



## LEGAL REQUIREMENTS OF NUCLEAR LAUNCH APPROVAL

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*The launch approval review for spacecraft with a radioisotope thermoelectric generator (RTG) is a lengthy multi-year and multi-million dollar process. In this paper, we review the guiding legal and policy documents, as well as launch-related litigation, to determine what parameters are provided for scope or content of the review, if any. While many documents govern the review – including Executive Office of the President (EOP) documents, statutes, agency regulations, interagency agreements, and agency policies – none provide details regarding what analysis is required. Based on the review conducted herein, there is no legal reason why changes could not be made to streamline the approval process for launches with RTG, so long as safety is not compromised.*

### I. SPACE NUCLEAR LAUNCH APPROVAL

Any U.S. launch of spacecraft with a radioisotope thermoelectric generator (RTG) requires the approval of the President of the United States. To satisfy this and other legal requirements, a lengthy safety review process has developed over time. The safety review for RPS launches actually involves three separate (somewhat concurrent) reviews – (1) the National Environmental Protection Act (NEPA) process which results in an Environmental Impact Statement (EIS), (2) the safety analysis which results in a Safety Analysis Review (SAR), and (3) the launch approval process which results in a Safety Evaluation Report (SER) and ultimately launch approval or disapproval [1]. For recent missions, the entire process has taken anywhere from just over four years (New Horizons) to just under nine years (Cassini), and has cost millions. The review for Mars2020 was initiated in December of 2012 with the award of the mission.

#### I.A. Origins of the Review Process

In 1961, due to the international policy implications of launching nuclear material into space [2], McGeorge Bundy, President Kennedy’s National Security Advisor, issued National Security Action Memorandum No. 50 (NSAM 50), which informed NASA that the “President desires to reserve to himself all first official

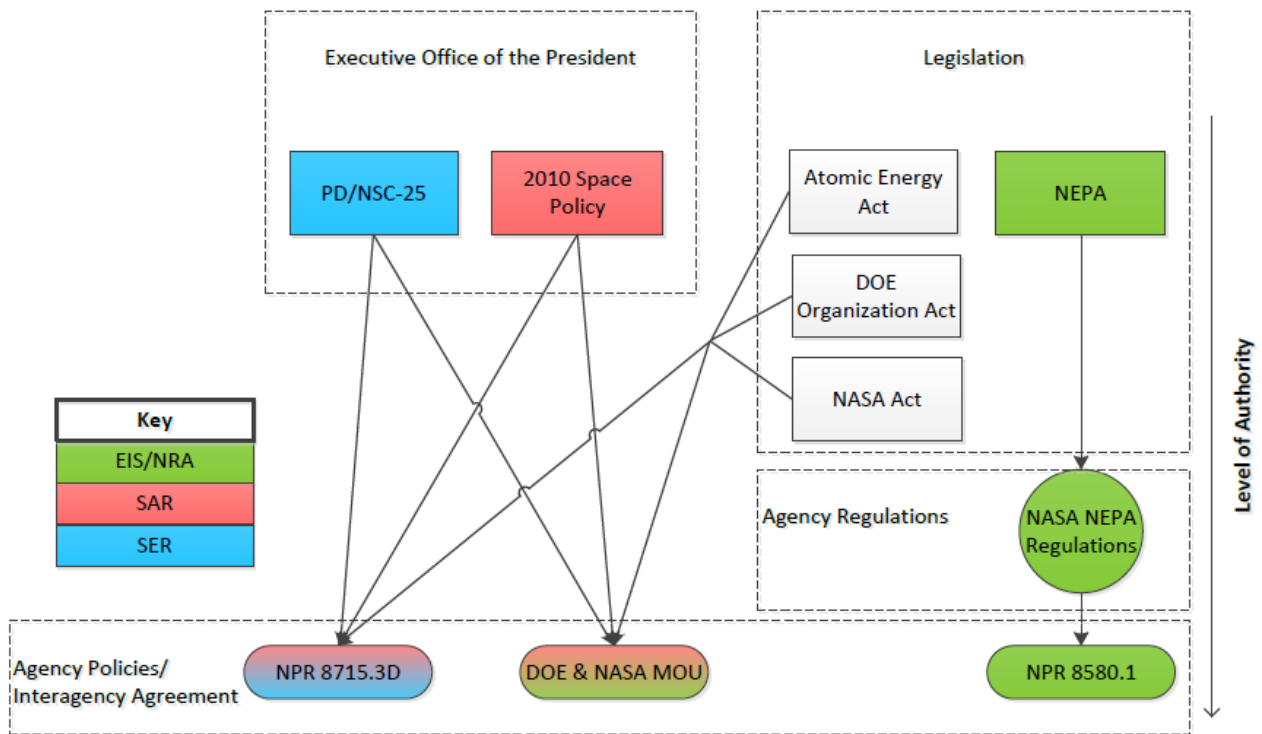
announcements covering the launching into space of systems involving nuclear power in any form” [3]. NSAM 50 was revised April 10, 1965.

NSAM 50 was supplanted by Presidential Directive/National Security Council Memorandum No. 25 in 1977 during the Carter Administration which laid out a more detailed procedure for the required review process prior to nuclear space launches. PD/NSC-25 mandates an environmental impact statement (EIS) or a Nuclear Safety Evaluation Report (SER) for any nuclear space launch. It also requires Presidential approval for any launch with “more than 20 curies of material in Radiotoxicity Groups I and II and for more than 200 curies of material in Radiotoxicity Groups III and IV (as given in Table I of the NASC report of June 16, 1970 on “Nuclear Safety Review and Approval Procedures.”).” PD/NSC-25 officially establishes the Interagency Nuclear Safety Review Panel (INSRP), an ad hoc panel consisting of members from the Department of Defense, Department of Energy, and National Aeronautics and Space Administration. The INSRP is charged with evaluating the risks associated with the mission and preparing the SER. The Nuclear Regulatory Commission (NRC) is also to be included as an observer. The head of the agency sponsoring the launch must request the President’s approval for the flight through the Office of Science and Technology Policy. Either the Director of OSTP or the President is authorized to render approval for a launch [4].

PD/NSC-25 was updated in 1996; the modifications included adding the Environmental Protection Agency as a member, upgrading NRC to a technical advisor, and instituting a quarterly reporting requirement of the launch forecast of radioactive materials.

### II. ADDITIONAL GOVERNING LAWS, REGULATIONS, AND POLICIES

In addition to PD/NSC-25, the launch approval process is governed by Executive Office of the President (EOP) documents, statutes, agency regulations, interagency agreements, and agency policies (Figure 1).



**Fig. 1.** Governing Laws and Policies

### II.A. Executive Office of the President Documents

Other than PD/NSC-25, the primary EOP governing document is the 2010 National Space Policy [5]. The Obama Administration policy endorses the existing process without providing any additional details. The policy states,

Approval by the President or his designee shall be required to launch and use United States Government spacecraft utilizing nuclear power systems either with a potential for criticality or above a minimum threshold of radioactivity, in accordance with the existing interagency review process. To inform this decision, the Secretary of Energy shall conduct a nuclear safety analysis for evaluation by an ad hoc INSRP that will evaluate the risks associated with launch and in-space operations (emphasis added).

### II.B. Statutes and Agency Regulations

The governing statutes include NASA and DOE authorizing acts [6], which simply give each agency authority over various parts of nuclear space launch, and NEPA [7].

NEPA requires Federal agencies to assess the environmental impact prior to taking any major action. Different levels of review are required depending on the significance of the proposed action. The highest level of review is the EIS, which is a report that thoroughly addresses the potential effects on the environment and potential alternatives of a proposed program or project. An EIS is warranted if the proposed action is expected to have significant environmental effects or lead to public controversy. The agency prepares a draft EIS which is reviewed and scored by the Environmental Protection Agency, as well as made available for public review and comment.

Under NASA’s NEPA regulations, an EIS is always required for launch of a nuclear reactor or radioisotope power system [8]. However, no further details are provided regarding the specific analysis required.

### II.C. Agency Policies and Interagency Agreements

Chapter Six of NASA Procedural Requirements (NPR) 8715.3D covers Nuclear Safety for Launching of Radioactive Materials [9]. The policy outlines the level of approval required based on the amount of radioactive material ( $1000 \leq A_2$  triggers need for presidential approval) (Table 1).

**TABLE 1.** Nuclear Launch Approval Summary [9]

A <sub>2</sub> Mission Multiple	Launch Reported to NFSAM	Launch Concurrence/ Approval by	Launch Reported to OSTP	Required Level of Review and Reports	Approval/ Concurrence
A <sub>2</sub> < 0.001	Yes	NFSAM	no	Paragraph 6.3.3	Concurrence letter from NFSAM
0.001 ≤ A <sub>2</sub> < 10	Yes	NFSAM	yes	Paragraph 6.3.4	Concurrence letter from NFSAM
10 ≤ A <sub>2</sub> < 500	Yes	Chief, Safety and Mission Assurance	yes	Paragraph 6.3.5, Nuclear Safety Review	Approval letter from Chief, Safety and Mission Assurance
500 ≤ A <sub>2</sub> < 1,000	Yes	NASA Administrator	yes	Paragraph 6.3.6, Safety Analysis Summary (SAS)	Approval letter from NASA Administrator
1000 ≤ A <sub>2</sub>	Yes	Executive Office of the President	yes	Paragraph 6.3.7, Safety Analysis Report	NASA Administrator requests approval via Director, OSTP

Interestingly enough, for lower levels of radioactive material, NPR 8715.3D provides detail on required analysis. For example, for launches with A<sub>2</sub> mission multiples equal to or greater than 10 but less than 500, the nuclear safety review must include “an analysis of probabilities of launch and in-flight accidents which could result in the terrestrial release of radioactive materials (surface and air),” and “an estimate of the upper bound of health and environmental effects due to a radioactive material release” [9].

However, when presidential approval is required (as is the case when an RTG is present), NPR 8715.3D simply outlines the procedural steps, but is silent with regards to scope and content of the necessary analysis. The policy states that the NASA Administrator shall empanel an INSRP, in accordance with PD/NSC-25, and appoint a NASA INSRP coordinator. NASA program executives, in consultation with the Nuclear Flight Safety Assurance Manager, the empaneled INSRP, the program, and the appropriate DOE offices, are responsible for developing the schedule for delivery of the nuclear safety analysis (e.g. SAR) and preparing or having prepared a SAR. The policy requires that the NASA INSRP Coordinator facilitate the preparation of an INSRP-developed SER of the radiological risk for the proposed nuclear mission as required by PD/NSC-25 [9].

DOE and NASA also have a standing interagency agreement that once again covers the procedure, but not the technical scope and content, of the safety review. Under the agreement, DOE shall provide a documented analysis of potential accidents and their associated risks, e.g. Safety Analysis Report. The agreement also requires DOE to specify, “in consultation with NASA, the minimum radiological, occupational/public health, safety procedures/criteria, and provid[e] guidance with respect to safeguards and security requirements related to NASA

facilities and services associated with the radioisotope power systems.” NASA agrees to provide DOE with the technical data and support to allow DOE to conduct the analysis associated with the environmental assessment and nuclear launch safety approval process [10]. The document, like the others, does not outline required metrics, risk thresholds, or necessary tests or models.

### III. LITIGATION

Various interest groups have sued to prevent several of the most recent space nuclear launches – Galileo, Ulysses, and Cassini [11]. The most recent legal challenge occurred for the Cassini mission in 1997, and no suits have been filed in the last 20 years.

All the lawsuits have been filed after presidential/OSTP director approval for the launch and courts have been quick to issue their decisions before the scheduled launch date. Since NASA has always prevailed and launches have proceeded as scheduled, the lawsuits have not contributed to the length of the review process.

Plaintiffs have only challenged launches in terms of the NASA’s alleged failure to adequately review the environmental impacts as required by NEPA. The court has therefore not reviewed or commented on adequacy of review contained in SAR or SER. This is critical because it means there is no legal precedent requiring the analysis found in the SAR and SER to be as extensive as it has been in the past. The court has been deferential to the agency (as is typical in administrative law cases), and more or less takes it on face value that the review was performed sufficiently.

### IV. DISCUSSION

After reviewing legal guiding documents, the most striking fact is that there is no statutory requirement for SAR or SER; only the EIS is legislated by NEPA. This means that the modifying the review process would be relatively simple to accomplish by Executive action, since no legislation must be amended. Furthermore, none of the other legal documents provide any details regarding the scope or content of analysis required for SAR or SER. This has been a double edged sword – on one hand, it has provided a measure of flexibility to allow the review process to evolve over time. On the other hand, there has been nothing to constrain the seeming overgrowth of analysis that now goes into the multi-year process.

According to STPI’s research, multiple factors have led to the length and breadth of the review, including the lack of a set risk threshold and the growth of modeling capabilities that enabled ever more sophisticated risk analysis. It is not clear, however, how much the increase in safety review has actually improved safety outcomes.

While courts have approved of the safety reviews conducted when the subject of litigation, the analysis has been constrained to the EIS portion of the review. As such, it seems appropriate to take another look at the process to ensure only the necessary analysis is being conducted and that time and money is not being wasted. Based on the review conducted herein, there is no legal reason why changes could not be made to streamline the process without compromising safety. In fact, given the paucity of specifics in the sum total of legal documents, no amendments would need to be made whatsoever.

LEXIS 12003 (D.D.C. 1989); Florida Coalition for Peace and Justice, et al. v. George Herbert Walker Bush, et al., 1990 U.S. Dist. LEXIS 13345 (D.D.C. 1990); Hawaii County Green Party, et al. v. William Jefferson Clinton, et al., 980 F. Supp. 1160 (D. Haw. 1997).

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7. National Environmental Protection Act, 42 U.S.C. §§ 4321-70.
8. Procedures for Implementing the National Environmental Policy Act (NEPA), 14 CFR Part 1216, Subpart 1216.3(c).
9. NASA Procedural Requirements (NPR) 8715.3D, Chapter 6, Nuclear Safety for Launching of Radioactive Materials (2017).
10. Memorandum of Understanding between the Department of Energy and the National Aeronautics Space Administration Concerning Radioisotope Power Systems for Space Missions (2016).
11. Florida Coalition for Peace and Justice, et al. v. George Herbert Walker Bush, et al., 1989 U.S. Dist.