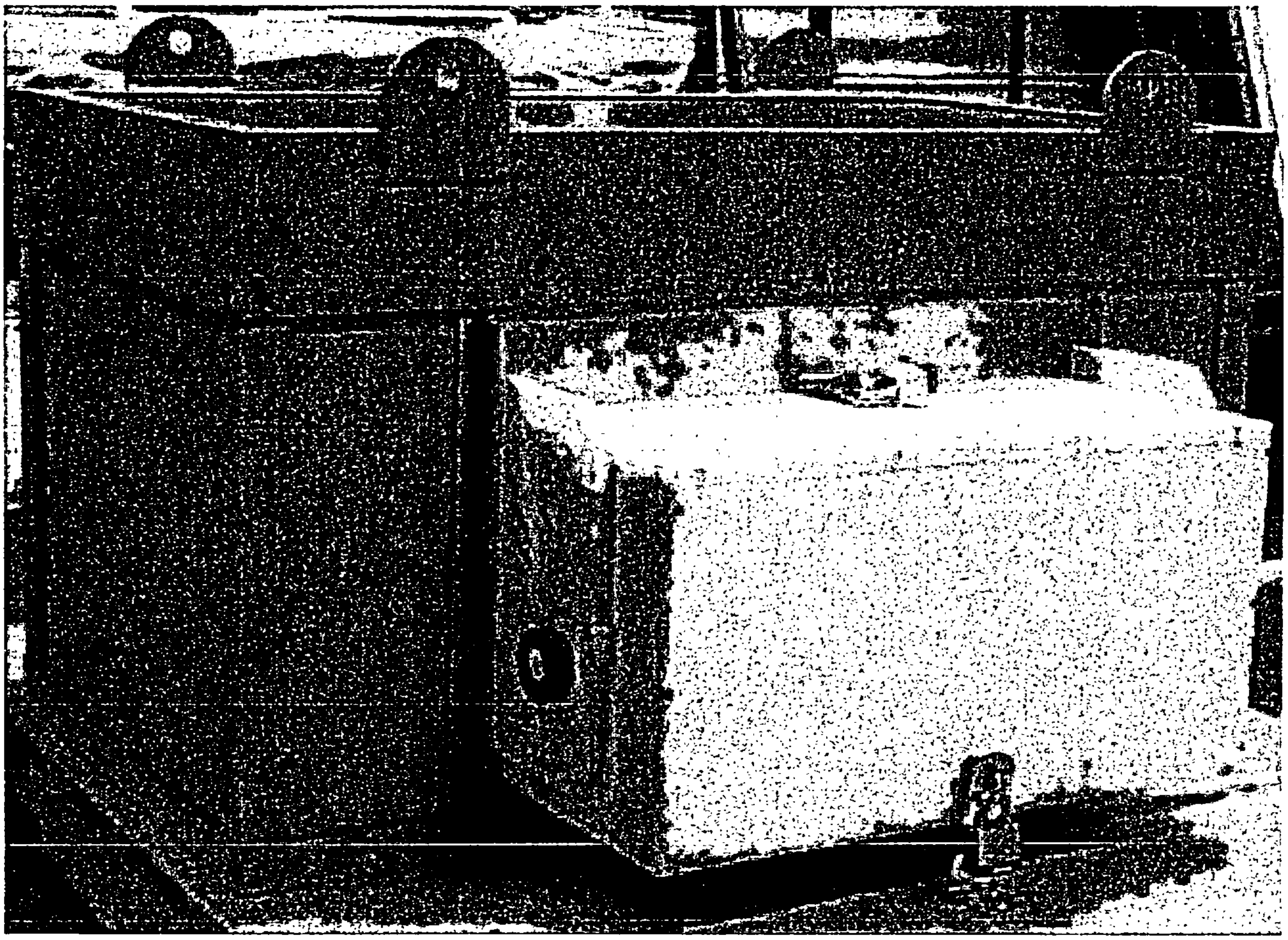

Figure E
Source Housing for the
Model XC – Series Materials Analyzer

Location of hasps and padlocks on the wheel cover (source access) on the source housing.

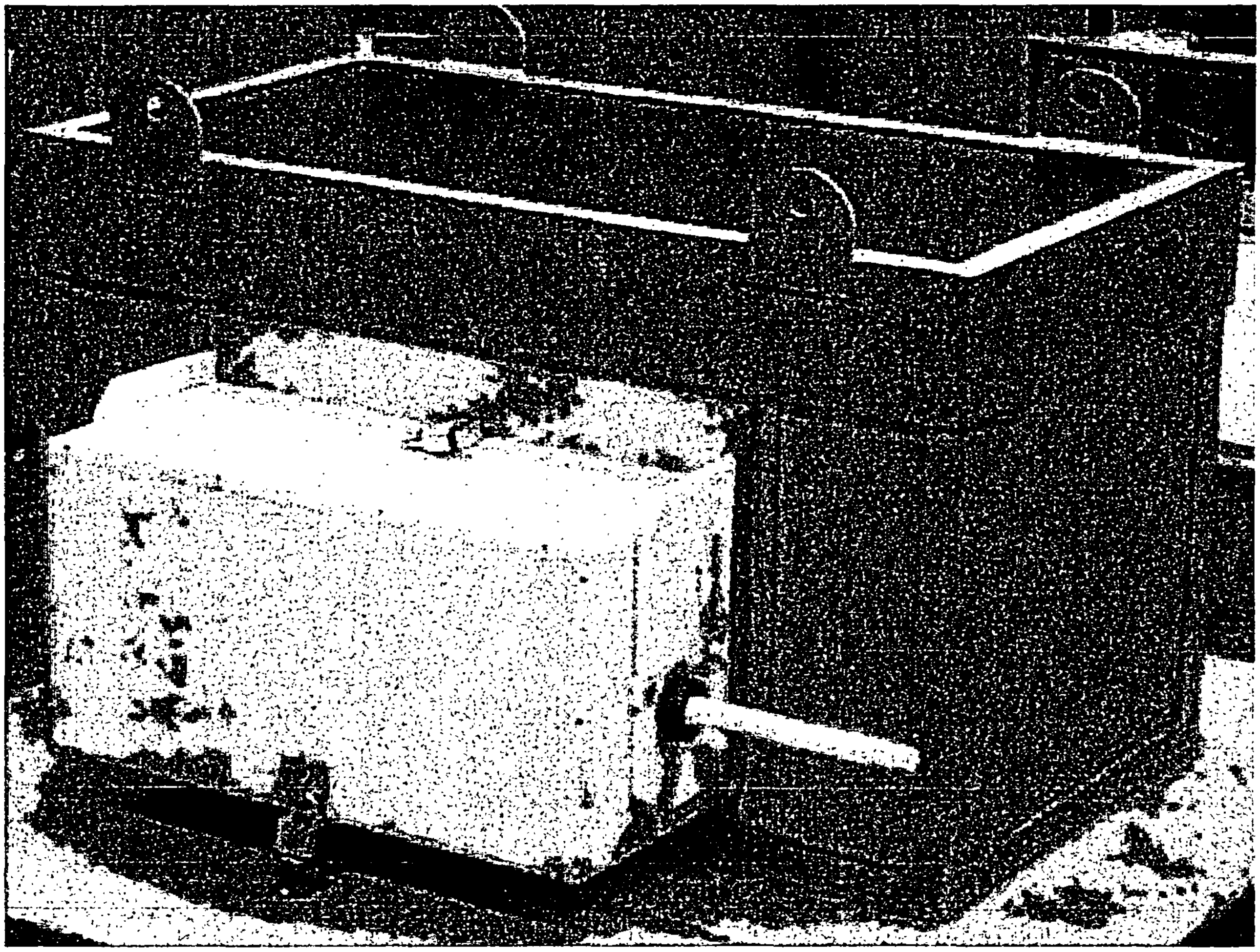

Figure F
Source Housing for the
Model XC – Series Materials Analyzer

Location of hasps and padlocks on the wheel cover (source access) on the source housing.

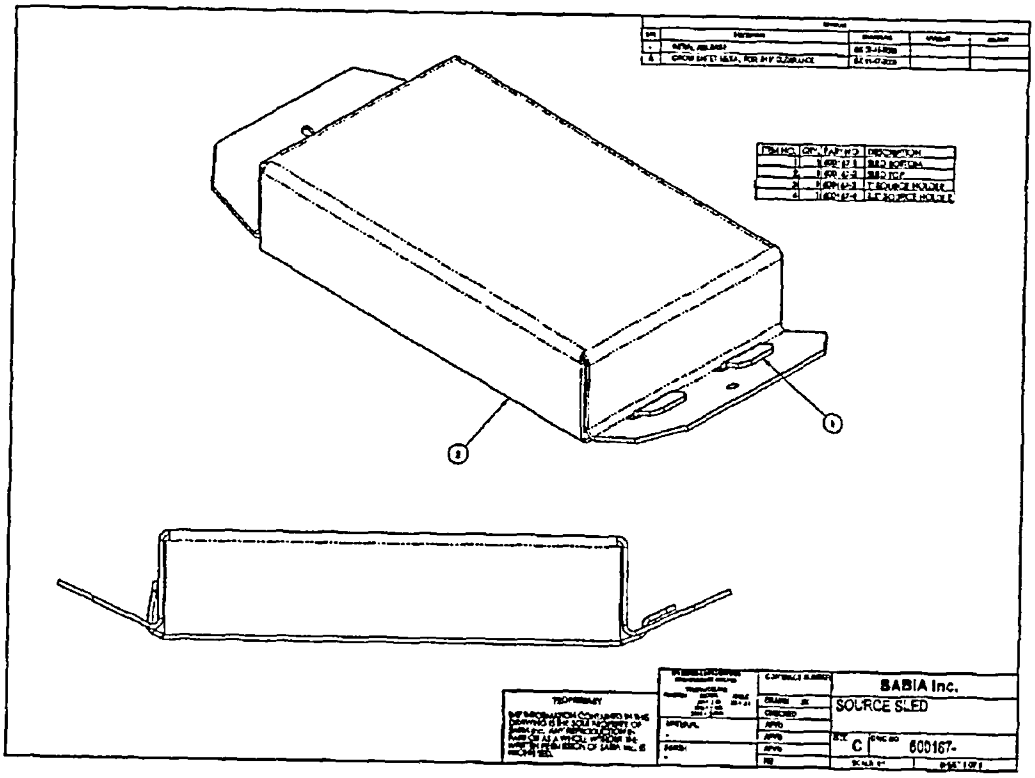

Figure 5.

600167 Source Sled

This is the Source Holder as described in NUREG-556, Vol. 3

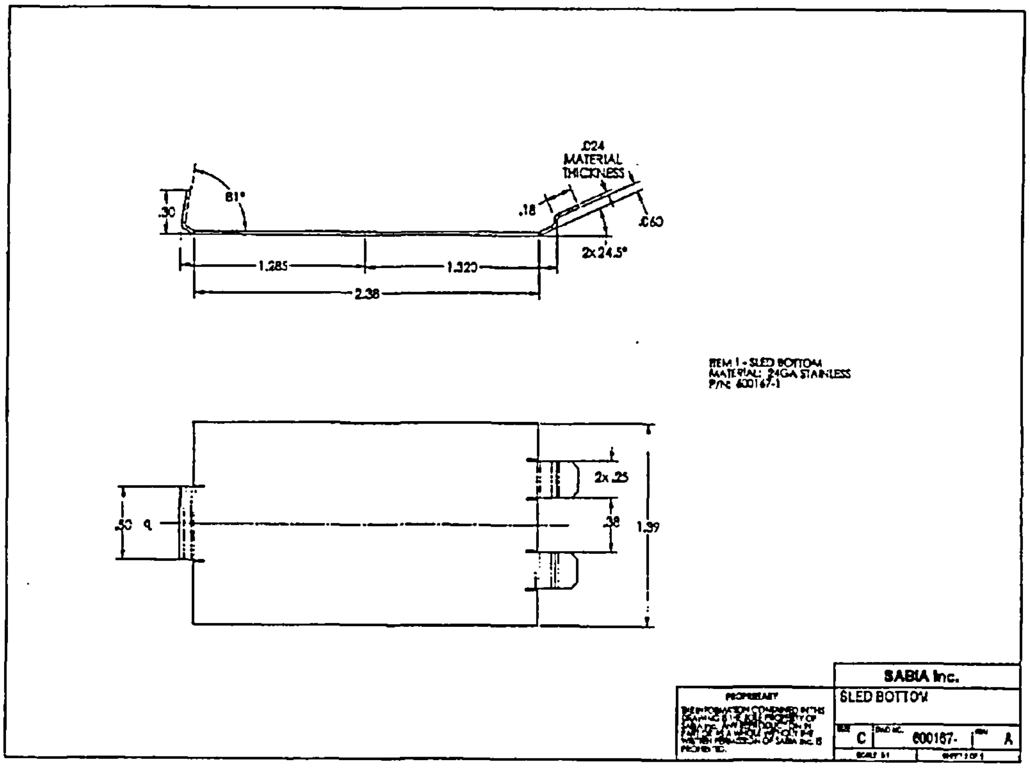

Figure 5.

600167 - 1 Source Sled Bottom

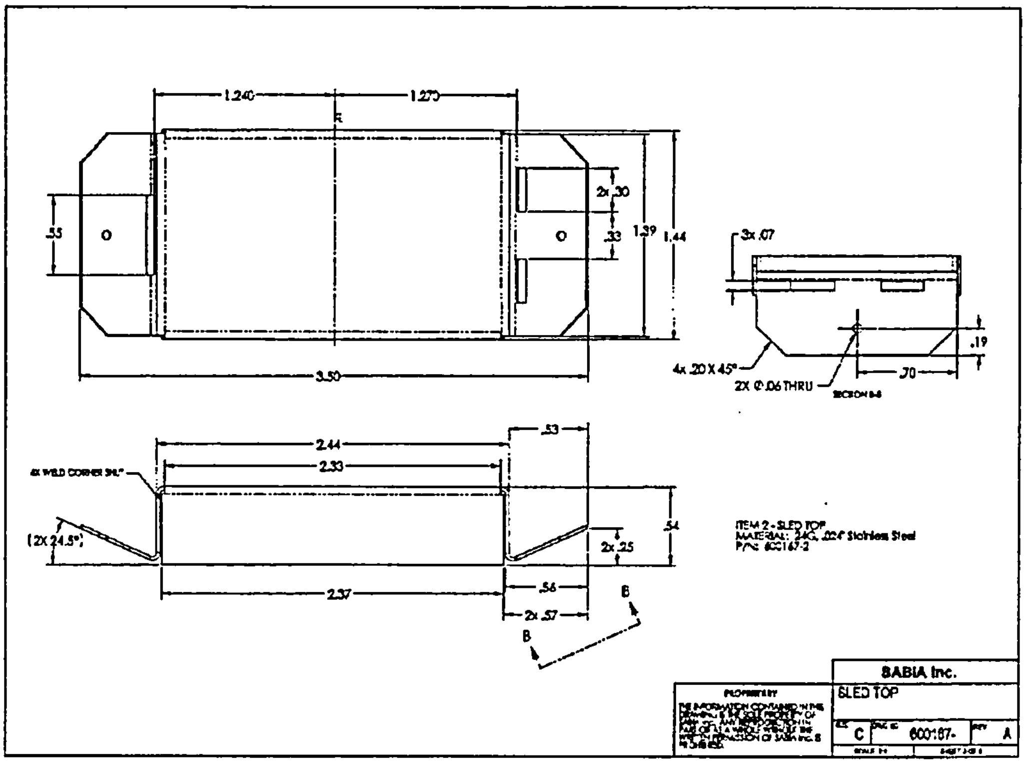

Figure 5.

600167 - 2 Source Sled Top

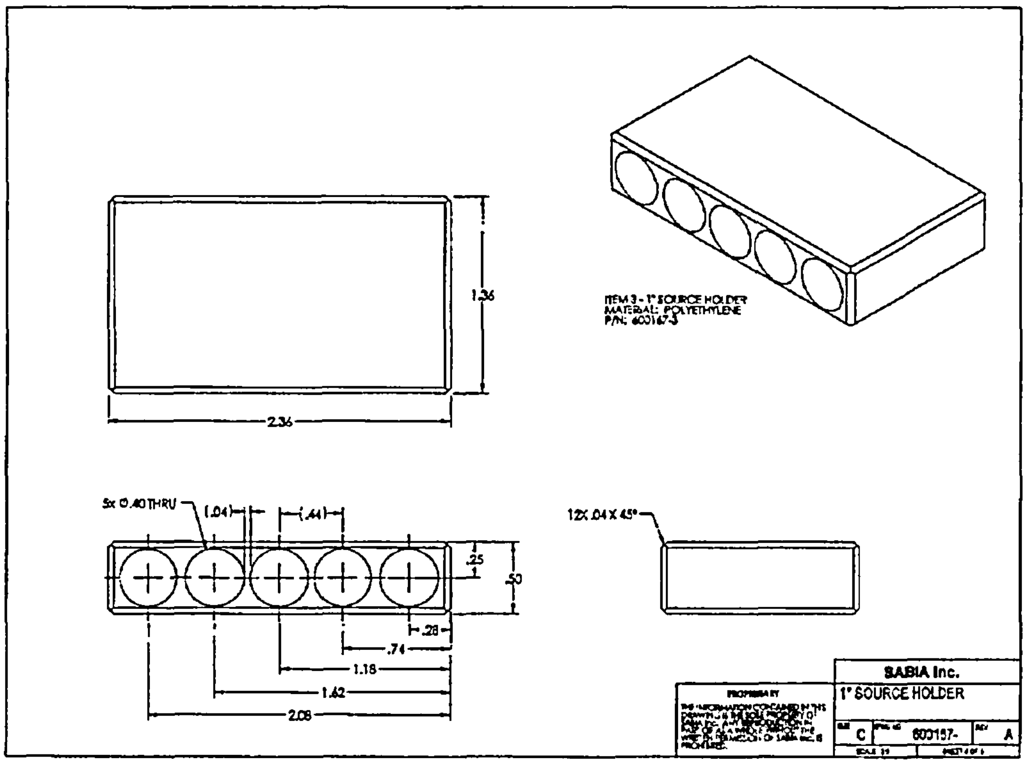

Figure 5.

600167 - 3 Source Sled - Source Holder

Designed to hold up to five 1 Inch Sources – Model 100S

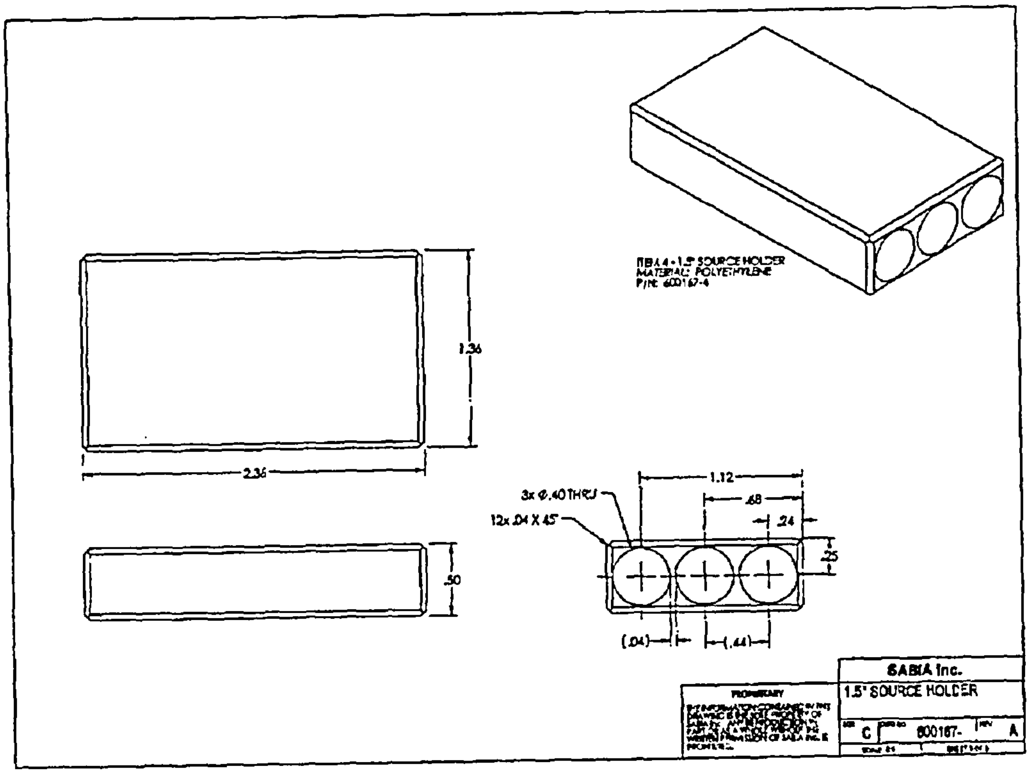

Figure 5.

600167 - 3 Source Sled - Source Holder

Designed to hold up to three 1.5 Inch Sources – Model 100

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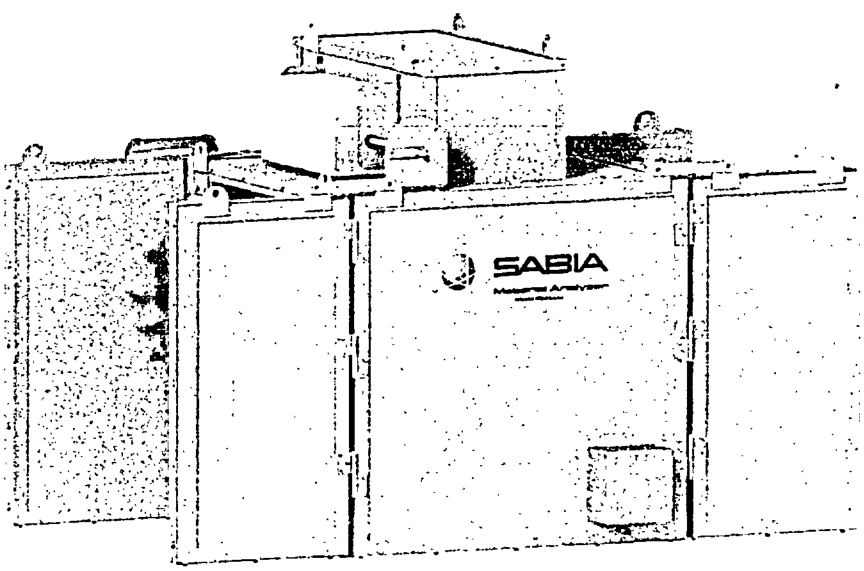
SABIA, Inc.

XC-5000 OnBelt Elemental Coal Analyzer

Operation Manual

Rev B. September 2004



For the purposes of device registration, this safety section of the SABIA, Inc. Operations and Maintenance manual may be reproduced. The Operations and Maintenance manual in it's entirety is considered as proprietary information, and as such, it cannot be reproduced without the prior, written permission of SABIA, Inc.

6 Safety

6.1 What Is Radiation?

All material is composed of atoms. Atoms are comprised of various parts – the nucleus that contains minute particles called protons and neutrons, and an outer shell made up of other particles called electrons. The nucleus carries a positive electrical charge, the electrons a negative electrical charge. As electrons are bound to the nucleus of the atom, so are the particles within the nucleus. These forces within the nucleus work toward a strongly stable balance. The process by which the nuclei of atoms work toward becoming stable is to get rid of excess energy. Unstable nuclei may emit a quantity of energy, or they may emit a particle. This emitted atomic energy or particle is what we call radiation.

- **Form** - There are two basic forms of radiation: particles and rays. Particle radiation consists of tiny fast-moving particles that have energy and mass (weight). Radiation also can be emitted in the form of pure energy like electromagnetic waves.

- **Ionizing/non-ionizing** - Ionization is the process of removing electrons from atoms, leaving two electrically charged particles (ions) behind. Some forms of radiation like visible light, microwaves, or radio waves do not have sufficient energy to remove electrons from atoms and hence, are called non-ionizing radiation. The negatively charged electrons and positively charged nuclei may cause changes in living tissue.

- **Radioactive Decay** - Large unstable atoms can become more stable by emitting radiation. This process is called radioactive decay. This radiation can be emitted in the form of a positively charged ALPHA particle, a negatively charged BETA particle, or GAMMA RAYS.

- **Fission or Nuclear Fission** - Some elements can split as a result of absorbing an additional neutron. This is called fission or nuclear fission. Such isotopes are called fissile isotopes. One particular fissile isotope is Uranium-235. This is the isotope used in commercial nuclear reactors. When a nucleus fissions three important events occur which result in the release of energy. These events are: release of radiation, release of neutrons (usually two or three), and two new nuclei (fission products) are formed.

6.1.1 What are the Sources of Radiation?

The sources of radiation are natural background and man-made.

Natural Background Sources

- Cosmic Radiation
- Terrestrial Radiation
- Internal Radiation

Cosmic Radiation

The earth, and all living things on it, are constantly bombarded by radiation from space, similar to a steady drizzle of rain. Charged particles from the sun and stars interact with the earth's atmosphere and magnetic field to produce a shower of radiation, typically beta and gamma radiation. The dose from cosmic radiation varies in different parts of the world due to differences in elevation and the effects of the earth's magnetic field.

Terrestrial Radiation

Radioactive material is found throughout nature. It occurs naturally in the soil, water, and vegetation. The major isotopes of concern for terrestrial radiation are uranium and the decay products of uranium, such as thorium, radium, and radon. Low levels of uranium, thorium, and their decay products are found everywhere. Some of these materials are ingested with food and water, while others, such as radon, are inhaled. The dose from terrestrial sources varies in different parts of the world. Locations with higher concentrations of uranium and thorium in their soil have higher dose levels.

Internal Radiation

In addition to the cosmic and terrestrial sources, all people also have radioactive potassium-40, carbon-14, lead-210, and other isotopes inside their bodies from birth. The variation in dose from one person to another is not as great as the variation in dose from cosmic and terrestrial sources.

6.1.2 Man-Made Radiation Sources

Although all living things are exposed to natural background radiation, two distinct groups are exposed to man-made radiation sources. These two groups are:

- Members of the public
- Occupationally exposed individuals

Members of the Public

Man-made radiation sources that result in an exposure to members of the public:

- Tobacco
- Televisions
- Medical X-rays
- Smoke detectors
- Lantern mantles
- Nuclear medicine
- Building materials

By far, the most significant source of man-made radiation exposure to the public is from medical procedures, such as diagnostic X-rays, nuclear medicine, and radiation therapy. Some of the major isotopes would be I-131, Tc-99m, Co-60, Ir-192, Cs-137, and others.

In addition, members of the public are exposed to radiation from consumer products, such as tobacco (polonium-210), building materials, combustible fuels (gas, coal, etc.), ophthalmic glass, televisions, luminous watches and dials (tritium), airport X-ray systems, smoke detectors (americium), road construction materials, electron tubes, fluorescent lamp starters, lantern mantles (thorium), etc.

Of lesser magnitude, members of the public are exposed to radiation from the nuclear fuel cycle, which includes the entire sequence from mining and milling of uranium to the disposal of the used (spent) fuel. This would be uranium and its daughter products.

The final sources of exposure to the public would be shipment of radioactive materials and residual fallout from nuclear weapons testing and accidents, such as Chernobyl.

Occupationally Exposed Individuals

Occupationally Exposed Individuals work in the following environments:

- Fuel cycle
- Industrial Radiography
- Radiology Departments (Medical)
- Radiation Onclolgy Departments
- Nuclear power plant
- Nuclear medicine Departments
- National (government) and university Research Laboratories

Occupationally exposed individuals are exposed according to their occupations and to the sources with which they work. The exposure of these individuals to radiation is carefully monitored with the use of tiny instruments called dosimeters.

Some of the isotopes of concern would be cobalt-60, cesium-137, americium-241, and others.

6.1.3 Ionizing Radiation Exposure to the Public

This chart shows that of the total dose of about 360 millirems/year, natural sources of radiation account for about 81% of all public exposure, while man-made sources account for the remaining 19%. Natural and artificial radiations are not different in any kind or effect. Above this background level of radiation exposure, the NRC requires that its licensees limit maximum radiation exposure to individual members of the public to 100 mrem (1 mSv) per year, and limit occupational radiation exposure to adults working with radioactive material to 5,000mrem (50 mSv) per year. (NRC regulations and radiation exposure limits are contained in Title 10 of the Code of Feral Regulations under Part 20).

6.1.4 How Does Radiation Affect the Public

We tend to think of biological effects of radiation in terms of their effect on living cells. For low levels of radiation exposure, the biological effects are so small they may not be detected. The body has defense mechanisms against many types of damage induced by radiation as well as by chemical carcinogens. Consequently, biological effects of radiation on living cells may result in three outcomes: (1) injured or damaged cells repair themselves, resulting in no residual damage; (2) cells die, much like millions of body cells do every day, being replaced through normal biological processes; or (3) cells incorrectly repair themselves resulting in a biophysical change. The associations between radiation exposure and the development of cancer are mostly based on populations exposed to relatively high levels of ionizing radiation (e.g., Japanese atomic bomb survivors, and recipients of selected diagnostic or therapeutic medical procedures). Cancers associated with high dose exposure include leukemia, breast, bladder, colon, liver, lung, esophagus, ovarian, multiple myeloma, and stomach cancers. Department of Health and Human

Services literature also suggests a possible association between ionizing radiation exposure and prostate, nasal cavity/sinuses, pharyngeal and laryngeal, and pancreatic cancer. The period of time between radiation exposure and the detection of cancer is known as the latent period. Those cancers that may develop as a result of radiation exposure are indistinguishable from those that occur naturally or as a result of exposure to other chemical carcinogens. Furthermore, National Cancer Institute literature indicates that other chemical and physical hazards and lifestyle factors (e.g., smoking, alcohol consumption, and diet) significantly contribute to many of these same diseases. Although radiation may cause cancer at high doses and high dose rates, public health data do not unequivocally establish the occurrence of cancer following exposure to low doses and dose rates – below about 10,000 mrem (100 mSv). Studies of occupational workers exposed to chronic low-levels of radiation above normal background have shown no adverse biological effects. Even so, the radiation protection community conservatively assumes that any amount of radiation may pose some risk for causing cancer and hereditary effect, and that the risk is higher for higher radiation exposures. A linear, no-threshold (LNT) dose response relationship is used to describe the relationship between radiation dose and the occurrence of cancer. This dose-response model suggests that any increase in dose, no matter how small, results in an incremental increase in risk. The LNT hypothesis is accepted by the NRC as a conservative model for estimating radiation risk. High radiation doses tend to kill cells, while low doses tend to damage or alter the genetic code (DNA) of irradiated cells. High doses can kill so many cells that tissues and organs are damaged immediately. This in turn may cause a rapid whole body response often called Acute Radiation Syndrome. The higher the radiation dose, the sooner the effects of radiation will appear, and the higher the probability of death. This syndrome was observed in many atomic bomb survivors in 1945 and emergency workers responding to the 1986 Chernobyl nuclear power plant accident.

Approximately 134 plant workers and firefighters battling the fire at the Chernobyl power plant received high radiation doses (70,000 to 1,340,000 mrem or 700 to 13,400 mSv) and suffered from acute radiation sickness. Of these, 28 died from their radiation injuries.

6.1.5 Radiation Exposure to the U.S. Population

In the following table, the first column shows the sources of radiation exposure. The second column shows an estimate of the number of people exposed to that source. For natural sources, the entire United States population is assumed to be exposed. The third column provides a measurement of the average dose (in units of millirems) to those exposed (number in column 2). The last column averages the total dose from the specific source over the entire U. S. population. For natural sources, the third and fourth columns are identical.

Exposure Source	Population Exposed (millions) 230	Average Dose Equivalent to Exposed Population (millirems/year)	Average Dose Equivalent to U.S. Population (millirems/year)
Natural			
Radon	230	200	200
Other	230	100	100
Occupational	0.93	230	0.9
Nuclear Fuel Cycle[1]	---	---	0.05
Consumer Products:			
Tobacco [2]	50	---	---
Other	120	5 - 30	5 - 13
Environment	25	0.6	0.06
Medical:			
Diagnostic X-rays[3]	---	---	39
Nuclear medicine[4]	---	---	14
Approximate Total	**230**	---	**360**

[1] Collective dose to regional population within 50 miles of each facility.

[2] Difficult to determine a whole body dose equivalent. However, the dose to a portion of the lungs is estimated to be 16,000 millirems/year.

[3] Number of persons unknown. However, 180 million examinations performed with an average dose of 50 millirems per examination.

[4] Number of persons unknown. However, 7.4 million examinations performed with an average dose of 430 millirems per examination.

6.1.6 Who Regulates Radioactive Materials and Radioactive Exposure?

- NRC
- Other Federal Agencies
- States

NRC has responsibility for regulating the use of—

- Source material (uranium and thorium)
- Special nuclear material (enriched uranium and plutonium)
- Byproduct material (material made radioactive in a reactor, and residues from the milling of uranium and thorium)

The NRC regulates the use of radioactive materials through 10 CFR Part 20, "Standards for Protection Against Radiation." Part 20 includes agency requirements for —

- Dose limits for radiation workers and members of the public
- Monitoring and labeling radioactive materials
- Posting radiation areas
- Reporting the theft or loss of radioactive material

Part 20 also includes—

- *Penalties for not complying with NRC regulations*
- Tables of individual radionuclide exposure limits

Some states have agreements with NRC to regulate the use of some radioactive materials within their borders. This includes radioisotopes used by industry and in medicine.

The individual States usually regulate the sources of radiation that NRC does not. For example, naturally occurring radioactive materials such as radium and radon, and radioactive materials produced in particle accelerators, such as cobalt-57, are regulated by the States rather than NRC. Radiation producing machines, such as particle accelerators and x-ray machines (both medical and industrial) are also regulated by the States.

Agreement States

The Atomic Energy Act (AEA) permits NRC to make agreements with the governors of states to turn over regulatory authority for AEA materials to the State if certain conditions are met. States that meet the conditions and agree to regulate AEA materials are called "Agreement States." Agreement States usually regulate all sources of radiation in the State, except reactors and large quantities of special nuclear material. Currently, 32 States have Agreements . - Non-Agreement States, and Areas of Exclusive Federal Jurisdiction within Agreement States.

NRC exercises regulatory authority over AEA materials in those States that do not have Agreements. In addition, certain locations within the Agreement States may be subject to "exclusive federal jurisdiction." Protected areas of nuclear reactors, most American Indian

Reservations, and certain areas on military bases are examples. NRC retains regulatory authority over AEA materials in areas of exclusive federal jurisdiction.

NRC's Interaction with State Regulatory Programs

NRC and the States coordinate the regulation of AEA materials through the National Materials Program. NRC retains a leadership and oversight role in the program through the Integrated Materials Performance Evaluation Process (IMPEP). IMPEP assures uniform regulation nationwide by reviewing the regulatory performance of both the NRC and the States using a common set of performance criteria.

NRC cooperates with State regulatory programs by providing technical support and maintaining databases of regulatory information. The NRC Regional Offices have designated staff, the Regional State Agreement Officers , to act as the primary contact with the Agreement States.

Similarly, the Regional State Liaison Officers are contacts for the non-Agreement States, and for all States in matters involving reactors or other federal jurisdiction.

At NRC headquarters, the Office of State and Tribal Programs (STP) provides backup to the regions. Each STP technical staff member serves as an Agreement State Project Officer with responsibility for specific States.

See our State and Tribal pages for links to the State regulatory programs, many of the regulatory information databases, and other sources of useful information.

Conference of Radiation Control Program Directors (CRCPD) and the Organization of Agreement States (OAS)

The CRCPD is a professional organization made up of the Directors and staffs of State regulatory programs (both Agreement and non-Agreement). CRCPD provides a forum for the States to coordinate the regulation of non-AEA radioactive materials, and to interact with NRC.

The OAS is a professional organization for the Directors and staffs of Agreement State programs. It was formed to facilitate communication between NRC and the Agreement States when most States did not have Agreements.

Both the CRCPD and the OAS participate in the National Materials Program. Each organization hosts an annual meeting to consider specific issues in materials regulation.

6.1.7 How Can Exposure to Radiation Be Minimized?

Although exposure to ionizing radiation carries a risk, it is impossible to completely avoid exposure. Radiation has always been present in the environment and in our bodies. We can, however, avoid undue exposure.

There is a range of simple, sensitive instruments capable of detecting minute amounts of radiation from natural and man-made sources. Radiation is very easily detected. In addition, there are four ways in which we can protect ourselves:

Time: For people who are exposed to radiation in addition to natural background radiation, limiting or minimizing the exposure time will reduce the dose from the radiation source.

Distance: In the same way that the heat from a fire is less intense the further away you are, so the intensity of the radiation decreases the further you are form the source of the radiation. The dose decreases dramatically as you increase your distance from the source.

Shielding: Barriers of lead, concrete, or water give good protection from penetrating radiation such as gamma rays and neutrons. This is why certain radioactive materials are stored or handled under water or by remote control in rooms constructed of thick concrete or lined with lead. There are special plastic shields which stop beta particles and air will stop alpha particles. Inserting the proper shield between you and the radiation source will greatly reduce or eliminate the extra radiation dose.

Containment: Radioactive materials are confined in the smallest possible space and kept out of the environment. Radioactive isotopes for medical use, for example, are dispensed in closed handling facilities, while nuclear reactors operate within closed systems with multiple barriers which keep the radioactive materials contained. Rooms have a reduced air pressure so that any leaks occur into the room and not out of it.

6.2 Radiation exposure limits for SABIA XC-Series On-Belt Coal Analyzer

The United States Nuclear Regulatory Commission has set the limits for exposure to the public to be less than 0.1 Rem per year, unless certain conditions are met. The limits of radiation exposure are specified in 10CFR part 20.1301

This regulation also specifies a maximum radiation level of 2 mRem per hour for an unrestricted area. The radiation level may be higher if the area is to be considered as a controlled or restricted area.

The regulations are worded to allow a maximum radiation exposure to individuals of up to 0.5 Rem per year, provided that this has been specified in the radioactive materials license and the licensee follows the regulations of 10CFR part 20.1301 subpart D, paragraphs 1, 2, and 3. While this is not difficult, most licensees have not made this request. Therefore, most licensees are obligated to follow the regulation of 0.1 Rem per year maximum radiation exposure for any member of the public.

The maximum radiation level at the conveyor belt rollers inside the shield area when the analyzer is operating may be about 10 mRem/hr. This radiation level is the maximum level measured at the side of the analyzer behind the hinged section of shielding that can be swung out from the conveyor frame, nearest the conveyor rollers. Even this level of radiation would allow a few hours of work without exceeding 10CFR part 20.1301 guidelines for members of the public. With the source stored, the radiation levels at the nearest conveyor-belt rollers are about 2 mRem/hr.

It is permissible to work in an area that is above 2 mRem/hr by declaring the area a controlled area. All individuals working in the area will then log the time spent in this controlled area. This time and resulting radiation exposure should be reviewed periodically by the Radiation Safety Officer to ensure compliance with the regulations, (less than 0.1 Rem per year).

6.2.1 10 CFR 20 Subpart D – Radiation Dose Limits for Individual Members of the Public

§20.1301 Dose limits for individual members of the public.

(a) Each licensee shall conduct operations so that —

(1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation, from any administration the individual has received, from exposure to individuals administered radioactive material and released under § 35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with § 20.2003, and

(2) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with §35.75, does not exceed 0.002 rem (0.02 millisievert) in any one hour.

(b) If the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals.

(c) Notwithstanding paragraph (a)(1) of this section, a licensee may permit visitors to an individual who cannot be released, under § 35.75, to receive a radiation dose greater than 0.1 rem (1 mSv) if—

(1) The radiation dose received does not exceed 0.5 rem (5 mSv); and

(2) The authorized user, as defined in 10 CFR Part 35, has determined before the visit that it is appropriate.

(d) A licensee or license applicant may apply for prior NRC authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv). The licensee or license applicant shall include the following information in this application:

(1) Demonstration of the need for and the expected duration of operations in excess of the limit in paragraph (a) of this section;

(2) The licensee's program to assess and control dose within the 0.5 rem (5 mSv) annual limit; and

(3) The procedures to be followed to maintain the dose as low as is reasonably achievable.

(e) In addition to the requirements of this part, a licensee subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR part 190 shall comply with those standards.

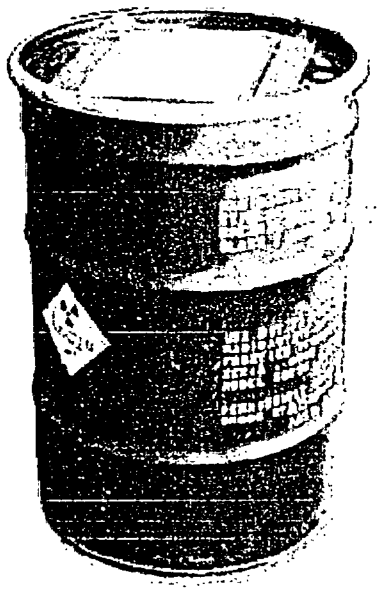
(f) The Commission may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee may release in effluents in order to restrict the collective dose.

[56 FR 23398, May 21, 1991, as amended at 60 FR 48625, Sept. 20, 1995; 62 FR 4133, Jan. 29, 1997]

6.3 Radiation exposure limits for SABIA XC-Series On-Belt Coal Analyzer

Analyzer components are shipped on pallets and can be unloaded with a forklift. Any damage to the packaging should be reported to the shipper and to SABIA Inc. The analyzer may be stored in a warehouse or similar protected area away from severe conditions of moisture, heat, or cold.

The nuclear sources necessary to provide a signal to the analyzer will arrive in a 30 or 55 gallon drum like the one shown in the photo below. In most cases, the SABIA field installation team will arrange for these sources to arrive when they are at the site. In those cases where the drum arrives before the SABIA team arrives, the customer should locate the drum in a secure, limited access area and post signs indicating the presence of nuclear sources and then notify the SABIA engineers of the arrival.



• Figure 6-1Typical Nuclear Source Shipping Cask

6.4 Analyzer Safety

The following outlines the proper safety for the SABIA elemental analyzer.

1. The analyzer contains Californium-252, a radioisotope that produces alpha particles and also produces neutrons and gamma rays through spontaneous fission. The radioactive source is double encapsulated in stainless steel. The alpha particles are stopped by the stainless steel capsule. The neutrons and gamma rays are reduced by the shielding of the analyzer.

2. This source is required to be tested at intervals of six months to ensure that there is no leakage or contamination of the Californium-252 outside of the source capsule.

3. The user is not allowed under any circumstances to work with, move, replace, repair, or perform any other work on the radioactive source, the source housing, or materials analyzer unless specifically identified on the site radioactive materials license.

4. All leak testing, source installation, source removal, source replenishment, or other maintenance is to be performed only by authorized SABIA personnel or by other persons specifically licensed to perform the work.

5. The user is not allowed to remove or replace any components on the materials analyzer.

6. All maintenance on the materials analyzer, including replacement or repairs to the electronic detector are to be performed only by authorized SABIA trained field personnel.

6.5 Analyzer Maintenance

Prior to performing maintenance on the conveyor belt or conveyor components (lubrication of conveyor idlers, etc.), the sources need to be stored. The following outlines the proper procedure for radioactive source storage.

1. Shift supervisor or other authorized personnel is to move the source handle on the source housing from ON to OFF.

2. From the main analysis screen, verify that the "counts" (detector count-rate), decreases by at least a factor of 5.

3. The source handle is then to be locked and tagged in the OFF position.

4. The side shielding can then be unbolted to allow the swing frames to move outward to allow access to the conveyor idlers adjacent to the analyzer shielding.

5. Following maintenance, the swing frames are to be moved to the closed position, and the frame bolted in place.

6. The shift supervisor or other authorized personnel may then remove the tag and lock from the source handle.

7. The shift supervisor or other authorized personnel is then to move the source handle from OFF to ON.

8. From the main analysis screen, verify that the "counts" (detector count-rate), returns to the original count-rate value +/- 10%.

6.6 Emergency Procedures

INTRODUCTION

The purpose of this procedure is to define the proper actions which should be taken in an emergency.

FIRE

In case of fire in, on, or near a radiation gauge, the proper precautions are:

Clear personnel from the area near the gauge.
Remove power from the radiation gauge.
Perform steps to control fire, if practical.
Notify safety authorities or fire authorities of the fire and of the presence of the radiation gauge.
Following fire, perform radiation survey of the radiation gauge and of the area near the gauge.

Contact:
SABIA Field Service at (304) 357-7392
State of California, Department of Health Services, Radiologic Health Branch of the fire, condition of gauge, and request any assistance or recommendations. Telephone:(800) 852-7550 (24 hours) or (916) 322-3482 (daytime) or Fax: (916) 324-3610 (daytime)
Nuclear Regulatory Commission, notify of the fire, condition of gauge, and request any assistance or recommendations at (301) 816-5100 or (301) 951-0550.

RADIATION GAUGE DAMAGE

In case of damage to a radiation gauge, the proper precautions are:

Clear personnel from the area near the gauge
Remove power from the radiation gauge
Perform radiation survey of the radiation gauge and of the area near the gauge.
Verify the operation of the source shutter mechanism, and close and lock the shutter in the OFF position.
Contact manufacturer for assistance or recommendations for repair to the radiation gauge.

Contact:
SABIA Field Service at (304) 357-7392
State of California, Department of Health Services, Radiologic Health Branch,
notify of accident and condition of gauge. Telephone: (800) 852-7550 (24 hours) or (916) 322-3482 (daytime) or Fax: (916) 324-3610 (daytime)
Nuclear Regulatory Commission notify of accident and condition of gauge, if required at (301) 816-5100 or (301) 951-0550.

PERSONNEL CONTAMINATION

In case of personnel contamination in the use of any sealed source:

Remove any contaminated clothing.
Scrub hands or other contaminated areas with soap and water to remove as much contamination as possible.

Contact:
SABIA Field Service at (304) 357-7392
State of California, Department of Health Services, Radiologic Health Branch, notify of accident and request assistance, if required. Telephone: (800) 852-7550 (24 hours) or (916) 322-3482 (daytime) or Fax: (916) 324-3610 (daytime)
Nuclear Regulatory Commission, notify of accident and request assistance, if required at (301) 816-5100 or (301) 951-0550.

XC-5000 Coal Analyzer Drawings

600260 On Belt Analyzer (Sheet 1 of 1 with white-out)
600270 On Belt Analyzer, Top Level (Sheets 1 through 6 with white-out)
600156 Lifting Tab (Sheet 1 of 1)
600157 Hinges (Sheet 1 of 1)
600158 Lock Plate (Sheet 1 of 1)
600261 Horizontal Box Assembly) (Sheets 1 through 3)
600262 Horizontal Small Box Assembly) (Sheets 1 through 5)
600263 Horizontal Large Box Assembly) (Sheets 1 through 4)
600264 Channel Vertical Center Box (Sheets 1 through 8)
600265 Channel Vertical Center Box (Sheets 1 and 2)
600266 Wing, Right (Sheets 1 through 5)
600267 Wing, Left (Sheets 1 and 2 with white-out)
600268 Access Plug (Sheets 1 through 3)
600166 Path Assembly (Sheet 1 of 1)
600167 Source Sled (Sheets 1 through 5)
600169 Wheel Cover (Sheet 1 of 1)
600xxx Source Housing (Sheets 1 through 3)
600171 Source Assembly (Sheet 1 through 11)
600271 Source Box (Sheets 1 through 13)
600272 Overall Detector Housing (Sheet 1 of 1) [This part to be mounted beneath the conveyor belt]

Of the above listed drawings, those drawings which are considered as non-proprietary are included with this drawing package. The proprietary drawings are listed on the following page and are included in a separate package.

SABIA Proprietary Drawings

600156 Lifting Tab (Sheet 1 of 1)
600157 Hinges (Sheet 1 of 1)
600158 Lock Plate (Sheet 1 of 1)
600261 Horizontal Box Assembly) (Sheets 1 through 3)
600262 Horizontal Small Box Assembly) (Sheets 1 through 5)
600263 Horizontal Large Box Assembly) (Sheets 1 through 4)
600264 Channel Vertical Center Box (Sheets 1 through 8)
600265 Channel Vertical Center Box (Sheets 1 and 2)
600266 Wing, Right (Sheets 1 through 5)
600268 Access Plug (Sheets 1 through 3)
600166 Path Assembly (Sheet 1 of 1)
600169 Wheel Cover (Sheet 1 of 1)
600171 Source Assembly (Sheet 1 through 11)
600271 Source Box (Sheets 1 through 13)

These drawings contain proprietary intellectual property of SABIA Inc.

The manufacturing drawings would allow unauthorized persons to build the SABIA Inc. Materials Analyzer.

Trade secret information is contained in the choice of materials used and the shape, size, and configuration of materials in the analyzer. In some areas, very small dimensional changes can appreciably affect performance of the materials analysis.

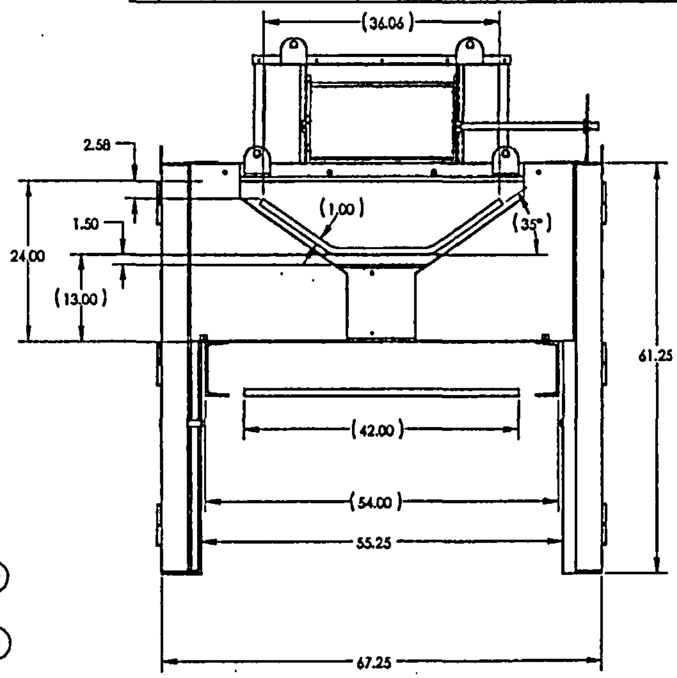
Extensive research and development has been required to develop the information that is revealed in these drawings and that provides the exceptional performance of this analyzer which is used for determining the elemental composition of the user's material.

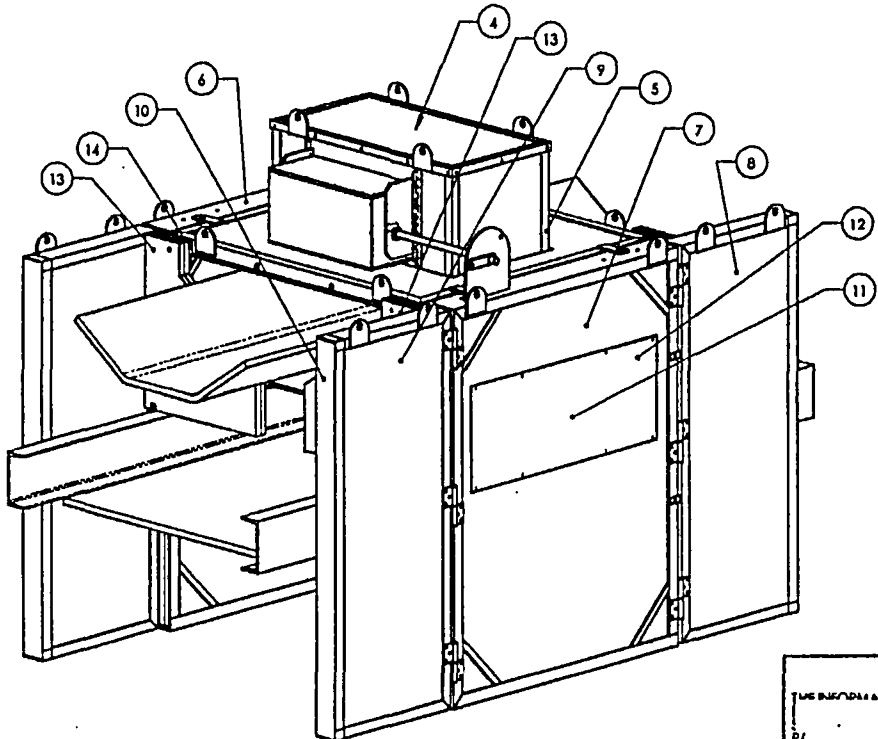
SABIA Inc. could be immeasurably harmed if this information were made public.

Please refer to the proprietary copy of these drawings for specific information.

ITEM NO	QTY	PART NO.	DESCRIPTION
1	2	-	Bin RAIL / CHANNEL
2	1	-	Conveyor Belt
3	1	-	Return Belt
4	1	600271	SOURCE BOX
5	1	600261	Horizontal Box Assembly
6	1	600264	VERTICAL CENTER SHIELDING
7	1	600265	VERTICAL SHIELDING ACCESS SIDE
8	2	600266	WING, RIGHT
9	2	600267	WING, LEFT
10	1	600272	DETECTOR ASSY
11	1	600268	ACCESS PLUG
12	1	600268-6	PLUG COVER
13			
14			
15			[illegible]
16	8	600158	LOCK PLATE

REVISIONS				
LTR	DESCRIPTION	DRAWN/DATE	APVD/DATE	REL/DATE
-	INITIAL RELEASE	SK 02-04-2004		
A	SOURCE BOX LOCK PLATE CHANGE	SK 02-05-2004		
B	VERTICAL SHIELDING TO 5 FT	SK 02-09-2004		

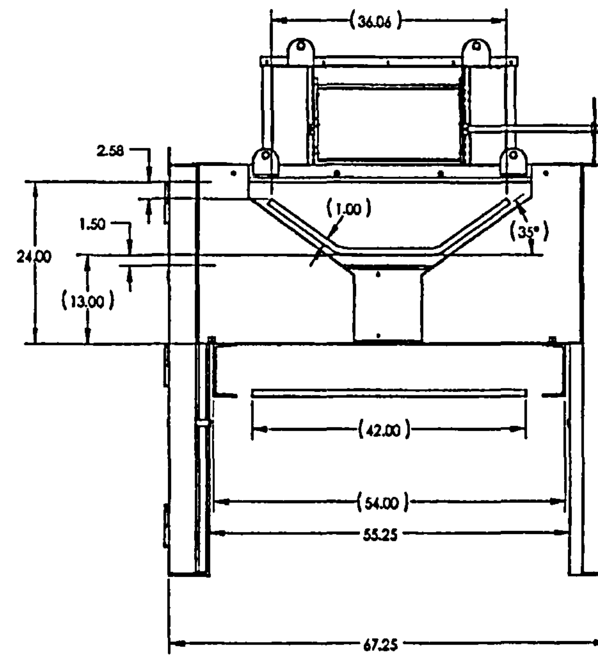


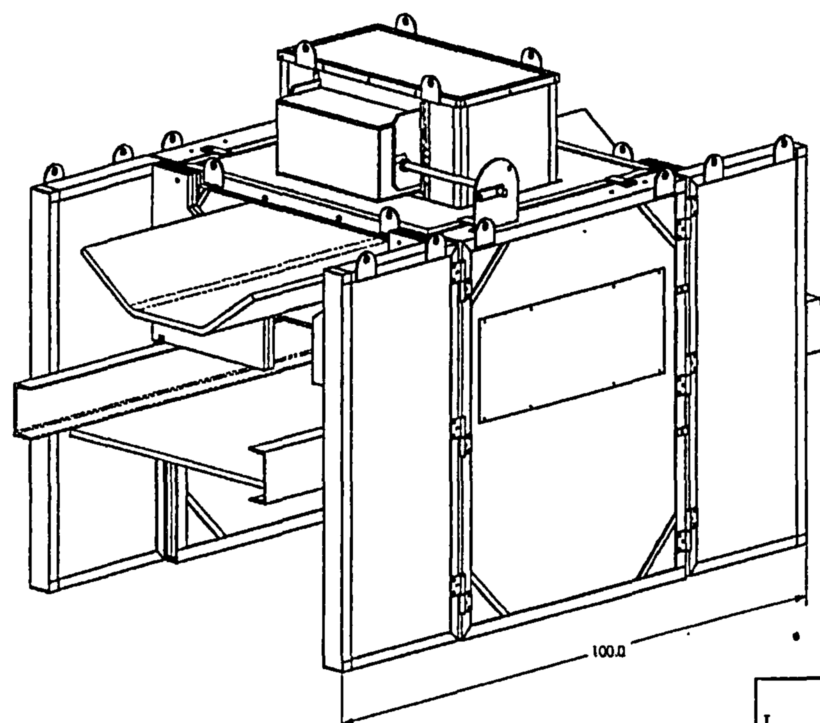


THE INFORMATION CONTAINED IN THIS ... OF ... P/ ... W ... OF SABIA INC. IS PROHIBITED.

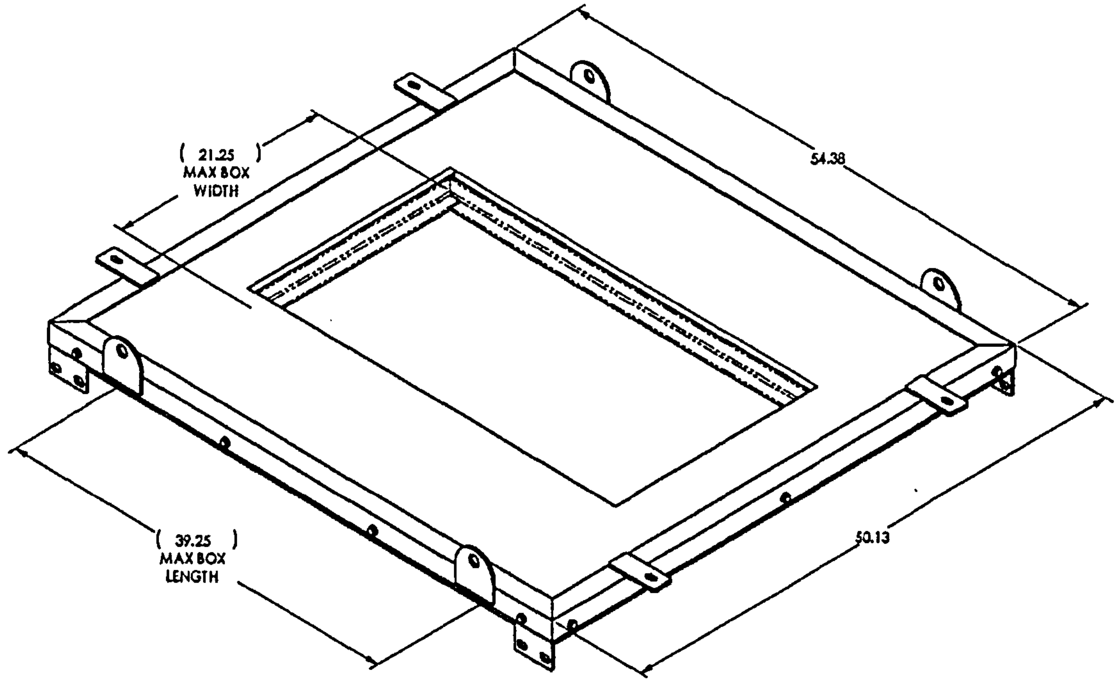
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTION / DECIMAL / ANGLE	CONTRACT NUMBER	SABIA Inc.	
MATERIAL	DRAWN SK	ON BELT ANALYZER	
FINISH	CHECKED		
	APVD	SIZE C	DWG NO. 600260
	APVD		
	APVD		
	REL	SCALE 1:12	SHEET 1 OF 1

REVISIONS				
LTR	DESCRIPTION	DRWN/DATE	APVD/DATE	REL/DATE
-	INITIAL RELEASE	SK 02-04-2004		
A	ADD 6TH SHEET SHOWING SOURCE BOX	SK 02-05-2004		
B	VERTICAL SHIELDING TO 5 FT	SK 02-09-2004		



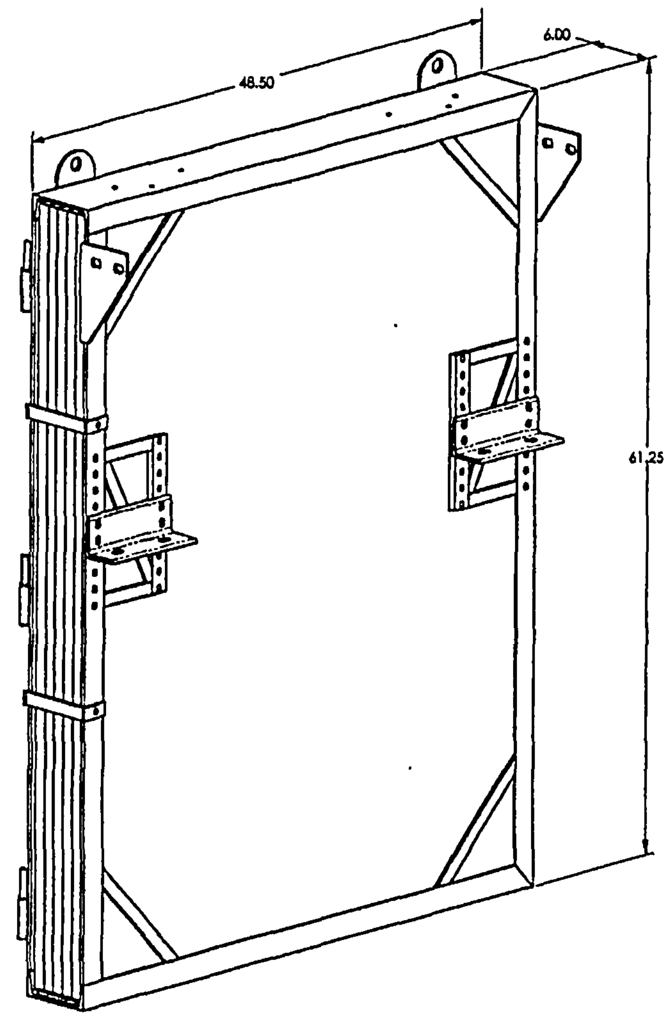


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTION DECIMAL ANGLE	CONTRACT NUMBER	SABIA Inc.
	DRAWN SK	ON BELT ANALYZER, TOP LEVEL
	CHECKED	
MATERIAL	APVD	
-	APVD	SIZE C DWG NO. 600270
FINISH	APVD	
-	REL	SCALE 1:12 SHEET 1 OF 6

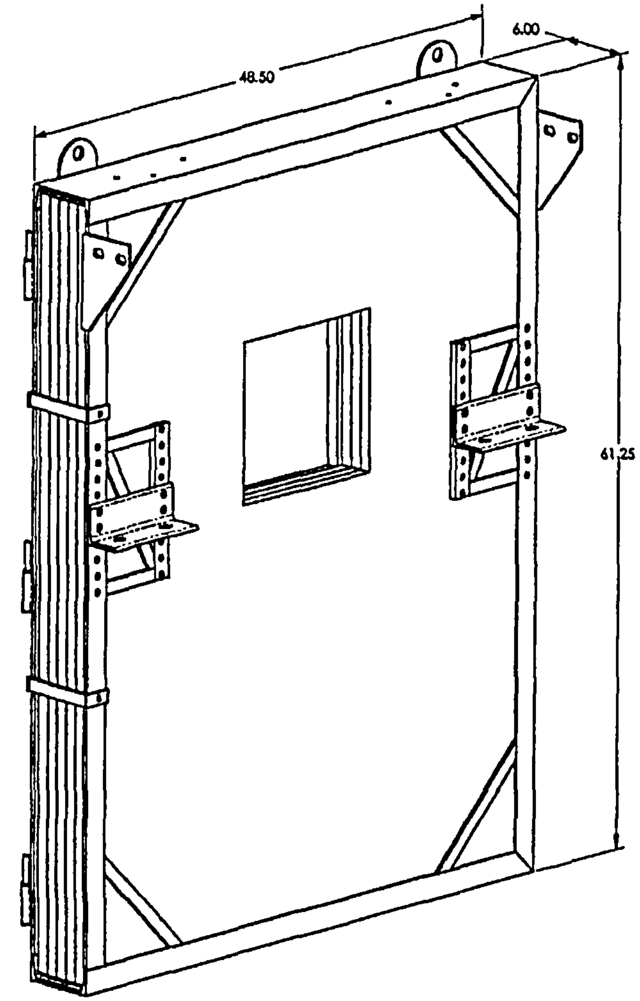


600261
Horizontal Box Assembly

SABIA Inc.				
HORIZONTAL BOX				
SIZE C	DWG NO. 600270		REV B	
SCALE 1:8		SHEET 2 OF 6		

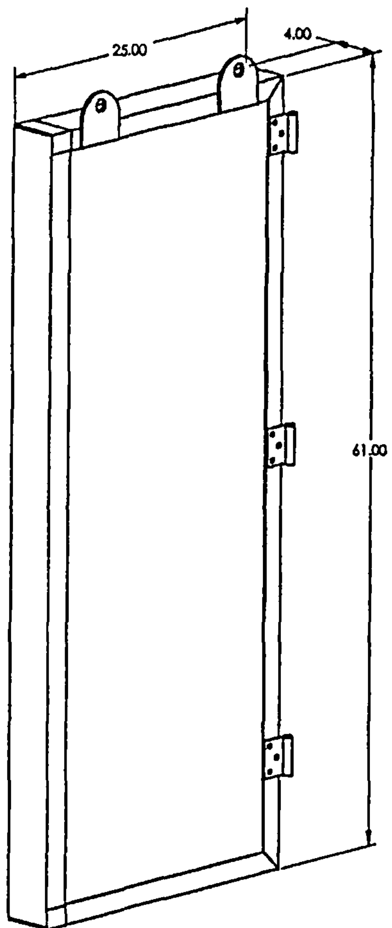


600264
VERTICAL CENTER SHIELDING

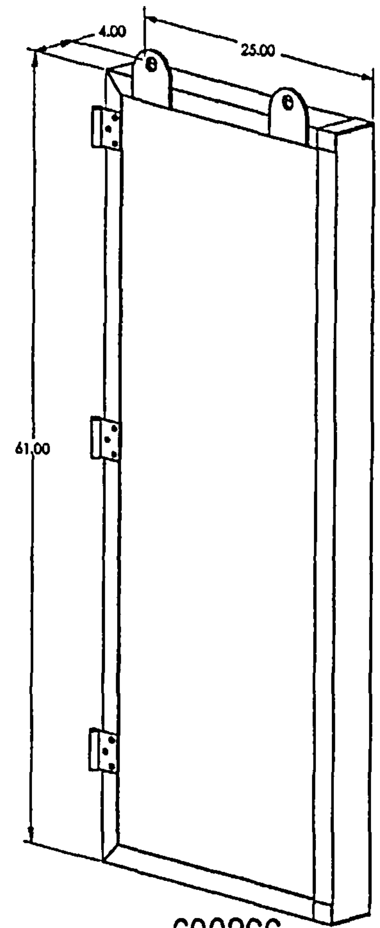


600265
VERTICAL SHIELDING ACCESS SIDE

SABIA Inc.			
VERTICAL SHIELDING			
SIZE C	DWG NO. 600270	REV B	
SCALE 1:12	SHEET 3 OF 8		



600267
WING, LEFT



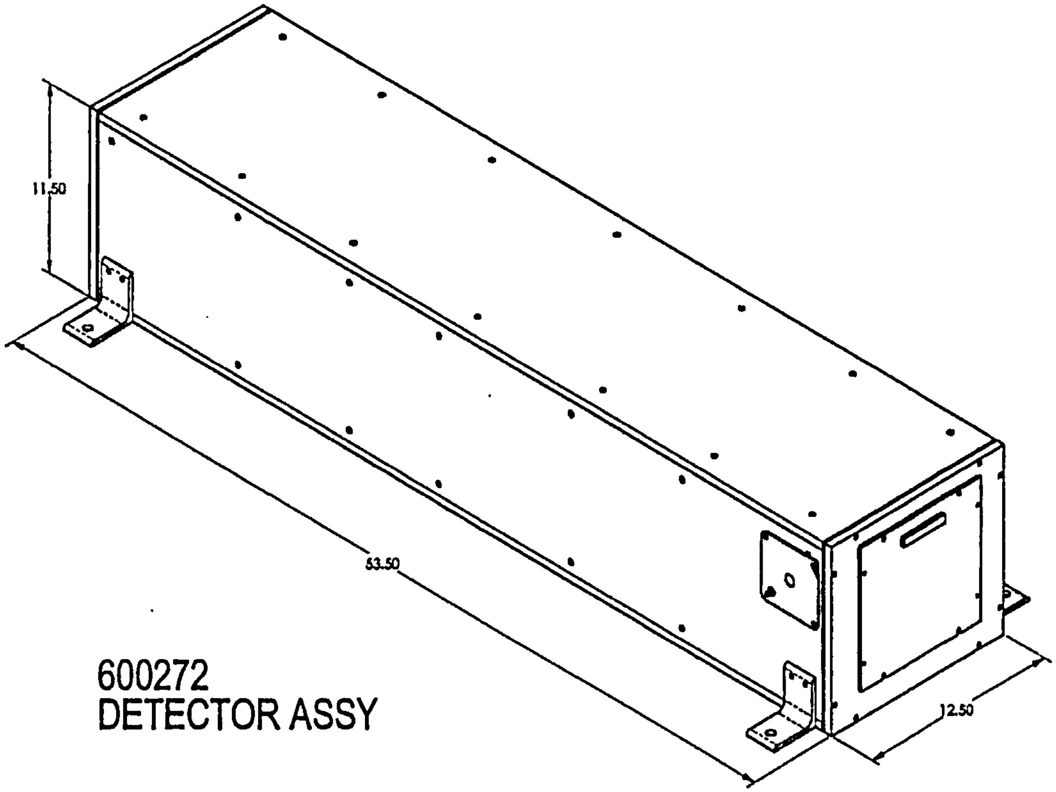
600266
WING, RIGHT

SABIA Inc.

WINGS

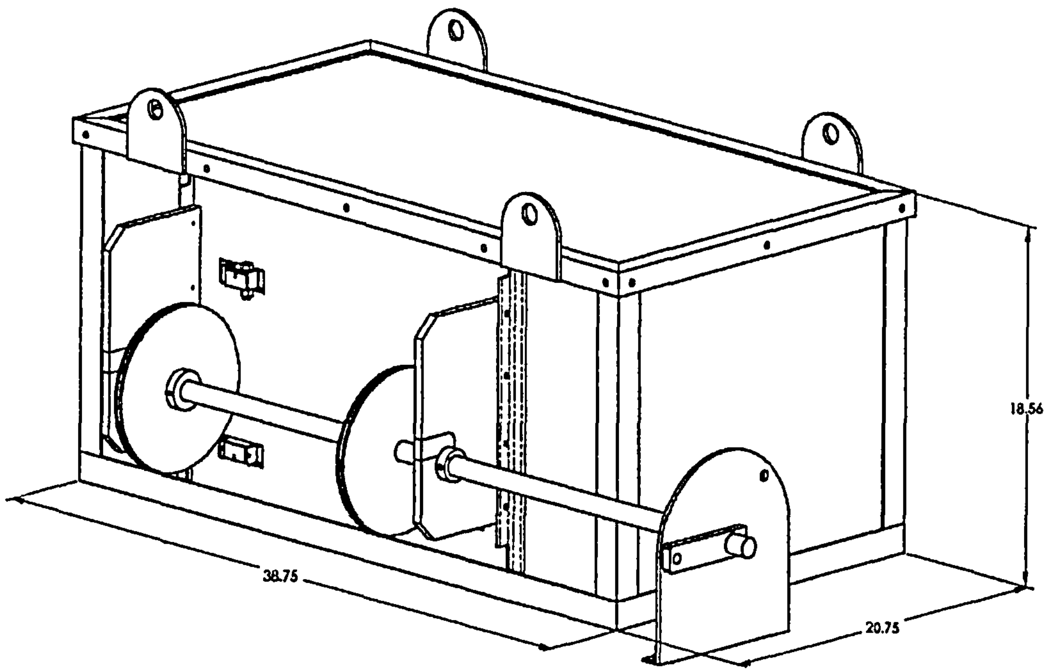
SIZE	DWG NO.	REV
C	600270	B

SCALE 1:12 | SHEET 4 OF 8



600272
DETECTOR ASSY

SABIA Inc.					
DETECTOR BOX					
SIZE	C	DWG NO.	600270	REV	B
SCALE 1:4		SHEET 6 OF 8			



600271
SOURCE BOX

SABIA Inc.		
SOURCE BOX		
SIZE C	DWG NO. 600270	REV B
SCALE 1:4	SHEET 6 OF 8	

600156 Lifting Tab (Sheet 1 of 1)

600157 Hinges (Sheet 1 of 1)

This drawing contains proprietary intellectual property of SABIA Inc.

600158 Lock Plate (Sheet 1 of 1)

600261 Horizontal Box Assembly) (Sheets 1 through 3)

This drawing contains proprietary intellectual property of SABIA Inc.

600262 Horizontal Small Box Assembly) (Sheets 1 through 5)

This drawing contains proprietary intellectual property of SABIA Inc.

600263 Horizontal Large Box Assembly) (Sheets 1 through 4)

This drawing contains proprietary intellectual property of SABIA Inc.

600264 Channel Vertical Center Box (Sheets 1 through 8)

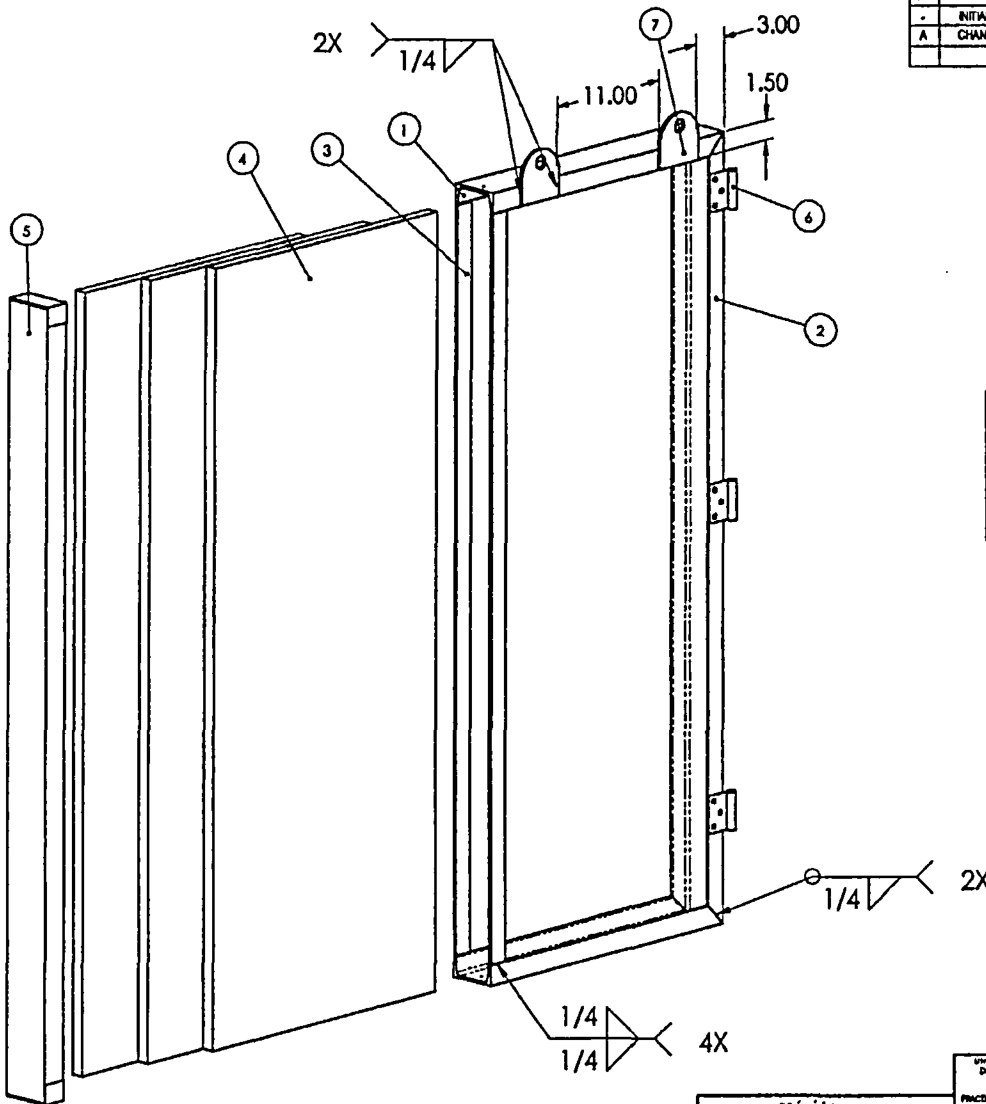
This drawing contains proprietary intellectual property of SABIA Inc.

600265 Channel Vertical Center Box (Sheets 1 and 2)

This drawing contains proprietary intellectual property of SABIA Inc.

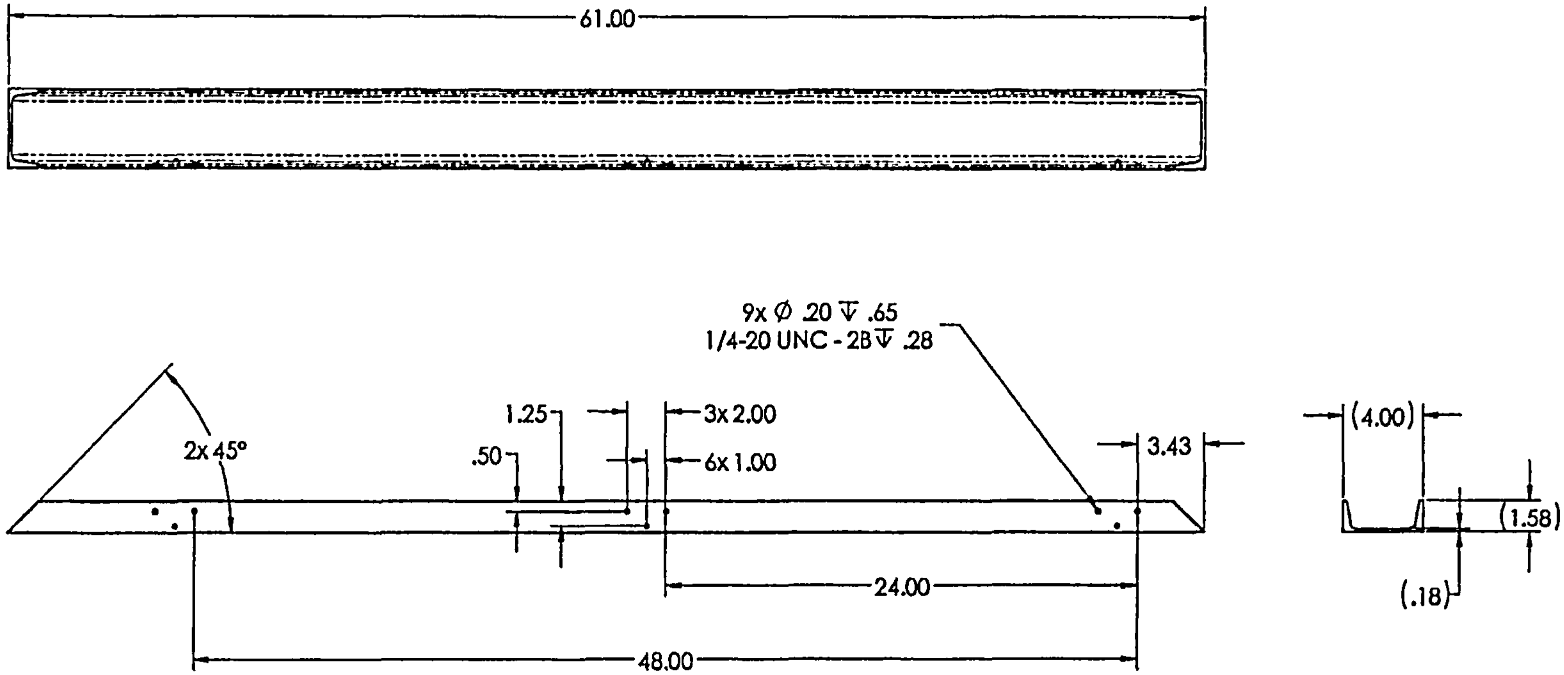
600266 Wing, Right (Sheets 1 through 5)

REVISIONS				
LTR	DESCRIPTION	DRAWN/DATE	APVD/DATE	REL/DATE
-	INITIAL RELEASE	SK 02-04-2004		
A	CHANGE VERTICAL LENGTH TO 5 FEET	SK 02-09-2004		



ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	2	600266-1	Horizontal Channel
2	1	600267-1	Small Channel
3	2	600266-3	Vertical Bar
4	3	600266-4	2' X 5' PE SHEET
5	1	600266-5	24GA Wing End Cover
6	3	600157-1	Left Door Hinge
7	2	600156	Lifting Tab

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTION / DECIMAL .XX= ±.10 .XXX= ±.005 / ANGLE .XX= ±1°	CONTRACT NUMBER	SABIA Inc.
	DRAWN SK	WING, LEFT
	CHECKED	
MATERIAL -	APVD	
	APVD	SIZE C — DWG NO. 600267
FINISH -	APVD	
	RFL	SCALE 1:8 — SHEET 1 OF 2



600267-1
ITEM 2 - Small Channel
MATL:

SABIA Inc.		
SIZE C	DWG NO. 600267	REV A
SCALE 1:4	SHEET 2 OF 2	

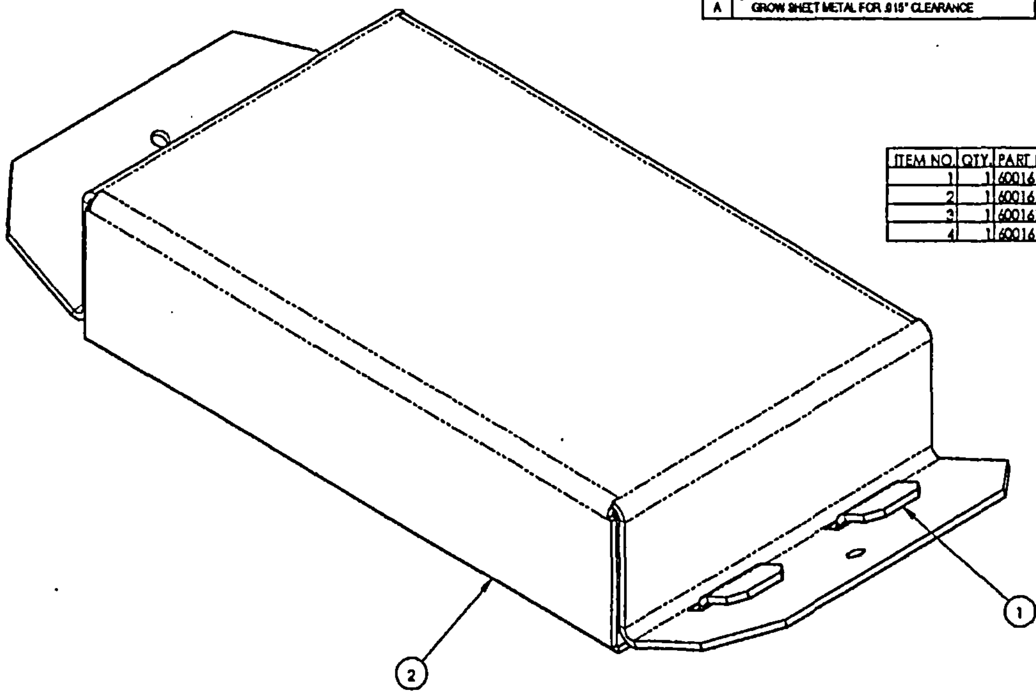
600268 Access Plug (Sheets 1 through 3)

This drawing contains proprietary intellectual property of SABIA Inc.

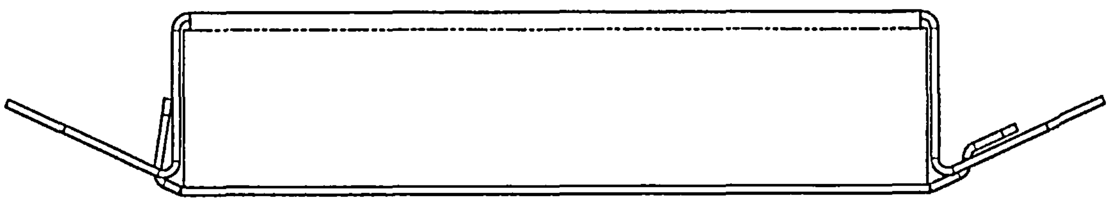
600166 Path Assembly (Sheet 1 of 1)

This drawing contains proprietary intellectual property of SABIA Inc.

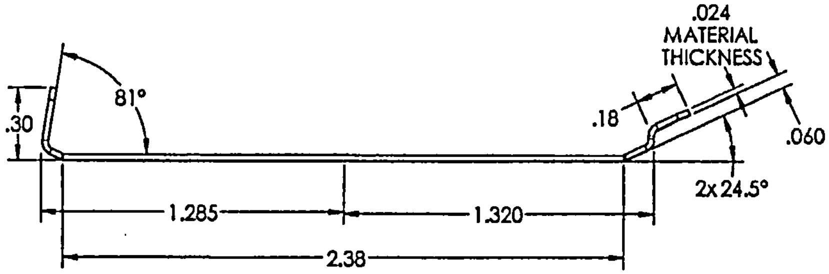
REVISIONS				
LTR	DESCRIPTION	DRAWN/DATE	APVD/DATE	REL/DATE
-	INITIAL RELEASE	SK 07-15-2003		
A	GROW SHEET METAL FOR .015" CLEARANCE	SK 11-17-2003		



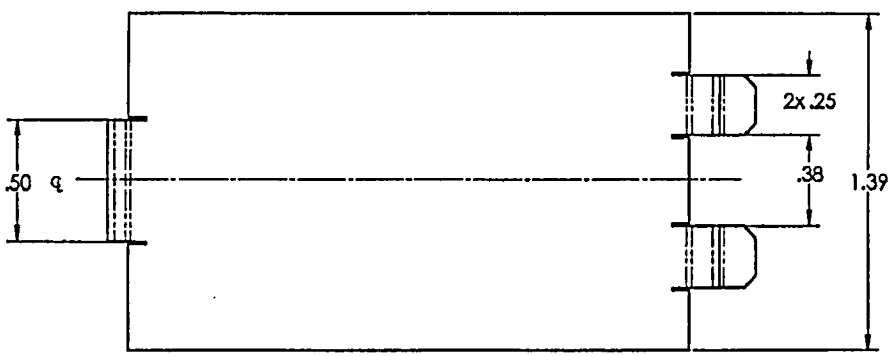
ITEM NO.	QTY.	PART NO.	DESCRIPTION
1	1	600167-1	SLED BOTTOM
2	1	600167-2	SLED TOP
3	1	600167-3	1" SOURCE HOLDER
4	1	600167-4	1.5" SOURCE HOLDER



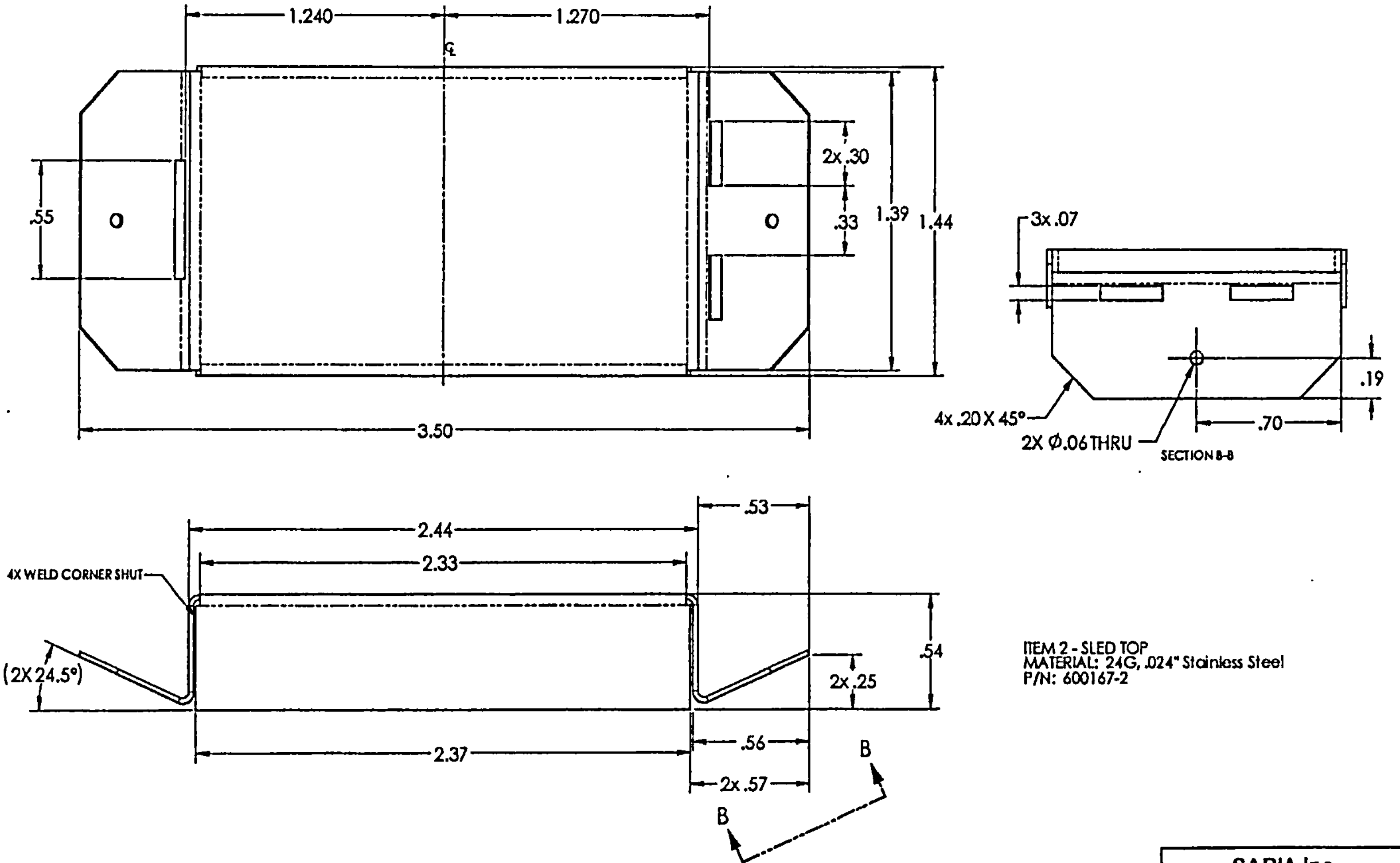
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTION, DECIMAL, ANGLE	CONTRACT NUMBER		SABIA Inc.
	DRAWN SK		SOURCE SLED
	CHECKED		
MATERIAL -	APVD		
	APVD	SIZE C	DWG NO. 600167-
FINISH -	APVD		
	REL	SCALE 4:1	SHEET 1 OF 5



ITEM 1 - SLED BOTTOM
MATERIAL: 24GA STAINLESS
P/N: 600167-1

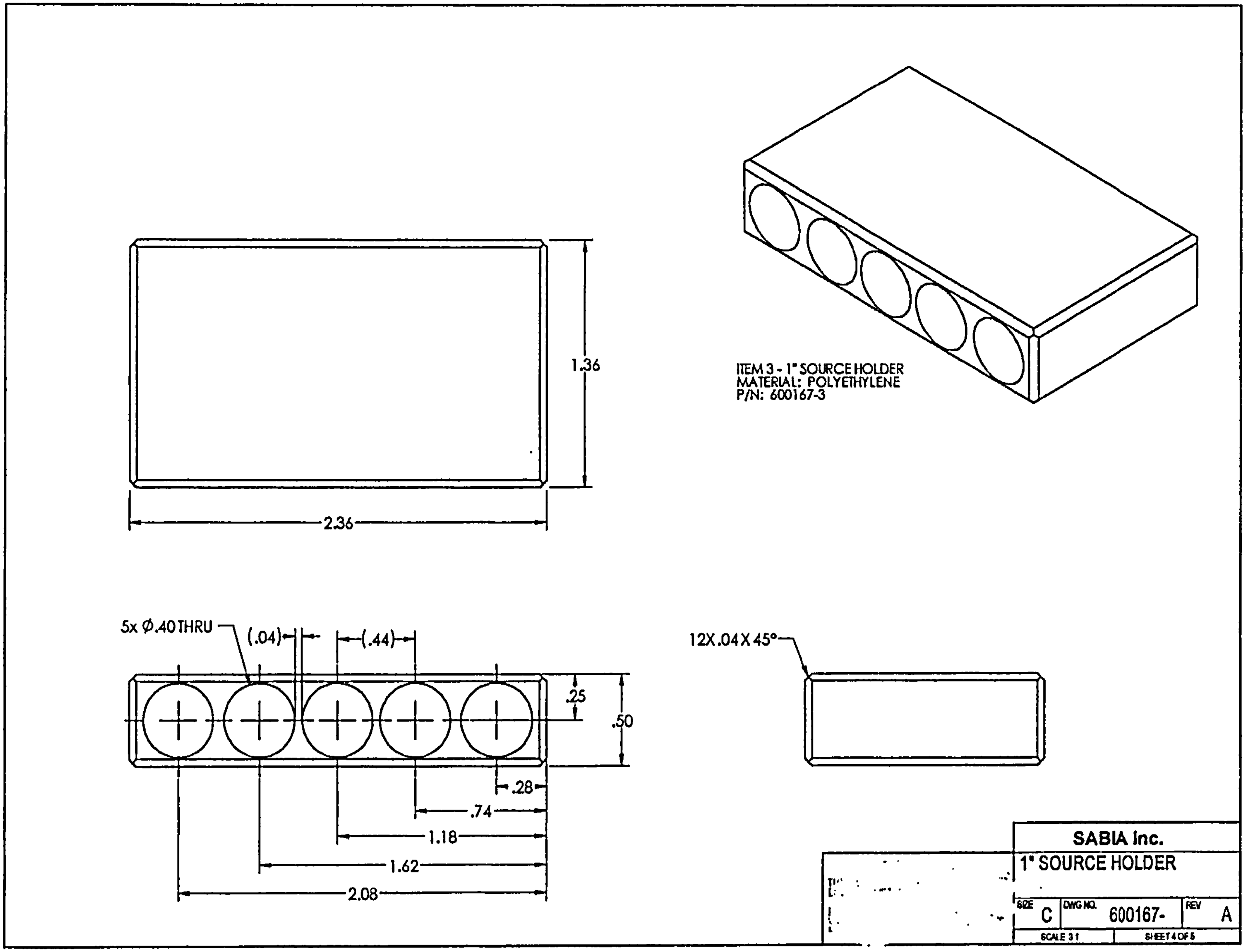


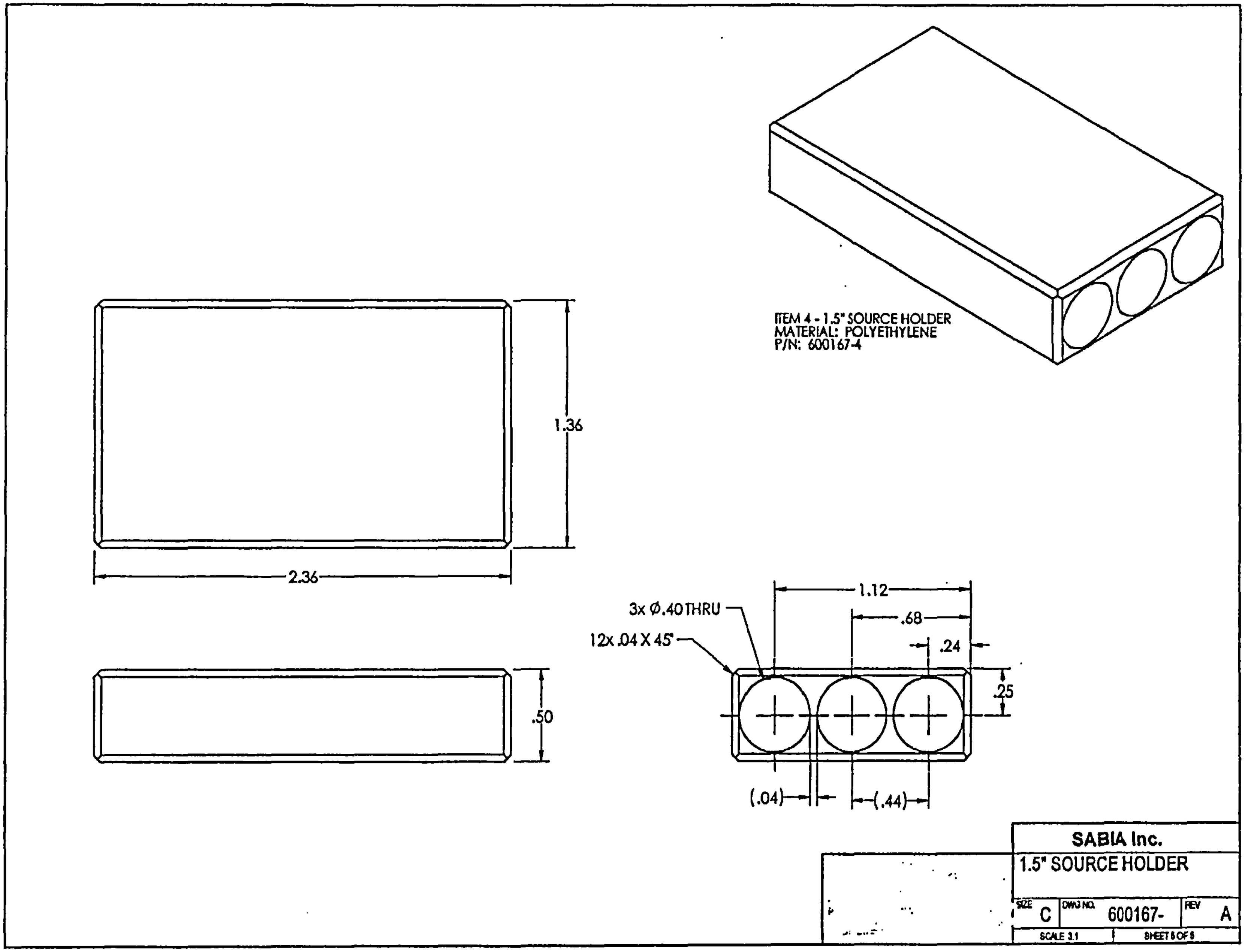
SABIA Inc.			
SLED BOTTOM			
SIZE C	DWG NO. 600167-		REV A
SCALE 3:1	SHEET 2 OF 5		



ITEM 2 - SLED TOP
MATERIAL: 24G, .024" Stainless Steel
P/N: 600167-2

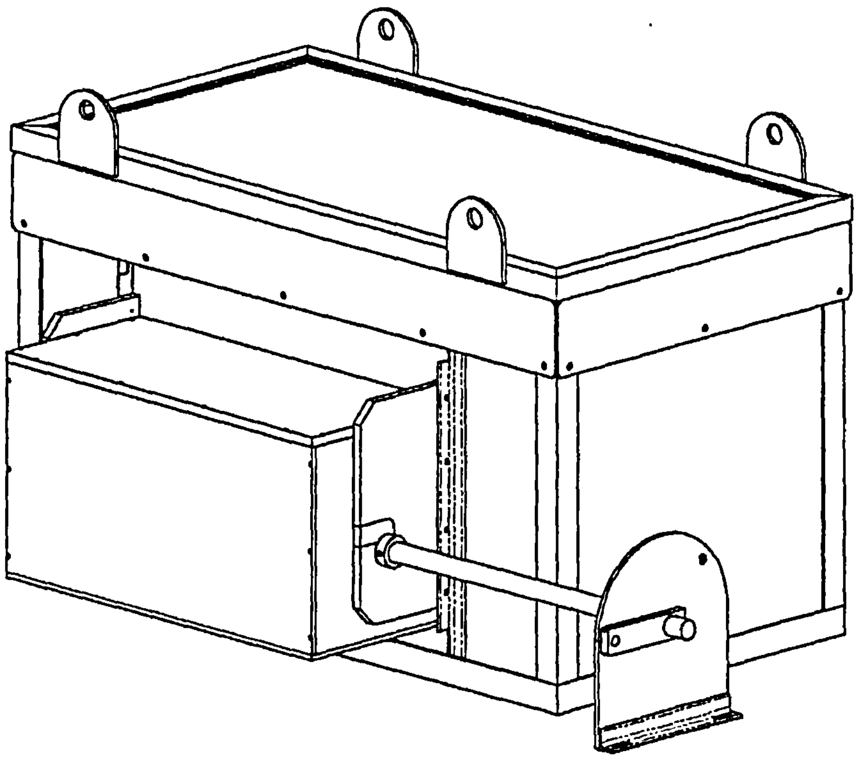
SABIA Inc.		
SLED TOP		
SIZE C	DWG NO. 600167-	REV A
SCALE 3:1	SHEET 3 OF 5	


1.36
2.36
ITEM 3 - 1" SOURCE HOLDER
MATERIAL: POLYETHYLENE
P/N: 600167-3
5x Ø.40 THRU
(.04)
(.44)
.25
.50
.28
.74
1.18
1.62
2.08
12X .04 X 45°
SABIA Inc.
1" SOURCE HOLDER
SIZE C
DWG NO. 600167-
REV A
SCALE 3:1
SHEET 4 OF 5

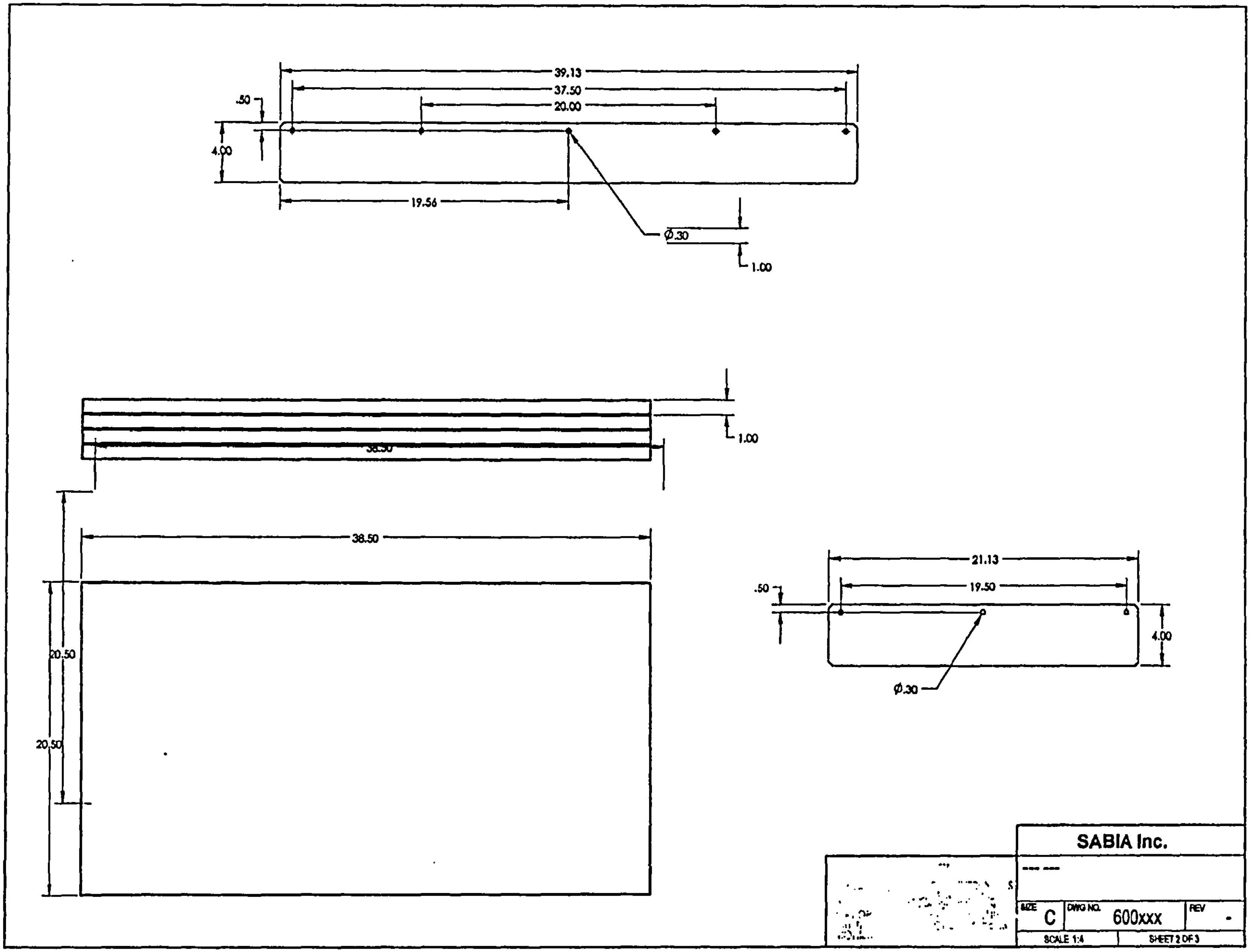

ITEM 4 - 1.5" SOURCE HOLDER
MATERIAL: POLYETHYLENE
P/N: 600167-4
1.36
2.36
.50
1.12
.68
.24
.25
3x Ø.40 THRU
12x .04 X 45°
(.04)
(.44)
SABIA Inc.
1.5" SOURCE HOLDER
SIZE C
DWG NO. 600167-
REV A
SCALE 3:1
SHEET 8 OF 8

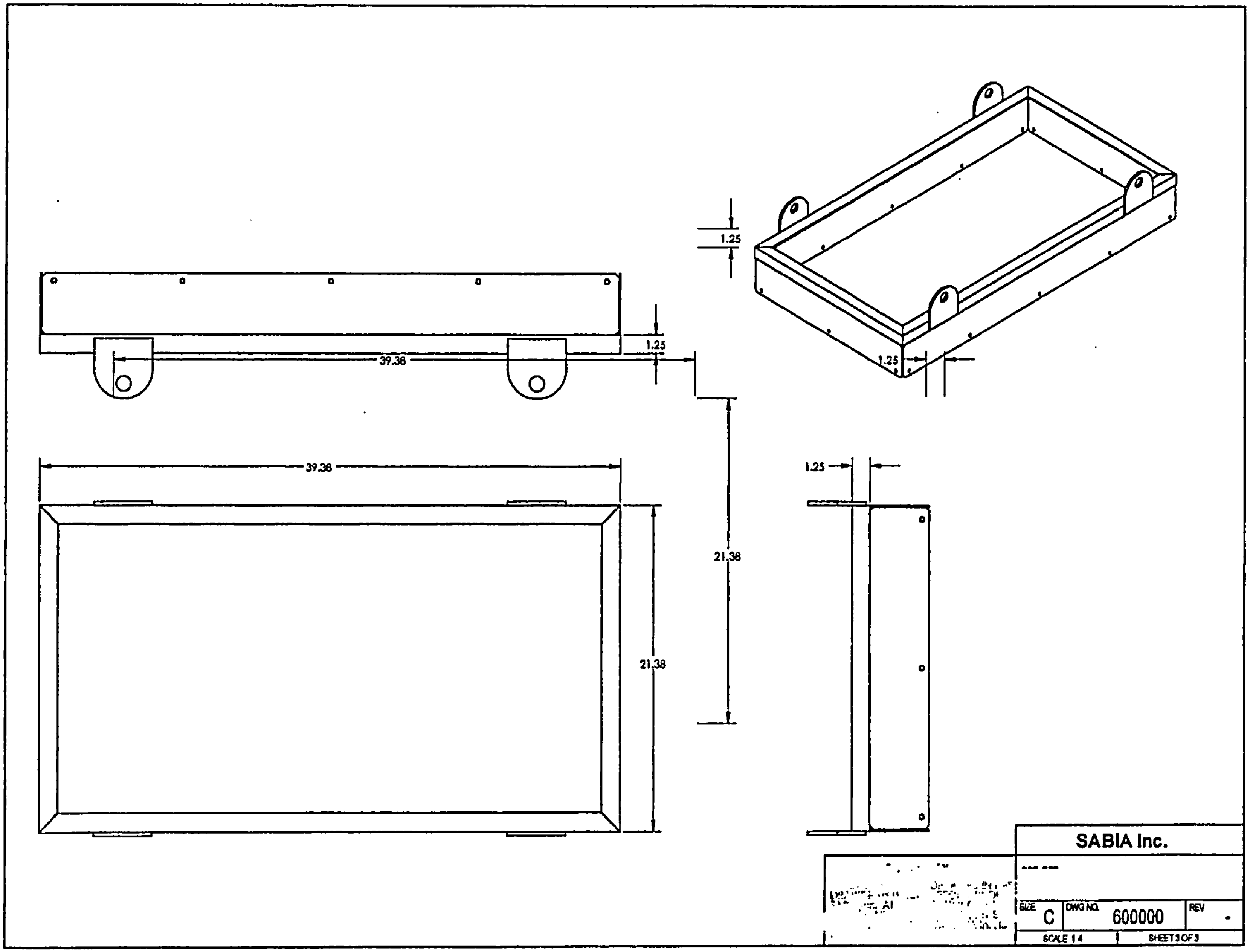
600169 Wheel Cover (Sheet 1 of 1)

REVISIONS				
LTR	DESCRIPTION	DRAWN/DATE	APVD/DATE	RELEASE
-	INITIAL RELEASE	XX XX-XX-XXXX		



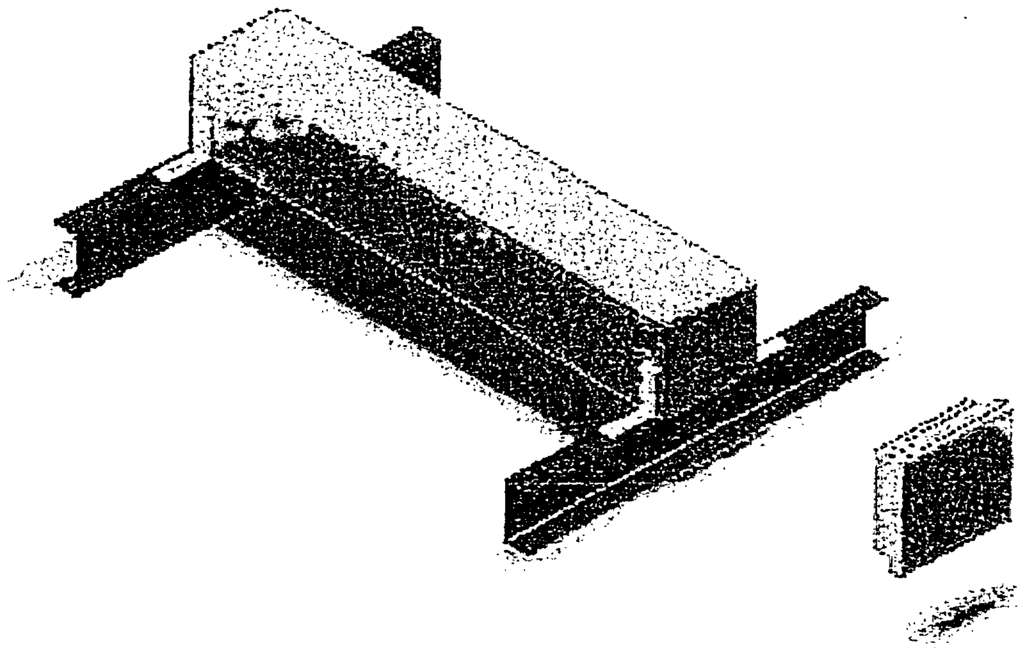
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTION, DECIMAL, ANGLE	CONTRACT NUMBER	SABIA Inc.
	DRAWN XX	
	CHECKED	
ATERIAL -	APVD	
	APVD	SIZE C — DWG NO. 600xxx
FINISH -	APVD	
	REL	SCALE 1 4 — SHEET 1 OF 3


39.13
37.50
20.00
.50
4.00
19.56
Ø.30
1.00
38.50
1.00
38.50
20.50
20.50
21.13
19.50
.50
4.00
Ø.30
SABIA Inc.
SIZE C
DWG NO. 600xxx
REV -
SCALE 1:4
SHEET 2 OF 3


1.25
39.38
21.38
SABIA Inc.
SIZE C
DWG NO. 600000
REV -
SCALE 1:4
SHEET 3 OF 3

600171 Source Assembly (Sheet 1 through 11)

600271 Source Box (Sheets 1 through 13)



Detector Housing

SABIA, Inc. Part No. 600272

Designed to be mounted beneath the conveyor belt

The detector housing is shown mounted across the conveyor belt support structure

Drawing is shown with access plug for side shield