COMMISSIONING AND OPERATION OF A NEW SECURITY TRUCK FOR SECURITY CLASS I AND II TRANSPORTS

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Abstract

In Germany, transports of security classes I and II (SC I, II) are authorised and carried out, based on the national Physical Protection Regulations, which are stricter than the IAEO-INFCIRC Regulations. These types of transports require the use of a heavily armoured vehicle.

In April 1982, Nuclear Cargo and Service (NCS) started operating their first Security Truck (SIFA 1). This consists of an armoured truck tractor and an armoured semi-trailer. The physical protection layout is based on the German Security Measures Catalogue 1977 (SMK 77). SIFA 1 is designed for the transport of nuclear materials of all kinds and in all forms, without integrating transport packages into the security concept.

In 1997, the NCS management decided to build a second SIFA (SIFA 2), the design of which was to be based on the new German "Regulatory Guide for Physical Protection of Radioactive Materials against Sabotage, Theft or Diversion during Transport", 1991 (SEWD-Guide).

This paper presents all the required steps, from the choice of the concept up to the actual carrying out of transports.

Introduction

The decision made by the NCS management in 1997, to put a new SIFA into service, was based on the following main points: the existing SIFA 1 was 15 years old at the time, SIFA 1 has a very large tare weight of approx. 34.000 kg, due to which its pay load is quite low, being only 6.000 kg (in most European States, and also in Germany, the max. total weight which may be operated without a heavy load authorisation, is limited to 40.000 kg). A heavy load authorisation would allow to increase the pay load up to 14.000 kg, but conditions to carry out transports with an authorisation for heavy loads have become more stringent in Germany and will not be granted in France for security class I transports with a total weight of more than 44.000 kg. Last but not least, NCS's customers requested a guarantee, according to which transports of security classes I and II would continue to be technically feasible for the next 10 years at least.

The main requirements towards the new security truck (SIFA 2) were defined as follows: no heavy load authorisation for a payload amounting to 14,000 kg (that meant reducing the tare weight by at least 9.000 kg in comparison to SIFA 1), approval of SIFA 2 according to the SEWD-Guide, approval of SIFA 2 in most European states, layout mainly for the transport of MOX fuel assemblies, suitability of SIFA 2 for transport on seagoing vessels and freight cars and an inconspicuous outside design.

The decision to built the SIFA 2 mainly for the transport of MOX fuel assemblies was based essentially on the fact that in Germany only few transports of other types of materials will be necessary in the future, due to the fact that the project of a German reprocessing plant was given up, and that the MOX fuel fabrication-plant was shut down. SIFA 1 will be available during the next forthcoming years to assure transports of other materials than MOX fuel assemblies, and as an backup solution.

Basic layout

Different preliminary conditions had to be observed for the design and construction of the SIFA 2. This included general vehicle technology regulations, e. g. keeping the exterior dimensions, authorised maximum total weight, maximum authorised axle loads, limits for noise and exhaust emissions, etc. within the European limit values.

Furthermore, customer requirements had to be observed too, e.g. maximum accelerations, frequencies and temperatures acting on the load, and also particular loading and unloading facilities at the plants of the shippers and receivers of such transports. The main point was, however, the observation of the preliminary requirements concerning security defined in the SEWD Guide. Next to these general conditions, complimentary conditions had to be observed, such as the results of vulnerability analyses, in which a determined number of external and of internal attackers are considered. The details of the a. m. design conditions are confidential. This is why only the following basic points may be mentioned here:

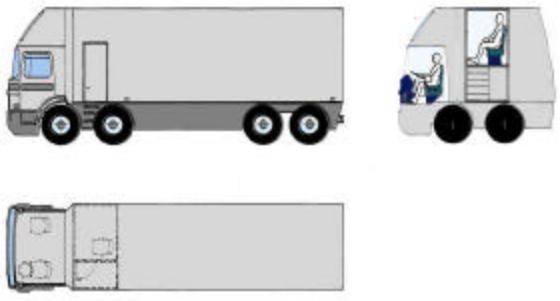
The first is that the driver's cabin and the compartment for the transport responsible person (TRP) must be burglary retardant, bullet protected in the highest class and assure effective protection against fire and gas. The TRP's compartment must be detached from the driver's cabine as a measure against a possible internal attacker. A two step immobilisation system to prevent the hijacking or the theft of the vehicle must be installed. The operating devices for these systems must be located in the TRP's compartment. All energy supply system must be protected, e. g. leak protected fuel tanks, uninterruptible power supply, etc. A communications system assuring communication within and with the outside of the vehicle, and two communication systems to assure communications between the TRP and the transport control centre (TCC) on the one hand and the police forces on the other, are required. The exact position of the vehicle and the status of the security sensors must be transmitted

automatically and periodically at short intervals to the TCC. Technical detection and surveillance systems must be installed on the cargo hold as a protection against unnoticed/secret theft of the cargo. These systems also supervise the status of the cargo hold and the conditions of the barriers. Manipulation or malfunction of these systems will automatically trigger an alarm. A mechanical barrier around the SNM, consisting of the packages and the exterior walls of the cargo hold, is required. These barriers must withstand chemical, thermal and mechanical tools and explosive charges, as anticipated by the vulnerability analysis, assuring protection during at least the delay required for the German police forces to arrive on the spot. Just to complete the picture: in Germany transports of security class I with SIFA 1 or 2, carried out under the responsibility of NCS, must be escorted by an NCS owned and operated armoured escort vehicle and be supervised by a TCC, which also is owned and operated by NCS. All persons involved in these transports are specially trained and carry hand guns. In special cases, transports must additionally be escorted by police forces.

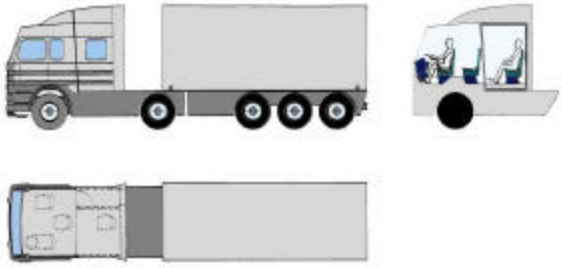
Conceptual definition

The conceptual definition was started on the base of the existing SIFA 1. The essential security relevant features required by the SEWD Guide are realised in SIFA1.

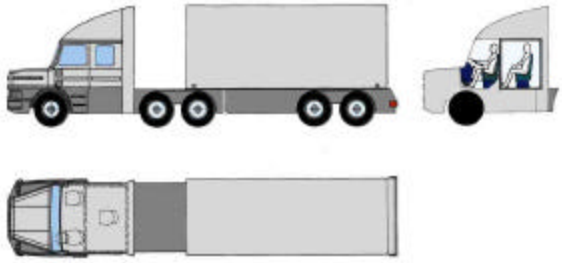
The concept of SIFA 1 was reviewed and evaluated together with the operating crew. What has proven positive and what is to be rejected, what is absolutely necessary for operating the vehicle or due to reasons of security technology, what may or must be changed, and what other concepts could be considered. These considerations yielded the following conceptions, which were selected by way of example from many other concept drafts:



The above mentioned concept is based on a motor truck with a removable container, which also contains the TRP's compartment. The total weight, including 14,000 kg payload, was estimated to be 39,000 kg. Due to this, the concept was dropped out, because in Germany, this type of vehicle only is authorised up to a maximum total weight of 32,000 kg without heavy load authorisation



This is a variation of the basic SIFA 1 concept, but with a cab-over-engine-truck. The separate TRP'S compartment should be easily removed, because in Europe this compartment only is obligatory in Germany. It was thus foreseen to remove the TRP's compartment when carrying out transports in other European countries. The total weight, including 14,000 kg payload, was estimated to be 45,000 kg, including the TRP's compartment. The project was also given up, because the following problems would have been very difficult and costly to solve, if they had a solution at all: relatively high tare weight, very complicated. mechanical and electrical connections between the TRP's compartment and the rest of the vehicle and handling and secured interim storage of the TRP's compartment.



This concept is meant to basically preserve all that has proven positive with SIFA 1, adapting it with new technology. The main changes as compared to SIFA 1 were:
cargo hold in the form of a removable container and integration of the transport cask for MOX fuel assemblies into the security concept. A first assessment of the weight, including the required payload of 14,000 kg, come to a total weight of approximately 44,000 kg. Finally this concept was selected, because its technical realisation seems to be the easiest and it appears quite probable that approximately 4,000 kg can be saved.

Working out the conception

Based on the basic concept, the next step was to prepare the specification for SIFA 2. In order to achieve the objective of a maximum total weight of 40,000 kg with a minimum payload of 14,000 kg, investigations were carried out in order to determine which parts could be modified in order to save weight. The truck tractor was considered to present only a small potential, so that the main weight savings had to be performed on the semi trailer. A point was to construct the cargo hold as a full trailer, instead of a removable container. So, the separate chassis as well as the security devices for the connection between container and chassis were not necessary. That gives a first few, but not sufficient weight savings. Further required weight reductions only could be achieved through the selection of materials for the semi trailer and the structures / barriers around the transport cask. After several preliminary tests were carried out internally by NCS, aluminium structures and arrays, compounded with other light materials, were chosen for the exterior walls of the semi trailer. This was examined as to compliance with the required protection objectives, under the observation of independent experts appointed by the licensing authority. The result of the examinations was positive. In order to save more weight, a removable roof was selected for loading and unloading, instead of the rear doors used for SIFA 1. Taking into account all structural groups of SIFA 2, e.g. all axles, which are fitted with pneumatic suspension, in order to achieve the requirements of the fuel manufacturers concerning acceleration and frequency values (3 g and 15 Hz at the utmost), except for the front axle of the truck tractor; a cooling system with approximately 5 kW cooling power for the cargo hold, in order to assure that the required maximum temperatures for the fuel assemblies shall not be exceeded; a generating unit for the cooling system, which also can be used as an emergency power supply, as well as all required auxiliary equipment for loading and unloading SIFA 2 (e. g. crane suspension gear for lifting off the roof and to remove transport packages, ladders necessary to attach the suspension gear to the crane and to obtain access to the cargo hold, etc.), tare weight of the complete SIFA 2 could be reduced to 26,000 kg.

Licensing procedure

The finished specification, which covered approximately 50 pages, was presented to the competent German licensing authority, Bundesamt für Strahlenschutz (BfS), in order to obtain the approval of the concept. BfS transmitted the specification for verification to different committees, e. g. the Committee for Security Technologies of the German Police. After about one year, NCS was granted the concept approval, under the condition that the construction of SIFA 2 was to be supervised by an independent expert organisation, Gesellschaft für Anlagen und Reaktorsicherheit (GRS), appointed by BfS, who

was to accept the vehicle once construction was finished. After the BfS approval had been granted, NCS applied for the approval/authorisation to operate SIFA 2 in other European countries. The time required for this ranged from one or two months to nearly one year. The authorisations was obtained in some cases without further questions, whereas in other cases extensive supplementary documentation and proofs were required. At present, in Europe, SIFA 2 has been approved in Germany, France, Belgium, the United Kingdom and Switzerland.

Choice of suppliers

After an analysis of the market, 4 or 5 possible suppliers were retained. This relatively small number was due to following points: due to the extensive consultation requirements expected during construction and the very extensive documentation, only a manufacturer for whom the German language was standard could be considered, which reduced the choice to companies established in Germany, Austria or in the German speaking part of Switzerland. The amount of European companies having the capacity to construct armoured trucks, fitted with special protective systems, is very restricted, because the demand for such vehicles is very small, coming usually from national banks. The manufacturer had to be experienced in the processing of armouring materials on the one hand, and of light materials on the other. Furthermore, and due to the required depth of processing and manufacturing flexibility, a company with a staff between 80 and 200 persons was given the preference. First contacts were made, based on the specification and the possibility to visit SIFA 1, so the selected potential manufacturer could have a rough idea of the scope of the contract. After this, the number of potential suppliers had been reduced to 3. These were asked to submit an offer. After the offers were examined, further meetings were held, during which mainly technical but also commercial questions were cleared. In order to facilitate the final selection, NCS presented a selection of technical questions to the tendering companies, requesting the presentation of solutions. After careful examination, an Austrian company was selected to construct SIFA 2. As a matter of fact, this was not the cheapest bidder.

Construction

NCS supplied to the manufacturer a SCANIA truck tractor with hood, in its simplest version, free of charge. This procedure was followed in order to simplify any warranty problems that might have appeared with SCANIA. In order to extend the armouring of the driver's cab, the original SCANIA driver's cab was completely removed, up to the hood, and rebuilt with armour steel. A reproduction of the original SCANIA cab design is not possible with armour steel, so the exterior aspect was obtained

through the addition of adequately shaped plastic parts to the originally square structure (cf. next figure, left side original SCANIA, right side SIFA 2).

The interior decoration of the driver's cab were taken from the SCANIA cab. The TRP's compartment was made completely new, with about 50 % of interior space being used for the required security systems. The mechanical and electrical links between the truck tractor and the semi trailer were manufactured in specially protected versions. Before the transformation, the truck tractor weighed 7,480 kg, after that, its weight was 12,650 kg. By way of comparison, the truck tractor of SIFA 1 weighs 14,580 kg. The semi trailer was manufactured according to a weight optimised, self supporting monocoque design, using the wall elements specified by NCS. The roof, which is protected against unauthorised opening through bolting systems supplementing its own weight, must be lifted off with a crane for loading and unloading the transport packages. For the performance of tasks related to the loading and unloading of the transport packages, as well as for tasks related to protection against radiation, access to the cargo hold may be obtained by means of a system of ladders carried along on board the vehicle. Essential parts of the electric security system, the cooling system for the semi trailer, a 5 kVA generator and further components were placed in a front part of the semi trailer and in several compartments located below the cargo hold. The weight of the empty semi trailer is 11,600 kg. By way of comparison, the tare weight of the SIFA 1 semi trailer is 19,380 kg.

The total tare weight of SIFA 2 is 24,250 kg. Thus, as compared to specifications, the payload could be increased by approximately 1,500 kg.

Start-up

At the end of December 1999, SIFA 2 was temporary handed over to NCS for a first test phase, for presentation and for first cold handling at the first customers to be served with SIFA 2. The customers were very positive in their appreciation of SIFA 2. There were some only some minor problems concerning radiation monitoring in the cargo hold, but these could be solved very fast. In this respect, it must be pointed to the fact that at that time, radiation monitoring were a very complex theme in

Germany, because the contamination problem concerning the flasks used for the transport of irradiated fuel to the reprocessing plants had no been solved finally at this time.

SIFA 2 was brought back to the manufacturer's plant from mid January till mid February, for final works and for final acceptance tests. After that, the required acceptance tests were carried out by the German Licensing Authority and by NCS.

Since February 2000, about 50 transports, covering approximately 70,000 km, were carried out with SIFA 2.

To this day, the operation of SIFA 2 was practically unproblematic. A few small incidents occurred, which were expected to a large extent and which mostly were prototype specific. These incidents, however, caused no break off, or even cancelling of a transport.

Summary

The vehicle received an excellent acceptance from customers, from the licensing authorities in Europe, and from the crews.

The construction of an extremely complex security truck such as SIFA 2 must be very carefully prepared. The specification must be well balanced, because on one hand, the observance of valid regulations must clearly be verified, whereas on the other hand, the manufacturer must have sufficient flexibility to be able to realise his own ideas and apply his own technological know-how. One cannot be careful enough in the selection of a manufacturer, in the follow-up of schedules and of costs, and in the accompanying of construction. The fact that both the licensing authorities and the customers were informed at an early time proved very helpful. The project could be finished within the projected cost frame, and as far as schedules were concerned, with an acceptable delay for such a prototyp of about half a year.

Summing up, we can say that SIFA 2 has proved satisfactory in all respects and has been accepted very positively by the authorities, the customers and the NCS staff.