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LISTING AND CLASSIFICATION: NEW ENTRY FOR BATTERIES CONTAINING SODIUM

Transmitted by the expert from the United States of America

BACKGROUND

1. Batteries employing elemental sodium afford considerable advantages in certain applications (for example, powering of vehicles) when compared to the more common and conventional battery technologies.

2. Two basic sodium battery technologies have emerged thus far, the "sodium/sulphur" battery and the "sodium/metal chloride" battery. While there are differences in these two sodium battery technologies, the basic configuration and operation is similar and batteries employing both technologies are generically described as "sodium/beta" batteries. This proposal addresses both types of batteries and, for purposes of transport, draws no distinction between them.

3. An extensive testing and development programme for sodium/beta batteries has been largely completed, and plans are now being implemented for the commercial utilization of these batteries as an alternate energy source for propulsion of vehicles.

4. The purpose of this proposal is to establish basic provisions that will ensure the safe and efficient transport of sodium/beta batteries. In this connection, it is emphasized that because these

batteries are large articles containing elemental sodium and, in some cases, sulphur, there is no existing UN entry under which they can be classified and for which, in modal transport requirements such as the IMDG Code, use of packaging appropriate to such large articles is provided for. It is for this reason that a specific UN entry for sodium/beta batteries is considered essential.

GENERAL DESCRIPTION OF SODIUM/BETA BATTERIES

5. Sodium/beta batteries for electrically powered vehicles are large, normally with a mass of several hundred kilograms but with the largest (to date) ranging up to a mass in excess of 800 kg. The batteries consist of a number of individual cells, electrically connected and mounted within a battery casing. Cells, which contain the sodium and any other reactants, consist of hermetically sealed metal casings. In the cells, sodium and other reactants are separated by a ceramic component which functions as the battery electrolyte.

6. When the battery is "cold" (i.e., the elemental sodium in the battery is in a solid state), the battery has no capability to produce electricity and is, therefore, electrically inert. Before a sodium/beta battery will operate to produce electricity, the cells must be heated to approximately 300 to 350 °C. Heating is accomplished by heating elements installed in the battery and requires an external power source. Once at operating temperature, the elemental sodium in the cells is in a liquid state and must be maintained in this state during battery operation. Because the battery is "hot" (i.e., the elemental sodium in the battery is in a liquid state) when operating, the battery casing consists of a double-walled, welded stainless steel vessel with the space between the inner and outer walls fitted with thermal insulation and usually evacuated of air.

7. Since elemental sodium is converted to various sodium compounds during the operation of the battery, the amount of elemental sodium present in a cell depends on the level of charge of the cell. However, the amount of sodium present is always relatively small in relation to the gross mass of the cell or battery. For example, for the largest sizes of sodium/beta batteries (i.e., with a gross mass of approximately 830 kg), the maximum total quantity of elemental sodium that would be present in the battery would be only approximately 60 kg. In addition, the individual cells further separate the sodium present into quantities of less than 75 g in each hermetically sealed cell.

SUMMARY OF THE PROPOSAL

8. The basic assumption in preparing this proposal is that the hazard presented by sodium/beta batteries, in the event of a release of dangerous goods contents in transport, is essentially that presented by elemental sodium, which is classified as a substance of Division 4.3. Although the sodium/sulphur type of battery also contains some quantity of sulphur, it has been assumed that the hazard associated with the sodium clearly takes precedence and, therefore, the primary hazard may be considered to be that represented by Division 4.3. Since a need also arises to transport individual cells for eventual installation in a battery, the proposal also provides for transporting cells without the benefit of the outer battery casing.

9. Establishing the crash-worthiness of the batteries and cells under motor vehicle accident conditions has necessitated testing of the batteries to performance levels far exceeding those provided for packagings in Chapter 9 of the UN Recommendations. As such, batteries and associated cells are designed to a level of structural integrity that affords an inherently high degree of safety in transport.

10. Given the high level of structural integrity, it is considered that appropriate safety will be provided in transport if cells are required to be transported in outer packagings that have been tested to Packing Group II performance levels. Similarly, based on the additional integrity afforded when these cells are installed within the double-walled, outer battery casing, it is proposed that the batteries be permitted to be transported either unpackaged or in protective enclosures such as crates that are not subject to packaging performance tests.

11. The proposal presented in this document is, for the most part, intended to provide for the large-scale, commercial transport of "cold" sodium/beta batteries and cells. While there are instances when "hot" batteries containing liquid elemental sodium must be transported, the transport conditions necessary to ensure the safe transport of these batteries are somewhat more elaborate. Therefore, this proposal makes no attempt to establish conditions for the transport of "hot" sodium/beta batteries, and provides that such batteries may only be transported with the approval of the competent authority. In the future it may also be necessary to elaborate the transport conditions for "hot" sodium/beta batteries.

TRANSPORT EXPERIENCE WITH SODIUM/BETA BATTERIES

12. Sodium/beta batteries are currently being manufactured in Germany and the United Kingdom and demonstration programmes employing these batteries for vehicle propulsion are underway in those countries and in other countries, including Canada and the United States. Under specific approvals, considerable transport experience has accrued. While many consignments of both batteries and cells have been transported and, although some incidents have occurred, none resulted in a release of dangerous goods. This experience has demonstrated that sodium/beta batteries can be safely transported.

PROPOSAL

13. The expert from the United States proposes the following amendments to the Recommendations:

(1) Insert the following new entry in the LIST OF DANGEROUS GOODS MOST COMMONLY CARRIED in Chapter 2:

(a1)	(a2)	(b1)	(b2)	(b3)	(c1)
"32AB	BATTERIES, CONTAINING SODIUM, or CELLS, CONTAINING SODIUM "	4.3	-	XYZ	II

(2) Add the following new Special Provision to Chapter 3:

"XYZ Batteries or cells transported under this entry may contain no other dangerous goods with the exception of sulphur. Batteries or cells may not be offered for transport at a temperature at which any liquid elemental sodium is present in the battery or cell unless approved, and under the conditions of transport established by the competent authority.

Cells should consist of hermetically sealed, metal casings which fully enclose the dangerous goods and which are so constructed and closed as to prevent the release of the dangerous goods under normal conditions of transport. Cells should be placed in suitable outer packagings with sufficient cushioning material to prevent contact between cells and between cells and the internal surfaces of the outer packaging, and to ensure that no dangerous movement of the cells within the outer

packaging occurs in transport. Packagings should be tested and marked according to the provisions applicable to Packing Group II solids.

Batteries should consist of cells secured within, and fully enclosed by a metal casing so constructed and closed as to prevent the release of the dangerous goods under normal conditions of transport. Batteries may be offered for transport, and transported unpacked or in protective enclosures (e.g., in fully enclosed or wooden slatted crates) that are not subject to the packaging testing provisions of these Recommendations."

(D2) (3) Add the following entries to the Index:

"BATTERIES, CONTAINING SODIUM.....4.3 32AB

CELLS, CONTAINING SODIUM.....4.3 32AB"